CAUSAL MECHANISMS OF CHOICE ARCHITECTURE INTERVENTIONS IN ALCOHOL CONSUMPTION

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Abstract

This thesis attempts to answer the research question: What are the causal mechanisms for behaviour change undergirding choice architecture (CA) interventions in alcohol use? This thesis is organised along two dimensions: conceptual and empirical. At the conceptual level, this project discusses the application of CA to public policy; the lack of consensus regarding the theory of change underpinning the relationship between CA intervention stimuli and modified behaviour; and the need for clearer understandings of the CA intervention components in relation to other behavioural interventions. At the empirical level, this project systematically reviews available CA interventions intended to reduce alcohol consumption in public drink settings and suggests new alcohol-related CA intervention strategies.

This thesis is organised into 8 chapters:

- Chapter 1 offers an overview of CA and the theory of behaviour change undergirding CA interventions.
- Chapter 2 summarises the relevant empirical research on alcohol consumption and intervention strategies to moderate or reduce consumption.
- Chapter 3 summarises the methodological approach used by this thesis to answer the overarching research question, relying on methodology used in Cochrane-style systematic reviews, reviews of theory, realist reviews, and qualitative taxonomy generation.
- Chapter 4 details a review of dual-process theories of health-related behaviour and cognition.

- Chapter 5 includes a systematic review and meta-analysis of CA interventions on reducing alcohol consumption via manipulation of the physical dimensions, packaging, placement and advertising of alcoholic beverages in one setting as observed within public drinking spaces or naturalistic barroom setting.
- Chapter 6 offers a realist review of causal mechanisms of CA interventions in alcohol use, focusing in particular on identified alcohol CA trials and their theoretical underpinnings.
- Chapter 7 offers a qualitative taxonomy of those mechanisms, intended in part as a methodological guide for designing new CA interventions in alcohol use through the specification of intervention components intended to change micro-environmental cues in order to influence consumption.
- Chapter 8 concludes with final thoughts and ideas for developing future theory-driven CA interventions in alcohol use, with potential application to other health policy domains in which CA interventions may be used.

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Chapter 1.
Introduction to Choice Architecture (CA) Interventions

1. INTRODUCTION

In some situations—and for seemingly irrational reasons—individuals make choices that are distinct from, or in opposition to, their own self-interest (Albarracin et al. 2005; WHO 2008). For example, when given a choice between making monthly contributions to retirement pension funds and pocketing the entirety of their monthly salaries, individuals are more likely to pocket the entirety of their monthly salaries—even if they expect to retire and ostensibly subsist on their own savings in the future. Such 'irrational behaviour' may be rooted in automatic and volitional cognition (Tversky & Kahneman 1973) and may demand a public policy response that improves individual-level behaviour via the same dual process cognition model (Sunstein 2012). This general approach usually consists of nudges—e.g. disclosure, warnings, and default rules—to prompt self-interested behaviour that is in line with an individual's wellbeing. For example, in response to the evidence of myopia mentioned above when it comes to individual savings levels, the social safety nets in many countries now require mandatory defined-contribution pension schemes. Many companies now automatically enrol—as a default—their employees in pension schemes that take an increasing percentage of salary increases over the course of an employee's working life (Thaler & Sunstein 2008).

Behavioural interventions are policy treatments intended to change the cognitive, social, and informational decision context of individuals in order to influence their behaviour (Rogers & Frey 2014). A subset of behavioural interventions, choice architecture (CA) interventions—or

'nudge' interventions—are a treatment of public policy that involve altering features of physical or social environments to influence individual behaviour. CA was popularized through the 2008 book by Richard Thaler and Cass Sunstein, *Nudge: Improving Decisions about Health, Wealth and Happiness*. Although the philosophical underpinnings of CA—in particular, the notion of 'libertarian paternalism' put forward by Sunstein—remain open to debate, the governments of the UK, Norway, Denmark, Germany, and others have established policy teams that investigate which aspects of policy may be susceptible to 'nudging' (Ly & Soman 2013). Naturally, CA interventions are not entirely novel—in many ways they simply represent a new frontier in 'soft' paternalism that is non-coercive (discussed in section 2; Sunstein 2012). Yet the undeniable influence of CA—and the wider policy and social scientific challenges it confronts—guides at least one impetus for this project.

Given its recency and provenance, however, there has been limited systematic effort to define the active ingredients of a CA intervention. This project attempts to answer the research question: What are the causal mechanisms for behaviour change undergirding CA interventions in alcohol use? This project posits a conceptual understanding of CA interventions; conducts a review of theory of dual-process models of health-related behaviour and cognition; conducts a Cochrane-style systematic review and meta-analysis of CA interventions on reducing alcohol consumption via manipulation of the physical dimensions, packaging, placement and advertising of alcoholic beverages in one setting as observed within public drinking spaces or naturalistic barroom settings; conducts a realist review of CA interventions in alcohol consumption; and develops a typology of intervention components for CA interventions.

2. BACKGROUND

2.1 Choice architecture

Many public policies are considered paternalistic because they intend to influence individuals to adopt one course of action or another. Some 'hard' paternalistic policies are manifested in mandates or bans (Sunstein 2012). For example, in many countries parents are required to provide for the education of their children through age of majority. Other 'soft' paternalistic policies are manifested as economic incentives (Sunstein 2012). For example, in many countries tax breaks levied on contributions to non-profit organizations are intended to encourage charitable giving by households. A subset of 'soft' paternalistic policies are called nudges, which is defined as "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein 2008, 6). Examples of nudges in daily life abound. Text-message reminders to take necessary medication at specified times of the day are an example of a nudge; default double-sided print settings on copiers intended to reduce paper consumption are another; even direct deposit and automatic bill-pay features may be considered nudges. Within the sphere of public health, government nudges include mandated smoking warnings consisting of aversive images and text on tobacco packages; nutrition facts posted on packaged food; and opt-out default arrangements governing organ donations.

In regard to health-related behaviours, CA refers to the privileging of the healthiest or optimal choice available—amid a selection of behavioural options—available to individuals with

respect to their rational self-interest. Of greatest importance, however, there are few operational definitions of these terms in applied policy domains, such as tax policy or public health, or in the particular environments in which such choices are made (Marteau et al. 2011). This thesis attempts to articulate a theory of CA—with proper specified terms and definitions—in the context of intervention strategies intended to reduce alcohol consumption.

2.2 Philosophical origins

In discussing the philosophical underpinnings of CA, it is useful to begin by distinguishing among varieties of paternalism. As mentioned above, some forms of 'hard' paternalism are coercive (e.g. civil fines or criminal jail sentencing) and others are 'soft', or non-coercive (e.g. disclosure policies or default rules; Sunstein 2012). Some public health officials favour 'soft' paternalistic policies because many are intended to 'normalize' healthy individual behaviour instead of explicitly forbidding forms of unhealthy behaviour. Many behavioural economists also favour 'soft' paternalism because it is thought to enable individual utility-maximization and market efficiency.

CA is supported by a relatively new philosophy of paternalism called 'libertarian paternalism', which justifies guiding an individual's behaviour (paternalistic) whilst ultimately respecting the individual's ultimate decision with regard to her own health (libertarian). According to Thaler & Sunstein (2008, 6):

> Libertarian paternalism is a relatively weak, soft, and nonintrusive type of paternalism because choices are not blocked, fenced off, or significantly burdened. If people want to smoke cigarettes, to eat a lot of candy, to choose an unsuitable health care plan, or to

> fail to save for retirement, libertarian paternalists will not force them to do otherwise or even make things hard for them.

Such an approach appeals to governments interested in 'non-bureaucratic' behaviour change policies. According to the UK Government, the appeal of nudging lies in its ability to offer a set of outwardly simple, non-bureaucratic, cost-effective guidelines to moderating individual behaviour across a number of domains without resorting to extensive law- or policymaking (House of Lords 2011). The practical effect of the 'nudge approach' is to borrow from the behaviour sciences those interventions that may affect behaviour without eliminating choice or involving extensive regulation.

2.3 Objections to CA

Given its stated intention to manipulate individual behaviour by targeting micro-environmental cues and incentives, CA is subject to all the 'usual' criticisms of paternalism, but it is also vulnerable to criticism from an efficacy standpoint. First, several objections to CA interventions are wellbeing-related in character, and taken together they view with suspicion the strong assumptions required to target individual behaviour, e.g. that all individuals behave similarly given the same micro-environment (Sunstein 2012). Second, public health critics in particular question if CA interventions actually represent the most effective intervention strategy available to policymakers intent on affecting individual health-related behaviour (Michie & West 2013). By way of crude example, a nudge intervention targeted to smoking cessation among pregnant mothers through aversive images on tobacco packaging may produce compelling results, but a blanket ban on the sale of tobacco products to pregnant mothers would almost certainly a larger effect on smoking cessation.

2.3.1 Wellbeing-related objections

Sunstein (2012) raises at least three objections to the CA approach from the perspective on wellbeing: namely, that it may neglect to respect individual circumstance, may fail to respect individual desires, and may be rooted in biased judgments. The fact that these charges may be levelled at wider paternalism projects does not diminish their particular relevance to CA.

First, paternalism more widely—and CA in particular—may disregard important, granular-level data about an individual's situation. Dating back to the 19th century, the liberal tradition asserts the primacy of individuals in knowing what will promote their own happiness, and other individuals may well miss or detract from that happiness (Sunstein 2012). Individuals should therefore be free to make decisions about almost any activity that affects themselves. Contrary to this argument, a blanket CA approach targeting behaviour cannot but operate under limited information about individual circumstances and may thus neglect an individual's strong and weak preferences. Put simply, individuals have the most complete data regarding their own particular circumstances.

Second, even with near-complete information, because the CA approach targets behaviour, a single intervention can only be delivered after strong assumptions have been made about uniform tastes and values among individuals exhibiting that behaviour (Sunstein 2012). For example, regarding pension savings, it is trite but true to assert that different individuals have different tastes regarding how much they consume at different time periods of income flow. In

specific contexts, then, the CA approach to behaviour change fundamentally overrides complete human autonomy and preferences.

Third, it need hardly be said that choice architects lack perfect decision-making ability and are beholden to imperfect heuristics themselves. As Sunstein (2012) points out, this argument gestures to at least one significant problem. Choice architects are subject to incomplete information and process that information in ways that are prone to error, and hence the decisions they make on other individuals' behalf—ostensibly in those people's interests—may be similarly coloured. And given the enhanced risk of accessing even less information about an individual's circumstance as compared to the individual herself—as discussed above—these imperfect heuristics will have an outsized effect on the individual's wellbeing.

2.3.2 Competency objections

The more serious objections to CA come from the perspective that it is not best equipped to solve serious policy issues, as profiled in Michie & West (2013). Consider, for example, that consumer behaviour is subject to powerful influencing by companies through marketing and product design. Critics argue that the CA approach to public policy discounts public duties to protect individuals from the potentially harmful corporate influences because the only ways to best ameliorate such influences are through laws and regulatory frameworks (Michie & West 2013). CA deliberately eschews legislative and fiscal remedies in favour of a 'soft paternalistic' approach (Thaler & Sunstein 2008)—which may therefore ultimately prove ineffective.

First, the CA approach to public policy frequently appears disguised as an implicit campaign to fend off corporate interests. CA advocates argue that what distinguishes their approach from, for example, traditional marketing in certain arenas (such as tobacco sales) is that the CA approach is exercised in service of an individual's health and wellbeing, whereas marketers for the tobacco industry intend to maximize shareholder's value. In this way, CA is justified because—in many policy domains—"the status quo is not neutral" (see Sunstein 2012). However, government already has powerful tools of legislation and regulation at its disposal to promote individual wellbeing by limiting the ability of corporate interests to influence individual purchase and consumption. The argument therefore goes, if it is determined that certain behavioural options are in fact harmful—e.g. tobacco consumption—why does government not sharply limit access to that behaviour (e.g. limiting areas in which tobacco may be consumed and increasing the price of tobacco through taxes)? Why should it instead encourage healthy behaviours and discourage unhealthy behaviours (by, for example, placing tobacco products behind shop counters), as it does through the CA approach?

Even more worrisome, second, choice architects are sometimes guilty of underestimate the role of unhealthy influences on individual decision-making (Michie & West 2013). For example, some CA advocates do not give adequate consideration to the idea that even if individuals were able to reflexively engage with all environmental stimuli that influence their health-related behaviours, they would still be subject to unconscious cues—fostered, for example, by years of industry marketing—that may prompt them to adopt an unhealthy behaviour (Michie & West 2013). For example, even "levelling the playing field" by introducing a healthy-diet CA intervention in a movie cinema would not remove the memories

of always eating sugary snacks at the cinema in previous visits (and thus may not prompt an individual to overcome such a temptation).

In this way, this thesis acknowledges that CA interventions are not uncontroversial, and it is possible to imagine some subset of interventions that may negatively affect an individual's wellbeing over time if a choice architect neglects to consider macro- and micro-environmental factors of the context in which a target behaviour is observed. However, for the purposes of this project, such philosophical and political objections are set aside given the real need to precisely specify what is actually involved in a CA intervention.

3. Introduction to Choice Architecture Conceptualisation

A subset of behavioural interventions, CA interventions involve the provision of behavioural options available for individual decision-making—in respect of individual rational preferences—whilst influencing both automatic and volitional cognitive processes. Such interventions influence individual decision-making by 'nudging' individuals to adopt a preferred course of action but do not eliminate or proscribe behavioural options. As mentioned before, CA interventions take the form of, among other things, changes to micro-environments, default settings, and social norms (House of Lords 2011). The definition of nudge offered by Thaler & Sunstein (2008) says what 'nudge' is *not* as much as what it is. Nudge interventions explicitly exclude legislation, regulation, and techniques that change economic incentives by eliminating choice. Subsequently, the remaining subset of interventions may include information provision (building on social norm feedback) in order

to increase the salience of healthy behaviour; the alteration of the default decisions of a range of health-related tasks, e.g. predetermining the size tableware for food and drink consumption; and the manipulation of the presentation and layout of products, e.g. including graphic text and images on cigarette packages.

This section develops an operational definition and preliminary typology of CA intervention components pertaining to changing behaviour related to health. This iterative approach may help to map CA interventions within other health areas—and even other policy domains—at the level of population interventions and analysis. At minimum, the synthesis of theory and practice will help to structure extant evidence, shape the emerging research agenda of nudges in alcohol use, and provide better understanding of effect mechanisms for behavioural interventions more widely. This preliminary conceptualisation will be elaborated upon through exposure to new conceptual considerations—especially pertaining to the theory of change and intervention design resident in nudges—and will be enriched through application and synthesis with empirical evidence from a Cochrane-style review and realist review (chapters 5 and 6). By systematically reviewing CA interventions this project will critically evaluate the causal mechanisms undergirding the theory of behaviour change for individual-level decision-making and in so doing enrich the conceptual understanding and organizing of 'nudges' within intervention science and, more widely, public policy. Ultimately, such an endeavour will render a little more meaningful the social, cognitive, and automatic processes and mechanisms that undergird both behaviour and altered behaviour.

One aim of this project is to develop a conceptual framework of CA interventions in alcohol use. Hollands et al. (2013) characterise CA interventions as, among other things, taking place within the same micro-environment as that of the behaviour that is targeted for change. For example, as regards dieting interventions, the authors consider the redesign of plates to include smaller portion sizes for food to be a CA intervention because—as per their definition—the intervention takes place within the same micro-environment as the behaviour targeted for change. Thus, the redesigned plate (the intervention) is used in the same cafeteria (the micro-environment) in which an individual consumes smaller portions of food (the targeted behaviour). This criterion is intended only to help draw a causal link between an intervention and an intended effect. Consequently, it ignores other interventions that would be considered CA interventions by Sunstein and Thaler (2008) that take place outside of the micro-environment as that of the targeted behaviour.

Therefore, this thesis relaxes the definition of CA intervention by Hollands et al. (2013) to include interventions that occur regardless of the micro-environment of the targeted behaviour. It refines the definition used by that Hollands et al. (2013) to characterise CA interventions as:

> Interventions that alter the intrinsic physical qualities or positioning of micro-environmental cues in an effort to alter health-related behaviour. This class of interventions may call on both automatic and volitional cognitive responses and respects classical economic rational preferences by not excluding any behavioural options that might otherwise be available if the intervention did not take place.

The distinct cues and properties that make up such strategies are intervention components that may be reasonably separated out for study. Among those, a subset of components is called ‘active ingredients’ that can be explicitly linked to the intervention’s effects on an outcome in

such a way that their omission would render the intervention ineffective (Hoffman et al. 2014). Examples of such components range from alcohol content labels to the size of drink receptacles. Hollands et al. (2013) categorise interventions on the basis of components that affect an object or stimulus's properties, placement, or both. Section 3.2 lists the types of components that may be used to classify a nudge intervention.

3.1 Theory of behaviour change for CA interventions

A fuller account of the general theory of behaviour change underpinning CA interventions in alcohol use is offered in chapter 4. However, because this chapter attempts to offer an initial sketch of the conceptual mapping of CA, it is worthwhile to profile the dual-process model of cognition and behaviour according to which CA interventions operate.

Theories of individual decision-making have influenced the development of behavioural interventions by assuming that human actions are the result of reasoned, conscientious, and deliberate cognitive responses—as well as automatic, reflexive, and involuntary cognitive responses—to stimuli. This body of theories on decision-making are called dual-process models as they draw on both the conscious and unconscious mind. In the case of the former—volitional responses—several models of decision-making related to health have privileged a subject's self-interested cognitive evaluation of stimuli (see, for example, Schwarzer 2001; Rogers 1983; Ajzen 1991). Interventions designed to manipulate the presentation of such stimuli therefore focus on providing information that might persuade a subject to adopt a course of action suitable to an optimized level of health and wellbeing. However, the

effectiveness of such interventions has limited empirical substantiation (Albarracin et al. 2005; WHO 2008). Empirical evidence also indicates substantial differences between individuals' intentions and actual behaviour. Other strands of research have therefore focused on additional mechanisms to understanding behaviour, particularly automatic and reflexive processes that influence behaviour in response to particular local environmental factors (Marteau et al. 2011; Marteau et al. 2012).

Dual-process models depend on granular environmental stimuli, which are thought to check or influence behaviour through a combination of conscious and unconscious cognitive impulses (Bargh & Morsella 2009). Physical and social cues in this way significantly shape individuals' perceived range of choices—of greatest interest to this thesis, specifically choices leading to particular health outcomes. A significant body of literature concentrated on determinants of health-related behaviour has been framed by conceptual frameworks that use the fundamental dual-process model as their operant theory of behaviour change (e.g. Dolan et al, 2010; Michie et al. 2011a; Solar & Irwin 2010; Dahlgren & Whitehead 1991; Bonnefoy et al. 2007). For the purposes of this project, then, the dual-process model of cognition and behaviour—and subsequent strong assumptions about environmental factors—provide the background into which health-related behaviour interventions may be situated.

In explaining the theory of change behind dual-process models of information processing, it is helpful to consider a concrete example. The use of aversive visual images is one intervention that has been used in population-level health settings in order to communicate the potential health risks and consequences associated with a particular behaviour or narrow range of

behaviour. For example, graphic-picture advertising that shows the harmful effects of alcohol consumption on internal organs is used to prevent or moderate heavy drinking (UK Department of Health 2010). Such a form of health-promotion advertising—like that also of aversive-picture warnings on cigarette packages—is intended in part to activate an automatic psychological response of fear or disgust in viewers. This purely visual advertising is less common than other forms of health communication which tend to rely on manipulating only textual or verbal communication. On the other hand, aversive-picture warnings in alcohol consumption are rarely unaccompanied by text, which engages rational, conscious psychological processes. Therefore, it frequently does not make sense to posit a sharp distinction between stimuli that typically serve as complementary sources of information to individuals. This account is intended to help explain the typology of CA interventions listed in the next section because the typology does not disaggregate CA intervention components on the basis of conscious or unconscious processes—instead, it recognises that the CA intervention strategy, as explained above, relies on both processes together.

3.2 Components of CA interventions

Asserting a conceptual typology for CA interventions for alcohol use is useful for categorising relevant intervention components as well as locating this subset of nudges within health-related behavioural interventions. Such a framework draws from theoretical material related to behavioural interventions, CA, alcohol use, and sustained behavioural change—as well as empirical studies of alcohol use. One hope of this project is to develop a model that will not

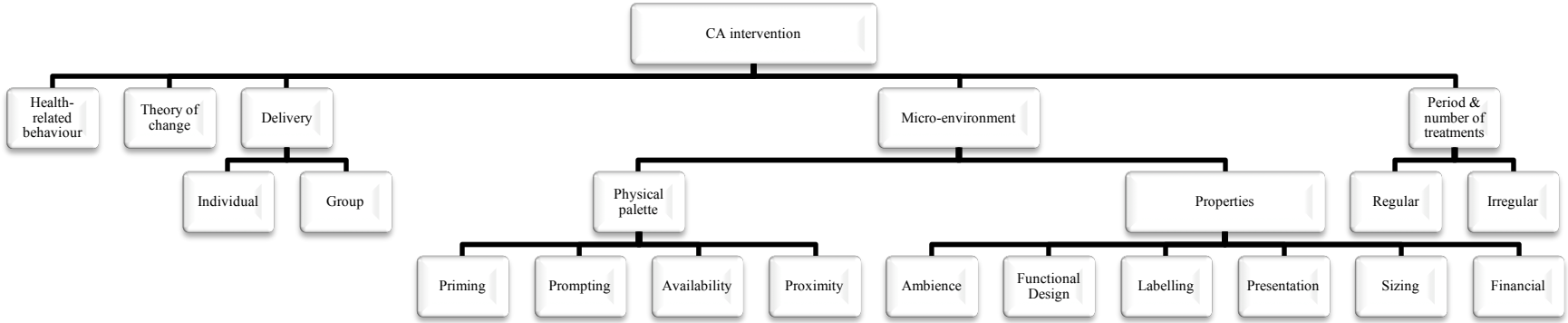
only nest all pertinent terminology related to CA as applied within a health-related behavioural context but will also be able to predict how future studies may be categorised.

If the Hollands et al. (2013) scoping review is perhaps the most recent and developed attempt to develop a typology of CA interventions in public health, the author develops a narrower typology of CA interventions in alcohol use (Figure 1.1). It represents a first attempt to assert a typology of concepts belonging to CA interventions in alcohol use within the wider operation definition of the same interventions in public health developed by Hollands et al. 2013.

The typology is comprised of five categories of intervention components, including targeted health-related behaviour; theory of change; micro-environment; period and number of treatments; intended recipients; and physical palette. Within these categories are a range of component sub-classes, including public or personal sphere (the micro-environment setting in which the behaviour takes place); a single treatment, regular treatments, or as-needed irregular treatments of the intervention (period and number of interventions); and intrinsic qualities or positioning (constituting the physical palette). Notably, the author has subsumed the nine intervention types identified by the Hollands et al. (2013) scoping review into the respective sub-classes: intrinsic qualities, positioning, or both. Preliminary results indicate that the 32 studies of alcohol use identified in the scoping review be categorized into this typology. In addition, this typology is consistent with the Bargh & Morsella (2009) model describing how environmental stimuli elicit behavioural responses through instinctive processes via perceptual, evaluative, motivational, and emotional responses. Finally, following this section

two examples from previous or ongoing studies reveal how CA interventions may be disaggregated into these five component categories.

Figure 1.1 Classifying components of CA interventions in alcohol use



3.2.1 Targeted health-related behaviour

CA interventions affect any number of health-related behaviours. The Hollands et al. 2013 scoping review focused on CA interventions in diet, physical activity, tobacco consumption, and alcohol consumption. Interventions may therefore be classified according to their underlying rationale, theory, and goals in service of changing a health-related behaviour. Given the range of stimuli that may be manipulated to that end, it is helpful to classify them according to at least two levels—which stimuli are necessary active ingredients and which are not.

3.2.2 Selection of intervention recipients and scaling to population level

CA interventions are explicitly intended to introduce, change, or moderate behaviour. However, there is no inherent constraint to a nudge intervention's ability to be scaled to a population level. Put another way, there is nothing inherently limiting about targeting behaviour that predetermines an upper limit to the number of intervention participants. In this way, the excludability constraints of CA interventions are broad enough to encompass a wide range of health behavioural patterns without necessarily specifying individuals of distinct intrinsic qualities, e.g. biomedical history.

3.2.3 Micro-environment in which observed behaviour is affected

Per the theory of change of CA interventions, physical and social micro-environmental factors are important for triggering both automatic and volitional decision-making. The basis of nudges

is to influence the tangible and intangible environment in which choices are made. Hence, studies to evaluate such interventions must assess the nudge at its locus of action: where the targeted behaviour takes place. In broadest terms, it may be possible to disaggregate micro-environments into public and private spheres. Behaviour in public spheres occurs in the vicinity of other individuals—at least some of whom may also be intervention recipients—whereas behaviour in private spheres may be thought of taking place in relative isolation, away from other individuals. In this way, one may consider CA interventions that take place in a home environment—for example—as having particular (familial) social influences or no social influences.

3.2.3.1 Micro-environment: changing physical palette of stimuli

The Hollands et al. (2013) scoping review characterises nudge intervention type on the basis of properties, placement, or both properties and placement of objects and stimuli that help constitute an intervention. For the purposes of this project, it is useful to subsume the nine categories posited by the authors into a wider 'physical palette' intervention component. For example, the absolute and relative location of one or more object and stimulus may be an important factor in individual-level behaviour, and thus a consideration of CA interventions. The absolute positioning of stimuli may affect interventions that rely on information processing (e.g. reading and thinking about nutritional information presented on a label). In addition, the relative positioning of stimuli may matter for interventions that—for example—increase the availability of 'healthier' options relative to 'unhealthier' options (e.g. increasing healthier food options) or change the proximity of options to individuals (e.g. moving cigarette packets behind a shop

counter). As with the physical palette component, the positioning of stimuli may be a constituent element of interventions that rely on extensive conscious processing (e.g. reading nutritional information presented on a label) or on instinctual processing (e.g. reaching across a long distance for certain food items on a cafeteria buffet table).

3.2.3.2 Micro-environment: changing properties of stimuli

Physical qualities of objects or stimuli matter for reasons of comparing efficacy and effectiveness of distinct CA interventions. For this reason, it is reasonable to systematically compare the containers in which alcohol are sold to consumers on the basis of their aesthetic appearance, size, shape, labels, and presentation. Notably, these properties form part of the information base on which individuals consciously and unconsciously make a consumption decision.

3.2.4 Period and number of intervention treatments

Per their theory of design, CA interventions may be delivered once or more than once. Some interventions may involve a single treatment (e.g. the introduction of graphic text and images on cigarette packages) whereas others, including many alcohol-related CA interventions, may include more than one treatment. Regular delivery of nudges may range in periodic occurrence (e.g. daily, weekly, etc.), whereas irregular delivery may commonly derive from an ‘as-needed’ treatment basis. While it may be difficult to compare the sustainability of nudges that vary in the instantiation of their delivery, it should be possible to compare within-group nudges that share

the same or similar number of delivery iterations.

3.2.5 Processes and modes of intervention delivery

Specifying the protocol involved in intervention delivery is important for reasons of efficacy. Examples of such procedures and processes include those associated with prognosis (e.g. screening), treatment (delivery), and assessment (follow-up, measurement of effectiveness, evaluation of intervention fidelity). In addition, it is important to articulate if the intervention delivery is delivered to an individual or a group, and—in the case of the latter—how large the group is, and what is the opportunity for interaction among group members (Hoffman et al. 2014).

Determining to what extent the intervention is delivered as planned is also a useful metric for classifying CA interventions. Intervention fidelity refers to the extent to which an intervention occurs as its designers have intended and naturally affects the degree to which it has the intended effect (Hoffman et al. 2014). This important thing is to precisely identify the target behaviour, which population performs the target behaviour, and the pathways along which the CA intervention causal mechanisms operate. Such a criterion involves not only the receipt of the intervention (who and how many subjects received treatment) but also to what extent the intervention is actually delivered in accordance with intended delivery. Given the wide variety of CA interventions, types of measures used to determine intervention fidelity will similarly vary. For example, in simple pharmacological interventions, assessing fidelity often focuses on recipients' adherence to taking the drug (Hoffman et al. 2014).

3.3 Examples of CA intervention

Given this abstract discussion of intervention components, it is useful to consider concrete examples in which CA interventions are disaggregated into their constituent active ingredients.

3.3.1 Example of CA intervention: effect of glass size on alcohol pouring

Consider, by way of example, a CA intervention to determine whether individuals pour different amounts of alcohol into short, wide glasses or tall, slender glasses (Wansink & van Ittersum 2005). In this intervention, 198 college students were instructed how to pour one standard shot (1.5 ounces, or 44.3 ml) of alcohol before being asked to pour one standard shot into larger glasses. In addition, 86 professional bartenders were instructed to pour on standard shot for four mixed drinks without special instructions. All participants were given 1.5 L rum and whisky bottles (filled with brown tea) and 1.5 L gin and vodka containers (filled with water). Half of all college students and half of all bartenders were given tall, slender glasses (355 ml in volume) and the other half of each sample were supplied with short, wide glass (also 355 ml in volume). In all cases, participants should have poured one standard shot (again, 1.5 ounces, or 44.3 ml) into each glass regardless of shape. Researchers then examined the volume of liquid poured into each glass.

Results demonstrated that the student and bartender groups instructed to pour alcohol into the short, wide glasses actually poured more than students or bartenders instructed to pour into the tall, slender glasses. In fact, averages indicated: for students, 46.1 ml v. 44.7 ml on average

among the two groups; and for bartenders, 54.6 ml v. 46.4 ml on average. These results were therefore perhaps more surprising for bartenders, who—despite an average of six years of experience across both groups—poured 20.5 percent more into the short, wide glass than the tall, slender glasses. It is possible to disaggregate the components that constitute this intervention by organising components into the five categories listed above (Figure 1.2).

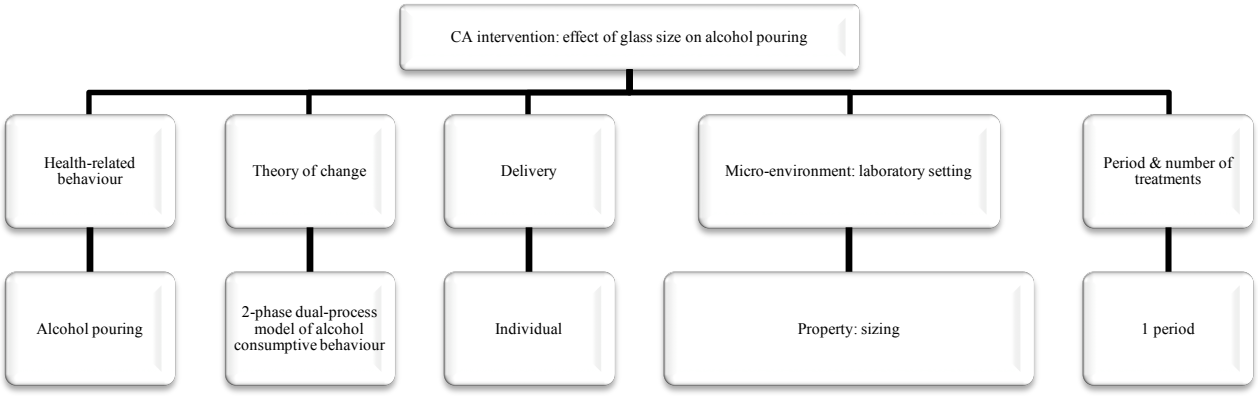


Figure 1.2 Example of CA intervention: effect of glass size on alcohol pouring

In the example above, the health-related behaviour is alcohol pouring. The selection of intervention recipients involved college students and bartenders. The micro-environment under observation is the laboratory setting in which the intervention took place. Most importantly, the targeted behaviour—alcohol pouring—is affected by the active ingredient, size of glassware. Namely, despite the two types of glassware containing the same liquid volume, one was short and wide whereas the other was tall and slender, and participants poured systematically different levels of alcohol into each. Finally, there is only one period under observation, whereby students and participants poured alcohol into four containers in one sitting.

3.3.2 Example of CA intervention: effect of GP financial incentive on HIV testing uptake

Consider too a recent CA intervention designed by an anonymous public health 'nudge' unit in a city that is a high HIV prevalence area. In response to the HIV rate, say that city's public health department proposed to routinely embed HIV testing within the new patient registration process in 40 general practitioner surgeries (GPs). As part of the project, those 40 GPs will be incentivized to offer routine HIV testing to all newly registered patients. While it might be expected that GPs would respond in a linear economic fashion to financial incentives—i.e. they work harder the more they are paid—project designers expect GPs will likely be nuanced in their response to incentives associated with structure, timing, framing and social nature of the intervention.

With this in mind, the public health 'nudge' team draws up a financial incentive structure to act as a catalyst in optimising the uptake of HIV testing alongside new patient registration in selected GP surgeries in the city. Of participating surgeries, half will be randomised to receive a flat-rate financial incentive to offer testing (in the form of a £7.00 payment per HIV test) whereas the other half will receive a group-based incentive in the form of £1.00 incremental payments for each decile threshold reached above 50 percent (e.g. £5.00 for testing 50 percent of new patients, £6.00 for testing 60 percent of new patients, etc.). Most notably, the success of the group will depend on the number of tests administered by the lowest-performing GP surgery, with 50 percent uptake representing the lowest threshold. For example, if almost all of the GP surgeries in this arm achieve an 80 percent uptake and yet one of the surgeries reports 60 percent uptake, the group would receive £6.00 per test. Based on this experimental design data, it is

possible to disaggregate the components that constitute this intervention by organizing components into the five categories listed above (Figure 1.3).

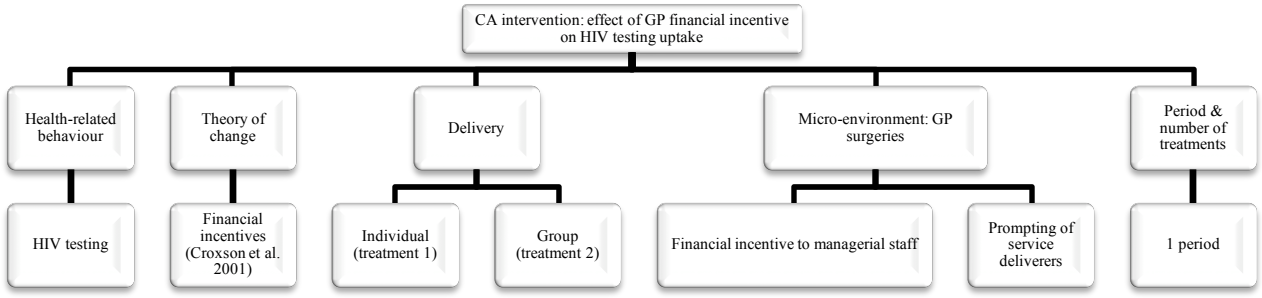


Figure 1.3 *Example of CA intervention: effect of GP financial incentive on HIV testing uptake*

This example is more complex, and complicated, than the first CA intervention example profiled above because 1) the intervention subjects are not as clear, and 2) the causal pathway by which the intervention (financial incentives) leads to behaviour change (HIV testing) is not easily specified. As mentioned, the targeted health-related behaviour is HIV testing, but the direct subjects of the intervention are not the GP patients—rather, it is the managerial GP staff. Indirect subjects of the intervention are service-delivery staff who are presumably motivated in some way to advantage the managerial staff by administering the actual HIV test.

The 'active ingredients' in this intervention are the form of financial incentive—individual flat-rate or group-based incremental payments levied on the basis of number of newly registered patients tested to GP partners—in addition to the form of motivation (e.g. staff meeting addendum, change to default registration form, etc.) that the administrators provide to delivery staff to take these extra testing measures. The micro-environment under observation is the GP

surgery—specifically, the intake room in which new patients are registered. At the level of financial incentives, there is only one iteration and period under observation: the one-off registration of new patients, at which HIV testing is expected to be performed. However, there are an unknown number of iterations in which GP managerial staff motivate service-deliverers to test newly registered patients across the 1-year trial period.

3.4 Survey of research into health-related CA interventions

In addition to CA intervention examples, it is useful to situate this class of behavioural interventions among other intervention sets (Figure 1.4). CA interventions are a class of structural interventions that focus on protecting individual choice and yet ameliorate the effects of negative contextual influences, such as environment and socioeconomic standing. The broader set of structural interventions intend to effect behaviour change through manipulating the structural context in which health choices are observed (Blankenship et al. 2006). What distinguishes the logic of structural interventions from that of other interventions is its attempt to situate the determinants of behaviour within the web of wider environmental factors that are demonstrated to influence such behaviour—such as socioeconomic status—rather than focus only on individual-level characteristics (Blankenship et al. 2006). For example, as regards to health-related behaviour, this intervention class focuses on environmental cues that influence determinants of infection, morbidity, and risk instead of other intervention classes that may focus only on individual-level characteristics.

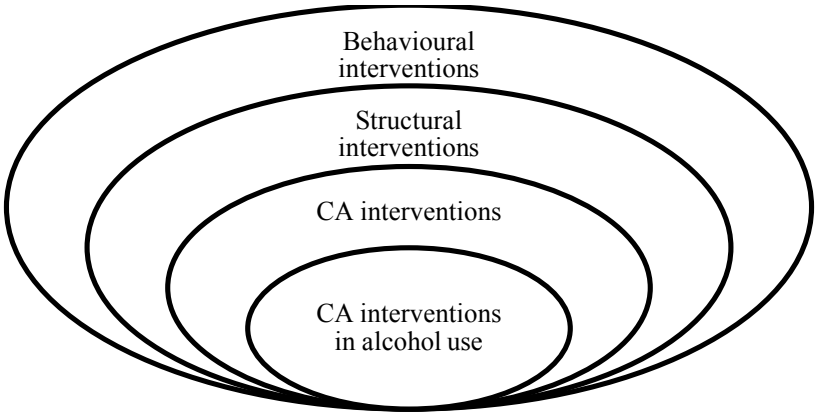


Figure 1.4 *Relationship of CA interventions in alcohol use to broader intervention classes*

As Blankenship and colleagues argue, individual-level interventions assume that "individuals have considerable autonomy to make and act on their choices, but structural approaches view individual agency as constrained or shaped by structures" (Blankenship et al. 2006, 60). Consider, for example, a structural intervention to prevent obesity among adolescents in low-income families by decreasing the costs of healthy foods in relation to other foods high in fats. While some individual-level interventions may privilege education and health-related information awareness, a structural intervention might attempt to change the socioeconomic, political, and physical environments that influence health-related behaviours. As a subset of structural interventions, then, CA interventions manipulate micro-environmental factors that are embedded in larger socioeconomic structures in pursuit of improving health outcomes for individuals.

3.4.1 Scoping review of CA interventions within public health

CA is only one of the latest approaches intended to complement and improve behavioural interventions (Quigley 2013). Just to highlight recent studies, consciously labelled CA interventions have taken place in the context of beverage consumption (Nakamura et al. 2014; Pechey et al. 2013), alcohol consumption (Pechey et al. 2014; Nakamura et al. 2014), tobacco consumption (Han et al. 2014; Hsu et al. 2013; Pechey et al. 2013), chronic disease prevention (Hall et al. 2014; Marteau et al. 2012), and physical activity (Shemilt et al. 2013).

As discussed previously, Hollands et al. (2013) conducted a large-scale systematic scoping review of primary studies in public health involving CA interventions. The authors found that studies were heterogeneous along measures of participants, interventions, comparators, and outcomes (4). Executing a highly sensitive search strategy revealed a paucity of common terminology among intervention studies. Consequently, the authors attempted to identify the key concepts of desired interventions by including terms that indicated variation in physical properties. Such a strategy yielded 1.2 million items from 15 databases and 800,000 after de-duplication. Notably, only one included study—Thorndike et al. 2012—incorporated 'CA' and only three included studies (Rozin et al. 2011; Dayan & Bar-Hillel 2011; Kalnikaite et al 2011) incorporated the term 'nudge' in their titles. Subsequent text mining enabled the reduction of manual screening by up to 90 percent. As a check, over 54,000 abstracts were randomly screened for eligibility. Ultimately, 346 full texts were reviewed and yielded data for extraction. Concurrently, the authors developed a taxonomy of terms for CA interventions in order to better interpret the data. Using their definitions and taxonomy, the authors have gone on to investigate

the effectiveness of CA interventions targeting consumptive behaviours of diet, alcohol, and tobacco by manipulating food labels (Vasiljevic et al. 2015); portion, package, and tableware size (Hollands et al. 2014); and point-of-sale alcohol displays (Nakamura et al. 2014).

In developing the typology of CA interventions in alcohol use, it is perhaps useful to think about such interventions in comparison—at least in principle—to other types of individual-level consumption, namely diet. The Hollands et al. 2013 scoping review revealed that around 4 percent of included studies focused on alcohol use in comparison with studies that focused on diet-related behaviours (over 70 percent). Other helpful considerations arise out of contrast. For example, alcoholic beverages undergo particular scrutiny—which is reflected in their regulation, restricted use, and pricing (Hollands et al. 2013, 37)—in comparison with food and drink items. Moreover, there is a narrower range of applicable or feasible CA interventions for alcohol use than for diet-related consumption. Although alcohol-related CA interventions may involve the provision of alternative products—e.g. lower or no-volume alcohol drinks, electronic cigarettes, nicotine patches, nicotine gum, etc.—the range of options tends to be significantly smaller than the range of options available to diet-related interventions that focus on the availability of unhealthy or healthy food items. In this way, the typology within and surrounding CA interventions in alcohol use may be usefully developed in parallel consideration with other consumption-related interventions.

3.4.2 Systematic review-level literature on CA health interventions

In order to test this emerging typology of CA interventions in alcohol use, it is necessary to systematically collect and assess the primary and secondary research literature that examines health-related nudge effects. There are several non-systematic collections of select evidence (Marteau et al 2011; Dolan et al. 2010; Thaler & Sunstein 2008), but there are relatively few systematic reviews of CA—and, importantly, no extant systematic reviews of CA in alcohol use. Still, it is instructive to draw from two related bodies of literature.

One body of relevant literature includes systematic review-level evidence of the impacts of environmental factors on behavioural patterns and health outcomes (Faith et al, 2007; de Vet et al, 2011; Davison & Lawson, 2006). These reviews assess behavioural interventions on the basis of intervention components that are distinct from those components identified in this paper as belonging to CA interventions. For example, Faith et al. 2007 examine macro-level environmental approaches to the problem of over-eating and obesity in a narrative review. Davison & Lawson (2006) and de Vet et al. (2011) examine environmental correlates of physical activity and dietary behaviour in young people. These reviews investigate intervention types that operate at the community-level and select participants on that basis (as compared with CA interventions, which select for target behaviours). Naturally, then, this body of literature reviews impacts of broad types of intervention within one or more behavioural pattern.

Another body of literature includes a single systematic review of CA interventions. Hollands et al. 2015 conduct a Cochrane-style systematic review to investigate the size of portions, packages,

and items of tableware associated with the microenvironment in which food, alcohol, and tobacco are consumed. They reviewed 72 randomized controlled trials, published between 1978 and July 2013, of which 96 percent pertained to food consumption, 4 percent pertained to tobacco consumption, and none pertained to alcohol consumption. Critical appraisal determined that evidence quality was moderate given possible study limitations due to reporting of research design and experimental conditions. When it came to food consumption, a meta-analysis of 58 trials (6,603 participants) determined a small effect size of portion, packaging, or unit size on intake (standardized mean difference = 0.38, 95% confidence interval: 0.29 to 0.46). The authors concluded that individuals, especially adults, consumed more food when presented with the option of varying-size food and non-alcoholic beverage portions.

4. NEED FOR THIS THESIS

Among other things, given the recent emergence of 'CA' and 'nudging' (Thaler & Sunstein 2008), it is unsurprising that evidence from health CA interventions generally lack a common terminology, which vastly complicates systematic search strategies (see Hollands et al. 2012). The inconsistent use of terminology to describe health-related CA interventions is likely due to several sources. First of all, it is important to note that there is little automatic health-related meaning attached to 'choice', 'architecture', and 'CA', indicating this set of related terms must be qualified in several important ways to render them meaningful. Second, because of the relatively new conceptualisation behind the CA approach, there is perhaps a lack of consensus on common acceptable terminology within the policy and academic spheres. For example, many CA interventions have been subsumed into the arena of 'behavioural insights' by the UK

Behavioural Insights Team, whereas other nudge units—such as ideas42, a US-based for-profit organisation—implement nudges that are called 'behavioural science applications'. Third, the recency issue likely helps to explain the nascent state of the evidence base: several studies are in varying stages of experimentation and publication. One desirable outcome of this project is to refine of 'CA' causal mechanisms in the specific context of alcohol use in order to aid in intervention design and evaluation.

Consequently, relatively little evidence has so far been systematically collected and analysed. Even more importantly, the recency of CA has thus far made it difficult to specify precisely the causal mechanisms that these interventions are intended to affect. Governments are spending tens of millions of dollars to enrol members of the public in well-intentioned programs that supposedly nudge optimal choices, yet conceptual understanding of the causal mechanisms undergirding nudge-related behaviour change has not yet been adequately theorised (House of Lords 2011).

This doctoral project intends to tackle these issues as part of a wider remit to specify and evaluate the theoretical components and causal pathways embedded in CA interventions in alcohol consumption. First, as mentioned above it tries to answer the core research question: What are the causal mechanisms for behaviour change undergirding CA interventions in alcohol use? It draws on systematic review methodology, including that used by reviews of theory, Cochrane-style meta-analyses, and realist reviews, in order to elicit the effects and mechanisms of CA interventions in alcohol consumption. Second, this project attempts to develop a methodological guide to designing CA interventions in alcohol use by inductively generating a

qualitative taxonomy of theoretical constructs and theories used in CA interventions in alcohol consumption in order to highlight potential research gaps and unrealised opportunities for future intervention design. Together, these aims should expand common understanding of the feasibility and desirability of allocating resources to CA interventions in view of improving health-related behaviour.

Chapter 2
Extant Research on Alcohol Consumptive Behaviour

1. INTRODUCTION

This chapter seeks to explore behaviours associated with alcohol, before and after consumption. It presents a brief profile of alcohol misuse as a leading risk factor contributing to the global burden of disease and then describes a model of behaviour to explain alcohol consumption, drawing from the twin influences of unconscious and conscious cognitive processes. First, it describes the prevalence of alcohol consumption in the general population; second, it briefly outlines the most common intervention strategy used to treat alcohol abuse; and third, it gestures to the operant logic by which CA interventions are intended to change alcohol consumptive behaviour.

2. PREVALENCE AND EFFECTS

2.1 Prevalence of excessive alcohol consumption

The World Health Organization estimates some 2 billion people consume alcohol (WHO 2004). The highest alcohol consumption levels are observed in Europe—with 11 litres of pure alcohol consumed per adult—followed by other regions containing developed countries (WHO 2011). Alcohol is the fifth leading component of the global burden of disease, contributing to 3.3 million deaths, or 5.9 percent, of all deaths worldwide and to 130 million disability-adjusted life years, or 5.1 percent, of total years of life lost (WHO 2014). In particular, among young people

aged 15 to 29, some 9 percent of deaths are related to alcohol consumption (WHO 2011). Significantly, nearly twice as many deaths of males are attributed to alcohol as compared to deaths of females; the ratio is 7.6 percent of deaths among males to 4 percent of deaths among females (WHO 2011). Moreover, 65 percent of alcohol-related deaths occur before the subject reaches age 60 (WHO 2004).

2.2 Physiological effects of excessive alcohol consumption

Several physiological effects are regularly observed in the context of overconsumption. Moderate consumption is associated with conditions affecting the bodily system (e.g. insulin sensitivity), brain (e.g. silent infarcts), blood (e.g. thrombosis, fibrinolysis, coronary blood flow), and skeleton (e.g. bone density), among others (Babor et al. 2010). Overconsumption is associated with conditions affecting the brain (e.g. vision changes, ataxia, impaired memory); mouth, trachea, and oesophagus (e.g. cancer); heart (e.g. cardio-myopathy); liver (e.g. cirrhosis, hepatitis); stomach (e.g. gastritis); and pancreas (e.g. pancreatitis; Babor et al. 2010).

The disease concept of alcohol tends to differentiate individuals who are non-dependent on alcohol (i.e. drink 'normally') from those who are alcohol-dependent (Jellinik 1952; Trice & Roman 1968). From the pharmacotherapy perspective, as a disease alcoholism merits treatment using medication, such as antidipsotropic drugs that induce a negative physical response to consumption (e.g. vomiting), psychotropic drugs that treat what is presumed to be an underlying psychosocial condition that spurs overconsumption (e.g. anti-anxiety medication treating social stress), and—at the extreme end—hallucinogenic drugs that seek to alter permanent behaviour

change via treatment on a substantially changed consciousness plane (Miller et al. 1998). From a psychotherapy perspective, alcoholism is thought to merit treatment via interpersonal interactions (in a group or one-on-one) that may include counselling, behaviour therapy, narrative therapy, metapsychiatry, mutual help (such as the 12-step program), among many others. Importantly, one of the most popular intervention strategies—brief interventions—falls into this camp and is discuss in section 4 (Miller et al. 1995).

2.3 Psychosocial and economic impacts of excessive alcohol consumption

Given its varied uses—as an intoxicant, beverage item, gift, and lubricant for social life—alcohol is the most popular recreational drug in the world. As a social lubricant, alcohol is associated with feelings of slight euphoria, changes in affect, and lowered inhibitions. It may also exacerbate losses in productivity, anti-social behaviours, and mental health issues (such as depression). However, overconsumption is associated with psychosocial effects including irritability, anti-social thoughts and behaviour, anxiety, psychosis, hallucinations, sleep disorders, and chronic cravings (Babor et al. 2010). Moreover, the stigma associated with harmful drinking and alcoholism (also discussed later) sometimes exacerbates these negative feelings and may contribute to a perverse feedback system in which an individual is driven to consume increasing amounts of alcohol.

Alcohol misuse is similarly related to a number of socioeconomic issues. According to the 2014 UK Drinkaware campaign, costs of alcohol misuse are estimate to be roughly £21 billion, of which £11 billion is expended on crime, £7.5 billion on losses in productivity and other

economic outcomes, and £3.5 billion is expended on health care. Collins & Lapsley (2008) assert a correlation between alcohol consumption and reduced workplace productivity, accidents, and drink driving. Heavy levels of consumption have also been associated with domestic violence (O'Farrell 1995; Cunradi 2002). Moreover, chronic alcohol consumption is a contributing factor to suicide, job instability, homelessness, and extended stays in hospitals (Caton 2005; Egbert 1985; Hibbs 1994; Kushel 2001; Mandelberg 2000). Importantly, it has been demonstrated the physical, psychological, and social harms accrue at least as much if not more to heavy drinkers (who exhibit signs of alcohol dependence) as to problem drinkers (Anderson 1991).

3. Alcohol Consumption as Harmful Behaviour

3.1 Social epidemiology of excessive alcohol consumption

More than 76 million people worldwide have disorders associated with alcohol misuse (Lancet 2009). Heavy alcohol consumption may be roughly categorized into at least three types on the basis of amount of alcohol consumed by volume: hazardous drinking, harmful drinking, and alcohol dependence (or problem drinking), but these categories are not easily separable (Kaner 2007). Alcohol dependence is the easiest to characterise. The Diagnostic and Statistical Manual of Mental Disorders fifth edition (DSM-V 2013) defines alcohol abuse as a destructive behavioural pattern of alcohol use that occurs within a 1-year period and produces maladaptive behaviours resulting in physical or social harms. Within alcohol abuse, alcoholism—or alcohol dependence—is observed when an individual no longer has control over their alcohol consumption, creating social, psychological, and/or work-related harms. The diagnosis of alcohol

dependence is asserted when an individual has three or more of the following characteristics: tolerance; withdrawal; uncontrolled behaviour; cravings; spends an inordinate amount of time imbibing or recovering from alcohol; reduces social or recreational activity because of alcohol use; and persists in alcohol consumption despite knowledge that their consumptive behaviour is contributing to their physical or psychological issues (DSM-V 2013).

Notably, this thesis makes reference to both harmful drinking and problem drinking. (The former subsumes the latter.) Harmful drinking is understood to refer to the behaviour of an individual who exhibits one or more signs of alcohol abuse but does not yet exhibit alcohol dependence. Problem drinking is understood to indicate alcohol dependence. This matters in part because some CA interventions discussed in chapters 5 and 6 are targeted to problem drinkers specifically, whereas others are targeted to harmful drinkers more broadly.

3.2 Sequelae of excessive alcohol consumption

Alcohol consumption has been proven to be a constituent factor of more than 200 disease and injury conditions, notably cirrhosis and alcohol dependence (WHO 2014). Chronic heavy alcohol consumption is linked to harmful effects on a number of bodily organs, including those in the gastro-intestinal system (Hillman 2003). Alcohol is estimated to contribute to up to 30 percent of oesophageal cancer, liver cancer, liver cirrhosis, and epilepsy (WHO 2010). More widely, clinical and epidemiological studies report a relationship between heavy drinking and physical and psychiatric illnesses, absence from employment, as well as injuries and fatalities due to alcohol-related motor vehicle accidents, falls, drowning, fires, and burns (NCIPC 2001). Rehm et

al. (2010) completed a systematic review of reviews and meta-analyses and reported a causal connection relating average volume of alcohol consumption and drinking habits to chronic and acute diseases, such as ischaemic heart disease and foetal alcohol syndrome. In addition to specific disease outcomes under review, the authors hypothesised that drinking patterns may be causally related to other outcomes, but the current state of epidemiological literature has thus far indicated a limited focus on regular episodes of heavy drinking.

4. State of the Evidence on Brief Alcohol Interventions

4.1 Brief interventions

Although there are a host of alcohol-related interventions that incorporate pharmacological and other components, perhaps the most popular alcohol intervention strategy is that of brief alcohol interventions (Kaner 2007). They are defined as "practices that aim to identify a real or potential alcohol problem and motivate an individual to do something about it" (Babor & Higgins-Biddle 2001). Brief interventions have been further characterized as an intervention strategy that—whilst incorporating different formats, durations, populations of interest, and facilitator types—attempts to moderate alcohol consumption through 1) alcohol education, 2) advice, 3) counselling, and/or 4) specialist referral for graduated levels of risk as determined by scores on the Alcohol Use Disorders Identification Test (AUDIT; Babor & Higgins-Biddle 2001). Though structure may vary significantly (Heather 1995), most brief interventions are grounded in personalized feedback on an individual's alcohol consumption, education about what constitutes differential risk levels for consumption, motivational interviewing with a focus on possible

benefits of intervention uptake, coping strategies in addressing 'high-risk drink situations' in which the temptation to consume would be great, and a planning stage for reducing alcohol intake (Babor & Higgins-Biddle 2001). In primary care contexts, brief interventions are usually delivered by health care professionals to harmful drinkers, targeted especially to harmful drinkers who are not thought to have sought aid for their consumption behaviour (Kaner 2007). The 'advice' component of brief interventions is critical because medical professionals are encouraged to take advantage of spontaneous opportunities to advise harmful drinkers who may be unaware that their level of consumption is greater than what is considered advisable (McCambridge 2014). And the 'brief' component is critical as well—many such interventions are delivered in 5 minutes (Makela 2011)—as they not only conserve the time and resources of medical professionals in demand elsewhere but they are also seen to be less intrusive to patients.

A brief alcohol intervention was first implemented in 1962, when Morris Chafetz and colleagues offered personalised feedback and advice to a patient vising the emergency room of Massachusetts General Hospital in Boston (Chafetz et al. 1962). The intervention roughly coincided with the start of a change in thinking about alcoholism in primary care—spearheaded by D.L. Davies (Davies 1962)—in which the previous focus on abstinence as the exclusive end-goal of treatment was supplemented with a focus on reducing, or moderating, consumption. Through the 1970s, the designation of alcohol as a disease was contested in part because of an emerging notion that problem drinking may be better considered a behaviour rather than a pathology (Marlatt 1973; Skog 1985) and out of a fear that the social opprobrium that came with being called an alcoholic might undermine the ability of health care professionals to find and help problem drinkers (Room 2012). Such disagreement drove in part the desire to pursue

alternative intervention outcomes, such as consumption reduction, and thus brief intervention strategies evolved and began to proliferate. Continued discussion around the epidemiology and policy of alcohol consumption lead to the development of a trial investigating the effects of a brief intervention on married men, in which 'brief advice' was tested against the treatment-as-usual policy (i.e. in-patient admission and facilitated aftercare; Edwards et al. 1977). These men and their wives were told that achieving their goals was within their own means instead of in the care of others.

A review of brief alcohol interventions helped to cement them as the most popular interventions strategy for reducing consumption (Bien et al. 1993). The review included 32 controlled trials and 5,951 subjects comparing a brief intervention to a control arm (19 trials) and a brief intervention to extended therapy (13 trials). Intervention content tended to include pamphlets, personalised input and advice, counselling, and referral, and the majority of interventions were offered in one-off sessions. Among included trials were some that incorporated motivational interviewing, an intervention component that seeks to engage participants in non-judgemental conversation and appeals to consider their own goals in reducing consumption (Miller 1991). Other components, such as personalised feedback, were informed by the Transtheoretical Change model, which saw attempts to moderate alcohol consumption as a series of stages in which strategies to motivate and guide participants could be targeted to the specific stage in which a participant found herself (Prochaska & DiClemente 1983).

Several systematic reviews have examined the effects of brief interventions on excessive drinkers (Moyer 2002; Poikolainen 1999; Wilk 1997; NHS CRD 1993). The most recent

Cochrane review and meta-analysis included 29 controlled trials, of which 24 were conducted in a GP office and 5 in a hospital emergency room (Kaner 2007). Over 7,000 participants—with a mean age of 42 years—were assessed, and at baseline they were found to drink on average over 306 grams (over 30 standard units) each week. Meta-analysis of 22 trials showed that those participants who received a brief intervention drank approximately 38 fewer grams a week (95 percent confidence interval: -54 to -23) as compared to the control group. Such a result was accompanied by a high degree of heterogeneity (I-squared = 57 percent). At one-year follow-up, treatment participants drank on average 38 fewer grams (CI: -23 to -54 grams) than control participants. Sub-group analysis for 8 trials (2,307 participants) indicated that men benefited more from the trial (mean difference: -57 grams a week, 95 percent CI: -89 to -25) as compared to women (mean difference: -10 grams a week, 95 percent CI: -48 to 29).

4.2 Relevance of CA alcohol intervention strategies

Just as thinking in primary care about alcoholism shifted between the 1960s and 80s, so has the thinking about the means of intervention strategies intended to reduce consumption. As dual-process models of health have proliferated (discussed in chapter 4), it is now increasingly recognised that problem drinkers—as well as heavy drinkers who may later develop health problems—are subject to unconscious and conscious psychological factors that shape their decision to consume alcohol as well as how much. There are now increasingly efforts to incorporate behavioural economic principles in brief intervention strategies which may help to mitigate the influence of cognitive biases that interfere with an individual's stated goals vis-à-vis alcohol intake.

Similarly, within primary care there is a growing focus on preventive care—especially among young people—to curb the burden of disease of overconsumption. Brief interventions may now be delivered over the Internet and SMS-text-based message services, and hence health care professionals enjoy the opportunity to experiment with intervention dosage and timing more than ever (Walters & Neighbors 2011; Tait & Christensen 2010). For that matter, because of the possibility of reducing time and resources devoted to interventions through such mediation by technology, some interventions of this kind may not need to be 'brief' (Linke et al. 2008). These changes reflect larger trends in defining intervention content and components (McCambridge 2014).

Chapter 3
Introduction to Relevant Systematic Review Methodology

1. INTRODUCTION

This chapter introduces the methodology used by this thesis in answering the research question, what are the causal mechanisms for behaviour change undergirding choice architecture (CA) interventions in alcohol use? It discusses the relevant philosophical and methodological approaches demonstrated by each of Cochrane-style systematic review and meta-analysis, review of theory, realist review, and qualitative taxonomy generation. As the three reviews and taxonomy explain, these different methodologies grew out of specific research aims that could not be satisfied using only one approach.

2. COCHRANE-STYLE SYSTEMATIC REVIEW

2.1 Introduction to methodology

Given the widespread popularity of systematic reviews in intervention science, this section only *briefly* introduces systematic review and meta-analysis methods, as best propagated by the Cochrane Collaboration (henceforth called in this thesis, 'Cochrane-style systematic review'; Higgins & Green 2011). As a methodology that later contributed to the development of evidence-based policy and practice, systematic reviews are used to aggregate and synthesise evidence from multiple studies (generally trials collecting primary data). The methodology focuses on gathering relevant empirical evidence using—most frequently—an *a priori* research protocol. Systematic

reviews grow out of a demand by US and UK policymakers for transparent investigations into social-scientific phenomena in the 1980s (Clegg 2005). The education of primary healthcare professionals was subject to one of the first such investigations, in which pre-specified criteria determined how relevant data would be generated and analysed (Guyatt 1991). Moving from the human sciences over to the social sciences and their inter-disciplinary intersections—in fields as diverse as criminology and education—systematic reviews are now widely used across investigations into social phenomena. This section therefore discusses the broad aims of Cochrane-style reviews and meta-analyses to anticipate chapter 5, a systematic review of CA intervention into alcohol consumption in public drink settings.

2.2 Principles

Systematic reviews grow out of the positivist tradition (Greenhalgh & Russell 2009), which asserts there is an objective reality external to human perception that may yet be understood by humans. The unit of analysis of systematic reviews and meta-analyses is usually the composite effect size generated by statistically combining the individual effect sizes of multiple trials along some outcome. Widely respected as a research method, meta-analysis forms the upper echelon of a posited hierarchy of evidence (Evans 2003). However, the approach is subject to substantial criticism, particularly from the perspective of epistemology given conflicting interpretations about the nature of social reality (e.g. whether it is external to human perceptions, whether it may be understood by humans; Pawson 2006). Moreover, Evans (2003) argues that Cochrane-style systematic review—and evidence-based policy and practice more widely—cloaks itself in sanitising language that takes for granted an agnostic approach to investigation (i.e. non-political,

among other things).

2.3 Methods

The Cochrane Collaboration has established publication standards for systematic reviews and meta-analyses (Higgins & Green 2011). Such standards guide the development of a research protocol that seeks to posit *a priori* 1) a research question; 2) criteria to critically appraise collected evidence; 3) comprehensive search strategies to collate all relevant studies that meet would be of interest in answering the research question; 4) methodology to generate, analyse, and synthesise data that is subject to the critical appraisal criteria; and 5) a synthesis of research findings. Most importantly, research protocols belonging to systematic reviews should be transparently reported so as to enable replicability by other researchers.

2.4 Results

This meta-analysis reported in this thesis will use a random-effects model in order to compare standardised mean-difference effect sizes across interventions. The random-effects model is helpful in addressing what will likely be heterogeneous data (Higgins & Green 2011). Such a comparison will enable analysis of the same outcome generated by different intervention strategies that operate according to the same causal logic (that of the CA approach based on dual-process models of behaviour). Standardised mean-differences report an intervention's effect size in relation to the total variance of a single intervention's scores. One powerful assumption required in interpreting this summary measure is that the single outcome generated by each

individual trial should only be attributed to each study's measurement scale and not to systemic differences in sample populations across the trials (Higgins & Green 2011).

3. REVIEW OF THEORY

3.1 Introduction to methodology

Qualitative systematic reviews have grown to encompass reviews of theory, which help to narratively define the conceptual landscape surrounding a set of phenomena (Lorenc et al. 2012). Reviews of theory are helpful in literature sub-genres in which the conceptual littoral are convoluted and draw from a range of methodological approaches. In developing such a review, some of the methods employed by Cochrane-style systematic reviews may help in articulating a research question and objectives, defining inclusion criteria and search strategies, and developing narrative syntheses. This methodology section builds on the approaches used by Campbell et al.'s review of theories about the causal relationship between income and health (2014), Bonell et al.'s review of theories on school environment and health (2013), and Baxter & Allmark's review of chest pain and medical assistance (2013). The broad principles and methods used in these papers in turn inform the development of a methodology applied in chapter 4, a review of theories used in dual-process models of health-related behaviour and cognition.

3.2 Principles

'Theory' may refer to a coherent, internally consistent conceptual framework that attempts to account for the existence and/or logical workings of a phenomenon or set of phenomena (see Merton 1968). A theory in natural science may attempt to organise and explain—using testable hypotheses—observations of a phenomena, and the results of testing those hypotheses should give credence to, or detract from, the explanatory and predictive power of that theory. Within the social sciences, Merton argued for a hierarchy of theory types, in which higher-order theories abstracted from large sets of social and physical phenomena and middle-range theories abstracted from a single phenomenon or small set of phenomena (1968). Inherent to many theories is causal power. Gough et al. (2012) discuss the logic models within which the features of a discrete cause or set of causes are channelled via well-defined pathways to an observable effect or set of effects. Within the health sciences, such logic models or causal pathways may be explicit or implicit in observational and other experimental studies.

Reviews of theory enable careful investigation into models that attempt to explain the wide variety of intrinsic and micro- and macro-environmental factors that affect human health. Such reviews help to isolate and delineate the relationship between a large variety of factors (Baxter et al. 2010). Their objectives are frequently to elicit and organise as complete a set of relevant theories as possible; synthesise theories that share overlapping themes and areas of conceptual agreement; and reveal areas of competing explanations and conceptual contestation (Campbell et al. 2014). Due in part to the fact that theory may be developed inductively or deductively, reviews of theory are frequently agnostic with regard to discipline or methodology as long as

long as the theory in question is relevant to a particular research question.

At least a few qualitative methods have been developed to conduct reviews of theory (Baxter et al. 2010; Bonell et al. 2013; Campbell et al. 2014; Bonell et al. 2016). One method takes the approach of a literature review, generated in large part from the most recent or salient relevant theories as well as expert knowledge. Yet such reviews are fairly subjected to criticisms of bias given that they may be skewed by a reviewer's particular discipline as well as a theory's publication date and/or impact factor (Campbell et al. 2014). Another method borrows from Cochrane-style systematic reviews, which incorporate *a priori* specified inclusion criteria and search strategies intended in part to limit the effects of bias on generating the review. Cochrane-style reviews also allow for critical appraisal and may elicit a comprehensive narrative synthesis of main findings (Bonell et al. 2013). Yet it should be carefully noted that a review of theory is *not* a Cochrane-style review and differs in several substantial respects. For one thing—unlike in a Cochrane-style review—the unit of analysis for a review of theory is theory itself, rather than primary trial effect sizes. Second, a review of theory is itself unlikely to be unbiased given that the narrative synthesis is inherently interpretive and thus incorporates subjective judgements about, for example, ways to map conceptual understandings of some phenomenon or set of phenomena (Campbell et al. 2014). On the other hand, these two limitations should not be considered disqualifying given that a review of theory is intended to elicit further conceptual thought—particularly in the context of 'meta-theories' synthesising two or more theories relevant to some research question—and thereby widening the creative space within which testable predictions and conclusions may be generated.

3.3 Methods

A review of theory research question may have a large or small aperture of focus, reflecting the objectives of the reviewers. For example, reviewers may pose a broad question in order to identify the greatest variety sample of theories that seek to explain a particular phenomenon (Baxter et al. 2010). Campbell et al. (2014) examined the broad range of relevant theories connecting income and health. Or, a narrow question may be posed in order to investigate a narrow slice of theories relevant to some interesting aspect of a set of phenomena. Bonell et al. (2013) examined theories linking school-level factors to precise health measures.

As with Cochrane-style reviews, inclusion criteria should be developed *a priori* to specify a prescribed set of relevant theories. Unlike Cochrane-style review inclusion criteria, however, reviews of theory lack specified publication standards or methodological guidance with regard to inclusion criteria. Therefore, one challenge for each review is to specify what is meant by 'theory' above and beyond what is described at the beginning of this section. A paper may appear to describe a hypothesis or experimental finding, and its designation as a 'theory' paper or not may be subject to contestation. Therefore, a paper's clear delineation of causation is critical. An included theory ought to posit an explanatory account or hypothesis articulating a causal pathway linking together two or more phenomena of interest (Campbell et al. 2014).

Because subjective judgement is in this way vital for determining inclusion criteria, reviews of theory should be iterative—meaning that inclusion criteria that have been developed *a priori* may well be refined. For example, reviewers may return again and again to excluded papers or

'boundary cases' as they learn more about the conceptual landscape surrounding a research question. In the first iteration of comparing a set of papers to inclusion criteria, reviewers may accidentally exclude critical theories that—while failing one or more inclusion criteria—are nonetheless key to understanding some aspect of a logic model connecting phenomena of interest. This is because reviewers themselves are learning more about the conceptual landscape within which a phenomenon is explained, and as they immerse themselves, they may wish their search to reflect a richer, more nuanced understanding of a field (Bambra 2011). Thus, it may be necessary to append the search protocol—providing that, of course, such revisions are fully and transparently documented. In addition, is is frequently also helpful for subjective decisions to be made independently by multiple reviewers reviewing and discussing each paper. Notably, the process of iterative searching and revisiting inclusion criteria naturally subjects a review of theory to fair criticism on the basis of subjective bias and replicability of search results (Campbell et al. 2014) as will be discussed in chapter 4.

Cochrane-style reviews frequently involve combing through electronic research databases of both ongoing and published trials. Review of theories also incorporate electronic searches in addition to expert consultations, forward- and backward-citation tracking, and perusals of reference lists among included papers (search strategies for systematic reviews are discussed in Petticrew & Roberts 2006). However, searches incorporated into reviews of theory may yield a sample of theories that is less than comprehensive given that—among other reasons—theories may not be labelled as such and may not be mentioned in paper titles or abstracts (Campbell et al. 2014). While synonyms for theories may be carefully searched (e.g. 'model', 'pathway', 'causal connection'), and while search fields may be expanded to include full-text reviews

instead of only title and abstract, it is possible that some theories may nonetheless be missed. This possible limitation of the review should be documented, as well as attempts made through the search strategy to mitigate it. For example, Bonell et al. (2013) searched concurrently for papers outlining theories linking school environment and student health and for papers reporting the effects of primary trials on the same. It is possible that searching for theoretical literature alone could have failed to yield papers that went on to be included in the review.

Data relevant to a review of theories may be extracted from included papers on the basis of their relation to an overall theory or to a theoretical construct (Bonell et al. 2013). Notably, theoretical data from included papers may be reported in a wide range of different sections of an included paper. For example, theoretical data may be drawn from a paper's introduction and background section, but also—in a primary trial study—from authors' summary and discussion of main findings. Causal pathways linking together a set of phenomena may not be directly characterised as such within a single paper, much less in the cross-comparison of papers (each with a potentially different set of conceptual vocabulary; Campbell et al. 2014). For this reason, careful review of entire the entire text of included papers is vital.

Perhaps the most difficult part of conducting a review of theory is critically appraising included theories in view of their relevance to a research question. One reason is because the 'methodological quality' of theories and theory development is markedly different from the evidence gathered in other qualitative reviews (Bonell et al. 2013). Critical appraisal of evidence—on the basis of its collection, analysis, and possibility for bias—helps systematic reviewers to weigh the relative merits of included documents in view of generating main findings

and implications for policy. There is intense methodological discussion as to if and how different qualitative study designs—generating different forms of evidence—should be critically assessed (Gough et al. 2012). Most appraisal tools rely on measures of internal validity and fidelity of study design and implementation (Gough et al. 2012).

Yet no such standardized tool is in widespread use for reviews of theory, in part because theory—as a unit of analysis—is frequently too heterogeneous to critically assess using a prescribed set of criteria (Bonell et al. 2013). Attempts have been made. For example, Baxter & Allmark (2013) have looked to the relative methodological quality of empirical data gathered on the basis of operant theories as a way to indicate the quality of those theories. However, theories and primary trial evidence necessarily represent distinct research arenas, and thus critically appraising one arena by the merits of another may be unfair (Campbell et al. 2011). Of greatest interest to this thesis, Bonell et al. (2013) developed a set of criteria centred on a theory's relevance to a research question and the degree to which a causal pathway and theoretical constructs are articulated. Admittedly, such a focus on detail does not capture the predictive power or generalisability of a theory, but at least evaluating on the basis of clear reporting of causal relationships within a set of phenomena represents an important initial step to developing critical appraisal tools for reviews of theory.

3.4 Results

The research question and objectives should guide the review's modes of analysing and synthesising theoretical data. Reviews of theory are intended to interpret and map theories in

such a way that conceptual and empirical evidence are understood in new ways (Gough et al. 2012). As a first step in synthesis, comparing theories on the basis of key concept definitions, hypothesised causal pathways, temporal sequencing, outcomes, and a range of contextual factors helps to distinguish significant areas of conceptual overlap and difference (Hardin 2008). Theories may then be mapped on the basis of common themes and aims and related through a narrative synthesis. For example, Lorenc et al. (2012) sought to specify individual causal claims from a set of included theories, outline the relationships between those causal claims and factors, and then sought to organise the theories in a framework. In contrast, Bonell et al. (2013) focused on the theories themselves—rather than just the individual causal claims contained within them—and organised them syncretically on the basis of shared assumptions.

Areas of divergence or disagreement should be clearly articulated as well, particularly where theories make competing causal claims regarding the same phenomenon or set of phenomena (Campbell et al. 2014). Reviews of theory tend to handle areas of disagreement differently, according to the research aims. One challenge in adjudicating disagreements is determining whether or not a disagreement arises from conceptual vocabularies belonging to different theories that are simply contesting the same causal claim—or that are actually incommensurable. Methods of thematic synthesis may help here by distinguishing different organisations of theories (Thomas & Harden 2008). For example, some themes may be generated from the shared focus of a set of theories on particular observed evidence. Some themes may grow out of the relation of a set of theories to a particular contested causal pathway, either a single factor or set of factors, or to the relationship between factors. Other themes still may derive from a reviewer's immersion into seminal papers, given their aid in organising inclusion criteria. Synthetic methods

borrowed from meta-ethnography—as outlined in Noblit & Hare (1988), for example—can also help reviewers to determine if seemingly incommensurable theories attempt to explain not the same causal pathway linking a set of phenomena but rather different stages along that pathway.

It is also critical that reviewers analyse and synthesise in turn, instead of moving uni-directionally from analysis of individual theories to synthesis of multiple theories (Baxter et al. 2010). Namely, reviewers ought to generate main findings from the narrative synthesis by considering and reconsidering individual theories and theoretical components. Moving back and forth between analysis of individual theories and the synthesis of theories grouped on the basis of theme or epistemic assumptions may yield additional insights into core concepts identified by one or more theories. These core concepts themselves may form the organising principles for a wider framework into which models—and their constituent factors—may be situated.

4. REALIST REVIEW

4.1 Introduction to methodology

Intervention science has struggled to develop a method to synthesise the results generated by seemingly heterogeneous interventions targeting the same outcome. Realist synthesis represents one qualitative theory-driven approach to review methods from the perspective of an intervention's underlying theoretical causal logic (Pawson 2006). In doing so, it elicits the interaction of context and an individual actor's decision-making in a given complex intervention setting. For the purposes of this project, a 'complex intervention' is an intervention that consists

of multiple human and non-human components that may interact in a non-linear, non-deterministic fashion that generates outcomes (Craig et al. 2008). Famously, realist synthesis attempts to explain not just if an intervention is effective, but exactly how it attains an effect—'how', 'why', 'in what ways', and 'to what degree' does an intervention work (Wong 2012, in Hannes & Lockwood 2012). In this way, the approach attempts to elicit the causal logic according to which interventions proceed and how they might be better designed (Wong 2012, in Hannes & Lockwood 2012). This section introduces the philosophical background of realist synthesis and then discusses its methodology. In doing so, it anticipates the methods employed in chapter 6, a realist review of causal mechanisms of CA interventions in alcohol consumption.

Realist synthesis is justified in investigating the extent to which an intervention's operant theory of behaviour explains the outcomes of a complex intervention. In contrast with Cochrane-style systematic reviews, realist synthesis assumes that it is not just the case that an intervention has an effect size with a given confidence interval. Instead, an intervention is thought to alter the physical and/or social context in which an individual operates which prompts an individual to behave in such a way as to produce an outcome (Wong et al. 2010). The 'prompting' takes the form of a mechanism or range of mechanisms resulting in a range of predicted and/or unpredicted outcomes. Most importantly, realist synthesis articulates more sharply than Cochrane-style reviews the possibility that a given intervention will achieve a particular effect in one context and not in another context, or to a lesser or greater degree.

A realist review may be necessary when the goal is to make sense of an outcome that is the result of individual decision-making within a particular physical and/or social context (Ford et al.

2016). To that end, realist synthesis uses theory to drive causal explanations for intervention outcomes. As such, they may be particularly helpful when conducted alongside Cochrane-style meta-analysis given those times that, for example, heterogeneous interventions are investigated to achieve a particular outcome or, conversely, that a particular intervention type generates heterogeneous outcomes (see chapter 5). Whereas a meta-analysis seeks to generate a composite effect size, the realist review seeks to address how it is that the observed effect size 'comes about'. In this way, a realist review enables insights that may go beyond the potential of synthesising purely experimental designs by persistently questioning the logic according to which an intervention proceeds (Wong et al. 2010).

4.2 Principles

Unsurprisingly, given its name, realist synthesis grows out of the 'realist' approach to the world, emphasising causal pathways among phenomena contained within a physical and social reality external to an individual's perceptions (Pawson 2006). Realists hold that this reality can only be measured, and therefore understood, indirectly. For this reason, Wong et al. (2013) write that this philosophy of science is placed along a spectrum between positivism (which asserts a reality that can be measured directly) and constructivism (which asserts that reality cannot be known even indirectly, given that it must only be filtered by individual human senses). Of relevance to this discussion, realists hold that physical and social reality may be changed through complex interventions which directly shape the environment, or context, within which an individual operates.

In complex interventions, human and non-human components interact via mechanisms to generate outcomes (Wong 2012, in Hannes & Lockwood 2012). Human components include any person who has a role in the intervention, including participants, researchers, and/or others. Non-human components include resources that are 'acted upon' in the intervention as a result of the decisions of individuals. Exactly how an individual operates, or makes decisions, within that environment depends in part on mechanisms, defined by this thesis as the "…underlying entities, processes, or structures which operate in particular contexts to generate outcomes of interest" (Astbury & Leeuw 2010). Mechanisms represent invisible catalysts through which an individual interacting within a context generates an outcome (Wong 2012, in Hannes & Lockwood 2012).

At a higher level of abstraction, the programme theory—using Pawson's term—consists of the logic chain linking together relevant intervention components that give rise to outcomes (Pawson 2006). In this way, individuals involved in the intervention make decisions and behave within a universe of possibilities; that universe is constrained by the environment and non-human resources shaping individuals' decisions and behaviour. If intervention components are specified, it may be possible to identify different pathways through which an intervention is enacted—resulting in a range of predictable outcomes (only some of which may be desirable by the intervention designer). In this way, the pathways of an intervention's operation are limited by the contextual factors—or the set of human and non-human components—involved in the study. The combination of contextual factors, the mechanisms through which those factors are actualised, and the outcome(s) are represented by Pawson & Tilley (1997) in the configuration C + M = O, in which C represents 'context', M 'mechanism', and O 'outcome' (henceforth called 'CMO configuration').

It should be noted that a realist review may struggle to appropriately define, situate, and test mechanisms (Pawson 2006; Pawson et al. 2005). Mechanisms are vitally important in enabling reviewers to use theory to make sense of intervention outcomes. For example, the mechanisms through which these outcomes are generated may be partially explained through 'middle-range' theories that, although conceptual, are "close enough to observed data to be incorporated in propositions that permit empirical testing" (Pawson 2006, 39). Those middle-range theories that may or may not explain or predict a given phenomenon of interest are called 'candidate' middle-range theories, as their ability to explain observed data is one of the key motivating questions for realist synthesis (Wong 2012, in Hannes & Lockwood 2012).

It should be clear that the pathways along which complex interventions operate may be neither linear nor deterministic (Pawson 2006). This is because individuals do not always make the same choices, particularly when contextual factors are even slightly altered. Yet, once again assuming that intervention components are properly specified, it may be possible to predict certain individual decisions and behaviours—and therefore intervention pathways and outcomes—with some degree of regularity. It becomes the role of an intervention designer then to shape the context within which an individual operates such that the universe of possibilities for an individual's behaviour may be constrained. In this way, it is possible to shape contextual factors that result in semi-predictable patterns of decision-making called 'demi-regularities' (Pawson 2003). Put another way, demi-regularities are the products of contextual factors triggering mechanisms, which result in outcomes (Wong 2012, in Hannes & Lockwood 2012). Demi-regularities are quite important to realist review, as they represent a higher level of abstraction above that of intervention components and represent an initial attempt in making sense of

observable data. They do this by allowing a researcher to observe the extent to which data do or do not 'fit' within *a priori* semi-predictable patterns of decision-making initially intended by an intervention's protocol (Wong 2012, in Hannes & Lockwood 2012). In this way, realist synthesis ought to identify relevant demi-regularities as a way to begin positing how an intervention is working.

If a demi-regularity is observed in multiple instances of the same intervention, or across a set of closely related interventions, then it may be possible to begin identifying underlying mechanisms. Of course, the mechanisms may be triggered to greater and lesser degrees across this set of studies, but the 'sameness in kind' across different contexts—even if contexts only differ in time points within the same physical and social environment—helps to implicate some aspect of causation within the intervention (Wong 2012, in Hannes & Lockwood 2012). The identification of demi-regular patterns of decisions and behaviours enables researchers to draw larger lessons among studies and to test candidate middle-range theories.

Drawing together these levels of abstraction it is possible to see that realist synthesis explains exactly how a complex intervention works in a given context whilst respecting the range of human decision-making. Among other things, this is important for explaining heterogeneous data—why, for example, an intervention may generate a particular effect in one context but not in another, even another seemingly similar context (Pawson 2006). Bespoke theory-driven explanations of this sort derive from accounting for outcomes through elucidating the mechanisms through which relevant contextual level factors and intervention participants interact. And the inductive approach—proceeding from specifying intervention components to identifying demi-regular patterns of choices and behaviour to organizing middle- and higher-

range theories—goes above and beyond determining "what intervention works" by insisting on interrogating how it works. In this way, the fundamental principles of realist synthesis enable it to be simultaneously backward-looking (in examining how an intervention has worked in the past) as well as forward-looking (in enabling inferences about how to improve upon the design of an intervention in another context).

4.3 Methods

As with other review methods, realist synthesis starts with the development of a protocol. Unlike other reviews, however, realist synthesis may require a reviewer to operate different processes of the review simultaneously, iteratively change the protocol, and return as required to each stage of the review as knowledge is generated about the programme logic under examination (Pawson et al. 2005). In this way, just as complex interventions are not assumed to operate in a linear fashion, neither does the review method. The reason for iterative data processing and theorising is because reviewers may—at almost any stage—identify previously unexamined CMO configurations or even middle-range theories (Wong 2012, in Hannes & Lockwood 2012). If that is the case, such configurations or theories should be investigated among other studies included in the review. Naturally, all revisions to an initial protocol are expected to be reported, for example, in the interest of understanding the backdrop against which new knowledge is generated.

The review proceeds from theory-driven consideration of a research question concerning a complex intervention that may be broadened or—more likely—narrowed as a review progresses.

In addition to purely academic interest, the question should emerge bearing the concerns of relevant stakeholders in mind—including, for example, the population to which an intervention may be applied (e.g. Kane et al. 2010). It is vitally important at this stage to understand that a realist review will likely be expected to focus only on one particular emphasis of 'how' a complex intervention proceeds. As it relates to causation, a review may focus on 'under what circumstances' a particular intervention yields a range of effects and not—for reasons of time and resources—on 'for whom' or 'to what degree' an outcome is observed (Wong et al. 2013). Other reviews may focus on particular intervention outcomes (e.g. smoking cessation) or particular environments (e.g. within particular neighbourhoods). This careful specification of emphasis naturally undercuts the extent to which a review may be generalisable even in the context of a particular complex intervention. Yet the uptake of such modest expectations for a review's objectives may well be that findings proceed from a more precise, rigorous examination of the review literature (Wong 2012, in Hannes & Lockwood 2012). And, again, given the iterative nature of realist synthesis, it is possible—contingent on time and resources—to provide for examination of additional emphases within the scope of the research question.

It may be the case that in positing a research question, a reviewer may have in mind a potential causal logic—or programme theory—to explain how observed outcomes are produced by a given complex intervention. Prior assumptions of this sort are likely borne out of a review team's previous knowledge of the literature and discussions with other experts, and they can help a team to focus attention on a preliminary set of intervention components of interest and, possibly, potential mechanisms through which those components are activated (Wong 2012, in Hannes & Lockwood 2012). Naturally as included studies are analysed and synthesised the programme

theory is enriched and complicated. As demi-regularities are identified and sorted in middle-range theories, candidate theories will likely be refined or discarded—a process that should, of course, be reported. Importantly, candidate theories should be held to the standards of parsimony, generalisability, and comprehensiveness (Wong 2012, in Hannes & Lockwood 2012). Namely, a candidate theory should 1) help articulate an answer to a given research question, 2) capture mechanisms that may be generalised to explain observable data beyond just one study, and 3) comprehensively explain the relationship between contextual factors, mechanisms, and outcomes. A review team would do well here to consider the kind of data that is necessary to help answer the research question and how that data may be pulled from included studies.

At the level of study selection, it is the objective of the review team to generate a representative 'maximum variety sample' of papers that may challenge middle-range theories (Wong 2012, in Hannes & Lockwood 2012). The generation of that sample should be conditioned on the research question. A maximum variety sample allows for the possibility of capturing both effective and ineffective case study interventions (Wong 2012, in Hannes & Lockwood 2012). Such a sample may be generated in part by broad inclusion criteria, the inclusion of a large number of databases, and the inclusion of multiple research designs, depending on the research question. By examining interventions along a spectrum of effectiveness and efficacy, a review team may begin to imagine the universe of possible contexts within which an intervention may be situated (Wong 2012, in Hannes & Lockwood 2012). And in these contexts, it may be possible to identify channels that promote or inhibit mechanisms through which outcomes are produced. Those search methods used by other review methods—including 'snowball' searching and combing

through electronic databases—are also used by realist reviews (Haig & Dozier 2003). However, search strategies may be employed again and again as candidate theories are identified and searches are refined and reported. One measure of the need to re-run searches is the identification of a new demi-regularity that is not explained by the middle-range theories identified so far. Frequently, discussion with experts in the field complement the searching of databases and reference lists (Greenhalgh & Peacock 2005).

Here it is worth asking at what point a search process may end. Pawson (2006) recommends using saturation to indicate when enough studies have been searched. 'Saturation' here signifies in part when enough data have been identified through new studies to identify demi-regularities and test middle-range theories (Pawson 2006). Naturally, the point at which saturation is achieved should be reported in the review, even if it is seemingly impossible to know if there are any further studies that could be relevant to the research question of interest.

Data that may be included for consideration by a realist review is generally of a diverse nature given that the unit of analysis for this review type is theory. In part because realist synthesis is agnostic with regard to study design, the inclusion and appraisal of data within a study is contingent on their relevance to theorising and testing theories as well as the rigor with which they have been generated (Wong 2012, in Hannes & Lockwood 2012). Notably, considerations about quality and rigor of study design are less important for data used to 'build theory' as they are for data used to 'challenge theory' (Wong 2012, in Hannes & Lockwood 2012). This is because the importance of data used to build theory is derived in part from their conceptual value in cogently explaining the causal logic linking outcomes to mechanisms and components,

whereas the importance of data used to challenge theory is derived in part from its empirical ability to bear out or undermine a given candidate middle-range theory.

Though their presentations may vary greatly, extracted data for realist synthesis generally includes study descriptions (including as much contextual detail as possible), possible results (in, for example, an observational study), and—importantly—the theoretical placement of the study in its design and its conclusions (Wong et al. 2013). Understandably data related to intervention components (especially 'active ingredients'), context, mechanisms, and outcomes are most important as they may implicate demi-regularities, middle-range theories, and a composite programme theory. Given the wide possible variation in data type and reporting, a review's extraction template will likely be refined over time as both analysis and synthesis proceed.

Realist review takes careful note of the quality appraisal of data, given the potentially large number of sources which may generate relevant of data. In particular, the 'rigor' with which a study is conducted or conceptualised is significant insofar as it generates data that may aid in challenging candidate middle-range theories (Pawson 2006). Unlike other review methods, such as Cochrane-style systematic reviews, the judgement of the rigor of, for example, a primary trial is not categorically accepted or rejected on the basis of its comparison to some external quality standard. Rather, what is most important is the 'best-fittedness' of a study's contribution to theory building or theory testing through the provision of data which serve one of those two purposes (Wong et al. 2013). For example, a study may well yield findings that do not appear methodologically rigorous, but for the purposes of the realist review that same study's conceptualisation of a model of behaviour could yield an important nuance to a middle-range

theory that appears to be borne out by the findings of a more rigorous primary trial. In a realist review, data may well be extracted from both included studies as they serve different purposes and lend different strengths to the review.

4.4 Results

Realist synthesis assumes that contextual-level factors fire mechanisms that result in outcomes of interest to a research question. Analysis helps to organise and make sense of intervention components and demi-regularities within different studies, and synthesis allows reviewers to compare how a programme theory is *supposed* to 'work' versus how it *actually* 'works' by elucidating and testing middle-range theories that make up the broader programme theory (Wong et al. 2010). Equally important, the strength of main findings generated at this stage of the review is measured in part based on their ability to articulate and understand the circumstances under which observed effects are generated from a set of contexts and mechanisms.

The product of realist analysis should elucidate inferences about the relationship between the constituent elements of a complex intervention: its context, mechanisms and outcomes. Those inferences should be organised within a programme theory that helps to explain observed demi-regular patterns. In this way, analysis proceeds at different levels of abstraction. At the higher level, the programme theory should—in some combination—explain the greatest possible degree of variation among observed outcomes (Wong 2012, in Hannes & Lockwood 2012). Within this programme theory, how contextual-level factors trigger (or do not trigger, as the case may be) mechanisms to produce outcomes should be clearly explained by middle-range theories. At a

lower level, analysis proceeds inductively by laying out the configuration by which those contextual-level factors (including individual components), mechanisms, and outcomes are arranged. It is important here to clearly delimit contextual factors, mechanisms, and outcomes—even as the review recognises the complexity and inter-connectedness of these elements (Ford et al. 2016). For example, one review's contextual factor may be represented in another review's mechanism (Wong 2012, in Hannes & Lockwood 2012). Observable patterns among those configurations (or demi-regularities) may enable testing middle-range theories that help to explain some set of contingencies in which some set of outcomes are achieved.

As synthesis proceeds, the observation of demi-regularities across different studies should be carefully noted as they may help make sense of CMO configurations as well as the relative generalisability of candidate middle-range theories. The objective of synthesis is—broadly speaking—to indicate whether the logic scheme according to which a complex intervention is supposed to operate is borne out in the granular theoretical landscape of included studies (Wong et al. 2013). A candidate theory is duly substantiated if it makes sense of and organises some set of demi-regularities and, in do doing, therefore explains under what circumstances (including which mechanisms are operating and to what degree) an observed outcome is produced given some set of contexts (Wong 2012, in Hannes & Lockwood 2012).

Realist synthesis is not ultimately definitive but rather represents the best contemporary understanding of a type of complex intervention (Wong et al. 2010). Its programme theory should continue to be refined as middle-range theories are enriched and complicated by application to new experiments and situations. Even as the validity and applicability of realist

synthesis is contingent on updated knowledge, however, the predictive power of its programme theory should enable it to be applied to situations that are most like the ideal types that its constituent middle-range theories represent (Wong 2012, in Hannes & Lockwood 2012). Namely, given the encapsulation by a middle-range theory of a highly specified set of contextual-level factors, mechanisms, and outcomes, an intervention designer may use it to design an intervention in a closely related situation to achieve a similar effect, understanding that no two contexts are ever identical and that human decision-making is rarely fully predictable. Yet the ability to consider programme theories in whole or in part makes it possible to guide intervention design. The findings of a realist review may indicate to researchers and policymakers not only if a complex intervention will work for a given situation but equally important *how* and *to what* degree it might work.

5. QUALITATIVE TAXONOMY GENERATION

5.1 Introduction to methodology

Research advances in intervention science have included attempts to classify intervention components using taxonomies. A taxonomy is an empirical mapping of available evidence that substantiates the existence of and possible relationships between such components, and therefore, helps to explain the phenomenon (Deatrick et al. 2006). The core competency of qualitative taxonomy generation is its ability to identify and cluster related components into patterns of commonality and variation. The characteristic logic of grouping “like with like” helps to specify clusters of attributes that prompt a researcher to conceptualise a complex topic area

using its constituent components, which are likely not easily distinguishable at first glance (Miles & Huberman 1994). In CA interventions in alcohol consumption, for example, it is desirable to cluster theories and theoretical constructs that describe CA causal mechanisms in order to better understand how a CA intervention generates behaviour change (chapter 7). One of the most cited typology generation methodologies is posited by Miles & Huberman (1994), who employ qualitative clustering through discrete aggregation and comparison techniques. The qualitative typology generation method used by this thesis is based in part on their model.

5.2 Principles

In general terms, qualitative research methods are undertaken to design, implement, and evaluate interventions across multiple policy domains. Among those methods, qualitative typology generation in particular is helpful in planning intervention protocols and specifying outcome instruments—both in selecting for the actual components of interventions but also for tailoring interventions to local circumstance. For example, each intervention treatment may represent a different ideal type, and the comparison of results may therefore clarify understanding of not just each ideal type but also the components that make it up (Deatrick et al. 2006). What also distinguishes typology generation from other qualitative methods are the processes of reintegration among decontextualized data (Given 2008). For example, qualitative content analysis considers coded data independent of their source, whereas thematic analysis allows for the possibility of examining data both separate from their context but also in re-imagined relation to their context through the application of new conceptual insights. Given its ability to help separate and organise conceptual elements in a transparent fashion, the qualitative typology is an

effective tool for analysing and articulating complex research topics in need of further conceptualisation.

Governing organisational frameworks used in generating qualitative typologies are dictated by different agendas. For example, education researchers may assert hierarchical critical assessment criteria to map quality of schools and teaching, whereas labour economists may organise components of financial management decision-making within group households within a matrix. Above all else, a taxonomy should follow a set of key organising principles in identifying and classifying elements of commonality and variation (Given 2008). In asserting a class of elements on the basis of some commonality, for instance, the researcher pinpoints something that is shared by more than one component of a phenomenon and may thus account for some part of the existence of the phenomenon. Although patterns of commonality may be intuited from the data, at first remove they may instead form an *a priori* motivation for a research question and thus be used to implicate ways of ascertaining relevant sources of data. For example, if a researcher interested in 'hotspot policing' hypothesises that a certain subset of shoplifting behaviour is common across most hotspots within a given area, she may test that hypothesis using focus groups to question public officials and police officers involved in designing the hotspot strategy.

In structuring a way to think about a phenomenon, the goal is to further disaggregate constituent elements until irreducible conceptual elements are identified. For example, within experimental psychology, many cognitive biases are understood to be irreducible and thus help to form the building blocks of typologies seeking to explain certain heuristics and behaviours (Blumenthal-Barby & Krieger 2015). More widely, the legitimacy of a conceptual element depends on its

manifestation in at least one component of a phenomenon and on its relevance to the research question.

5.3 Methods

Key to qualitative taxonomy generation is thematic analysis. This research method is intended to reduce and analyse data through the de-contextualisation, coding, categorisation, summarisation, and recombination of data in a way that meaningfully reveals conceptual insight into a complex topic or phenomenon (Given 2008). It is first and foremost a descriptive approach to a complex topic that identifies relevant data and organises it into inductive patterns. The output of such an analysis is some organised classification of such patterns from a conceptual dataset that not only describes data but also organises them.

In comparison to other qualitative methods, thematic analysis does not attempt to imbue data with novel conceptual understandings through at least partial inclusion of the researcher's analytical toolkit (Given 2008). Instead, conceptual elements are asserted and defined, bearing in mind that their later revision is not only acceptable but likely required. Subsequently, the researcher generates other concepts that are expected to be found within an evidence base. Concepts may be predicted through, for example, qualitative survey or focus groups that may identify data sources and trends of potential interest (Given 2008). It is also possible to generate a code through different systematic review methods, including realist review. While at this stage coding is likely to be more organic rather than systematic or analytic, categories of codes will develop as analytic induction of concepts generates within- and across-category comparisons

(Miles & Huberman 1994). Coding categories may themselves be organised into a smaller number of higher-order categories through a process called pattern coding. Cross-category analysis is enabled by pattern coding because it allows for cross-classification of subthemes as well (Miles & Huberman 1994), and the potential for such re-organisation of elements enables alternative interpretations of conceptual ideas and patterns of commonality and variation.

5.4 Results

While methodology standards often gesture to sequential steps, in practice qualitative methods such as typology generation are rarely so neat. An iterative process includes the non-linear sequence of coding data, categorising data, managing data, developing matrices, and specifying cross-classification of subthemes. In fact, few generalizations can reliably be made with regard to sequencing steps of data processing and analysis. First, each new conceptual element, coding category, and subtheme should be first evaluated with respect to its relevance to the research question (Given 2008). Second, coding tends to occur more often at the beginning of an investigation. Third, pattern recognition tends to occur more often toward the conclusion of an investigation (Given 2008). In this way, the boundaries between the stages of thematic coding, analysis, and synthesis are blurred. Ultimately, what is hoped for is that the decontextualisation of data will point to generalizations about both ideal types and 'boundary cases' in which conceptual elements may share properties with more than one higher-order category.

Generalisations about thematic patterns and ideal types are enabled through thematic synthesis. The synthesis stage is used to identify elements of commonality and variation within a complex

topic or phenomenon. Elements of commonality are likely to be found among and across categories of conceptual components, particularly as higher levels of abstraction are attained. At the same time, the researcher should remember that conceptual understandings of a phenomenon cannot but be influenced by context, meaning that environmental cues will influence the motivation and manifestation of a phenomenon on the basis of on-the-ground factors (Given 2008). It is partly in recognition of this complicated relationship between abstraction and context that CA intervention strategies in alcohol consumption are grouped in the taxonomy listed in this thesis (chapter 7).

Chapter 4
A Review of Theories of Dual-Process Models of Health-Related Behaviour and Cognition

1. Introduction

As discussed in chapter 1, CA interventions are complex interventions that incorporate dual-process models of behaviour. Yet it is difficult to make causal claims about the effectiveness of the CA approach without making explicit the theory of change behind the approach—or if a given CA intervention trial adequately operates along the logic of such a theory. No existing review—systematic or otherwise—has synthesised the CA theory of change. Collating and combining the conceptual literature behind the dual-system model in this way would enrich and complicate evidentiary analysis of CA interventions. Therefore, as part of this broad project, the author undertook a review of theory to examine the conceptual literature undergirding the CA approach to health by examining dual-process models of health-related behaviour and cognition. This review later feeds into a realist review of CA interventions in alcohol consumption (chapter 6) by specifying relevant theories that drive how alcohol-related CA interventions have been or could be designed. This review builds on the approaches used by Campbell et al.'s review of theories about the causal relationship between income and health (2014), Bonell et al.'s review of theories on school environment and health (2013), and Baxter & Allmark's review of chest pain and medical assistance (2013). Their objectives are to elicit and organise as complete a set of relevant theories as possible; synthesise theories that share overlapping themes and areas of conceptual agreement; and reveal areas of competing explanations and conceptual contestation.

As discussed in the research proposal, there are two conceptual frameworks to use in imagining how individual decision-making and behaviour operate. The first model (sometimes called System 1) is derived from unconscious, instinctive, and involuntary reasoning grown out of learned associations and leading to instinctive cognitive and behavioural responses (Kahneman 2011). Such a model is also characterised in part by its relation to specific cues in the environment, which may produce a behavioural urge to act based in part on stimuli's emotional effect on a subject. Thus, the locus of attention is on the environmental context of a particular situation. The second model of cognition and behaviour (sometimes called System 2) is thought to result from conscious reasoning in pursuit of personal interest and (generally) responds to incentives in the interest of maximising personal happiness or utility (Kahneman 2011). Thus, the locus of attention is placed on the individual's given set of information in a particular situation. Notably, there is substantial evidence that separate brain structures for information processing lends credence to the dual-system model (Rangel et al. 2008).

Importantly, considering these two conceptual frameworks together implicates the possibility that an individual will make an irrational or at least inconsistent decision with respect to their rational preferences. The reason for this is because an individual will be prompted by their System 1 cognitive processing to automatically respond to environmental context even as their System 2 cognitive processing prompts them to consciously consider the incomplete set of information gleaned from the situation (see Thaler & Sunstein 2008). Moreover, System 1 processes many things both simultaneously and unconsciously, whereas System 2 processes fewer things deeply and reflectively (Evans 2008). In the interest of enriching this thesis's discussion of factors conducive or disruptive to one particular health-related behaviour (alcohol

consumption), this review focuses on theories of behaviour and behaviour change that explicitly incorporate both models of behaviour (Systems 1 and 2). In doing so, it may be possible to refine the understanding of alcohol consumption using the dual-process model—especially in precisely specifying the causal pathways along which this particular health-related behaviour takes place.

1.1 Rationale for this review

Theory synthesis is of burgeoning interest within intervention science, demonstrating how critical it is to understand the conceptual mapping into which intervention mechanisms may be placed in achieving outcomes (Bonell et al. 2012, Pound & Campbell 2015). Conceptual mappings of phenomena aid in the development of interventions by, for example, guiding investigations into health behaviour and dictating the application of an intervention schema in a new context. Against this backdrop, this review is intended to synthesise the conceptual literature undergirding CA interventions by exploring relevant psychological dual-process models of health behaviour.

Equally important, until now many behaviour change interventions have relied on an individual's conscious decision-making ability in influencing their health-related behaviour. This speaks in part to the dominance of the rational choice paradigm popularised by mainstream microeconomic models (Elster 1986) which privileges consideration of the set of information and incentives presented to an individual in making a decision. However, analysis that assumes that an individual engages in conscious, reflective thought before making decisions may neglect a significant level of variance in behaviour (Webb & Sheeran 2006). Assuming a dual-process

model to explain health-related behaviour significantly contributes to the understanding of how and under what conditions such behaviour takes place, as well as how and under what conditions some set of interventions work to change that behaviour. It is possible to imagine, for example, that a properly specified causal analysis of a dual-system model may help reveal those situations in which one model (e.g. System 1) exhibits outsize influence on individual behaviour over and above another model (e.g. System 2).

1.2 Objectives

The aim of this review is to to scope and synthesise a spectrum of theories incorporating dual-process models of health-related behaviour. It seeks to delineate the theoretical constructs, such as 'self-regulation' or 'social preferences', that make up those theories for the purposes of synthesising causal mechanisms into relevant groups of theories.

2. Foregrounding Dual-Process Models in 'Rational' Decision-Making

Before examining dual-process models, it helps to focus on theories of behaviour entailing conscious, reflective decision-making (System 2) because as discussed above many behavioural interventions operate on the powerful assumption that an individual's behaviour depends upon volitional information-processing and decision-making alone. For example, brief alcohol interventions rely almost exclusively on motivational interviewing and cognitive-behavioural principles that assume individuals can consciously decide to moderate their alcohol consumption by—among other things—understanding the sources of craving and planning how to avoid

craving-inducing situations (Miller & Rollnick 1991). This section foregrounds dual-process models by reflecting on several popular antecedent theories used in healthy psychology that assume an individual is a rational actor whose behaviours result from conscious, reflective decision-making.

2.1 Rational choice theory

Psychological theories of behaviour have helped to inform standard economic theory with regard to systematic modelling of decision-making. In particular, assumptions about human preferences and the pursuit of them have become embodied in one school of thought called rational choice theory. The school assumes that persons seek to maximise their utility—proxies for which include happiness or satisfaction levels—through a careful consideration of advantages and disadvantages associated with pursuing utility. Moreover, a subset of rational choice models is called expected utility models, in which individuals are assumed to behave in such a way as to maximise their utility in the short- or medium-term future (hence their 'expected utility').

In formal terms, rational choice theory holds that preferences are consistent (meaning they are transitive and without contradiction) and that they are well-defined (meaning that they ascribe to a logical system; Elster 1986). These strict assumptions are useful because they allow behaviour to be modelled in such a way that compelling mathematical properties may be ascribed to them—useful for, among other things, describing and tracking trends over time. Other assumptions include the ideas that: preferences are stable and immutable across time, individuals are able to pursue their preferences bearing full and complete knowledge related to that pursuit,

and individuals know what would be the most efficient way to obtain those preferences such that their utility is fully realised (Elster 1986).

It should be noted, however, that rational choice models are not usually offered to fully explain and predict human behaviour. Rather, they are taken to offer a simplistic, extreme perspective of human behaviour that can 1) isolate specific features of behaviours and incentives used to trigger those behaviours, and 2) represent an epistemological foundation of individual decision-making that can be enriched and complicated (Elster 1986). On this view, individuals act 'mostly rational' most of the time but do not conform their decisions or behaviours to utility maximisation as rational choice would predict (Persky 1995). For the purposes of this review, rational choice theory—and related volitional decision-making models discussed below—are therefore *not* included as a dual-process model but rather serve as a useful study in contrast in comparison with the models included in the following review.

2.2 Expectancy value theories

Proceeding from rational choice, it is possible to unpack one of the assumptions undergirding rational choice models: the provision of full information to individuals as they seek to realise their utility preferences. Those preferences form the basis of an individual's expectations with regard to how much utility will result from certain behaviours—hence the term, 'expectancy value' (Darnton 2008). However, such an assumption is extreme given that in only very few cases is an individual given the full provision of information that relates to a given behaviour. More broadly, expectancy value theories are useful for exploring prior attitudes and beliefs that

may influence unidirectional decision-making. Simply put, behaviour is the result of a process linking beliefs about consequences of a range of behaviours alongside normative beliefs about those consequences. In other words, normative priors—conditioned in part by the expectation of others' beliefs—motivate how an individual assigns cost-benefit value to the full array of foreseen consequences of a behaviour.

One example of an expectancy value theory is the Health Belief Model (Rosenstock 1975). The Health Belief Model focuses particular attention on preventative health behaviours and harnesses the power of nuanced cost-benefit expectations, including perceptions of benefits and barriers to preventive care as well as perceptions of vulnerability and severity of possible conditions resulting from unhealthy behaviours. However, these perceptions are only triggered in combination with external incentives. A behavioural intention may be informed by the interpretation of fear-based constructs that employ rational components, such as the severity of an unhealthy medical condition, probability of such a condition obtaining, and efficacy of a treatment response. In this way, behavioural intentions are also the linear result of conscious consideration that forecasts outcome beliefs.

Perhaps the best known example of an expectancy value theory is the Theory of Reasoned Action (Fishbein & Ajzen 1975). According to the Theory, an individual's attitudes about a particular behaviour result from their beliefs about the likelihood of consequences attendant on that behaviour as well as beliefs about the normative evaluation of those consequences by others. Fishbein and Ajzen (1975) in this way connect attitudes and behaviours through intentions. In addition, the Theory asserts that individual attitudes are also partly driven by social stereotypes

(discussed later) in the development of an intention. Such considerations are formed in large part by the forecasting of other people's attitudes and beliefs by an individual considering a particular behavioural outcome in advance of achieving that outcome.

As attitudinal elements relating to behavioural intentions and outcomes are refined, there is an attempt to more precisely delineate types of beliefs. Ajzen (1991) goes on to articulate the popular Theory of Planned Behaviour, which notably positions beliefs as antecedent to attitudes oriented around behaviour. Beliefs are separated into three camps: agnostic likelihood forecasts about the full set of possible outcomes, evaluative beliefs about behavioural consequences resulting from cost-benefit analysis, and beliefs about what other people think with regard to an individual's behaviour. These three sets of beliefs are mediated by each other, and by norms, to produce a set of attitudes towards behavioural intentions. Continuing to move backward along the linear pathway outlined by expectancy value models—from behavioural outcome, to behavioural intention, to attitudes, to beliefs—other models examine external influences that help to shape beliefs.

2.3 Behavioural models proceeding from self-reflection

Expectancy value theories of behaviour flow in part from an individual's consideration of their self-concept and self-efficacy. Self-concept refers to the ability of an individual to evaluate their own competencies, limitations, values and worth (Calhoun & Morse 1977). It is used by an individual to distinguish themself from other people. The authors hold that this construct develops over the course of early childhood as an individual becomes self-aware and—garnering

knowledge through shared interactions with others, especially parents and siblings—begins to determine what makes them unique. Self-concept precedes self-esteem because the latter evolves out of a child's already partially determined estimation of his competencies in relation to other people (Calhoun & Morse 1977). Namely, self-esteem develops as an individual realises their strengths vis-à-vis those of other individuals around them. Because of the comparison aspect of this evaluation, Calhoun and Morse hold that self-concept tends to be more stable over time whereas self-esteem may evolve in relation to changing circumstances around an individual—for example, as they physically change and as their community changes.

In discussing attitudinal orientations towards behaviour, it is necessary too to investigate the role of an individual's agency. As a social psychological construct, Bandura's idea of self-efficacy has been popularised as a proxy of agency (1977). In Bandura's framework, self-efficacy helps to moderate the effects of motive on behaviour by taking into realistic account the probability of success, regardless of underlying motivation for that behaviour. Moreover, self-efficacy is thought to be at least partially path-dependent. That is to say, previous patterns of behaviour at least partly determine the self-efficacy with which a particular behaviour is informed. Bandura writes that the construct may also develop through exposure to the behaviours of other individuals (1977). Similarly, arousal triggered by shifting emotional states and the influence of other people may also drive self-efficacy. The construct of self-efficacy enables inclusion of behaviours which lack total conscious control or reasoning, even though it still operates largely as a linear system. At its heart, the construct represents an individual's forecasting of the facility with which a behaviour may or may not be performed—depending in part on physical constraints.

3. METHODS

This chapter attempts to identify and synthesise relevant dual-process theories of health-related behaviour. This objective flows from consideration of what end-users—especially researchers and policymakers interested in CA intervention design—will find helpful (Petticrew & Roberts 2006). Such a broad question reflects the reviewer's desire to scope out the universe of theories relevant to the research aims.

3.1 Inclusion and exclusion

As with Cochrane-style reviews, inclusion criteria were developed *a priori* to specify a prescribed set of relevant theories. Unlike Cochrane-style review inclusion criteria, however, reviews of theory lack specified publication standards or methodological guidance with regard to inclusion criteria. In this review, an included 'theory' or model must offer an explanatory account or hypothesis articulating a causal pathway linking together two or more phenomena of interest (Campbell et al. 2014).

In keeping with the research question, research criteria were limited to dual process psychological theories of health-related behaviour. In particular, the review concerned itself with both conscious or volitional models of behaviour *in addition to* unconscious or automatic models of behaviour, and thus documents that neglected to specify an investigation into both reasoning models were excluded. That is to say, theories were excluded if they focused only on conscious or unconscious models of decision-making. Moreover, this review focused on health-related

behaviour in particular, meaning that dual-process models that did not investigate behaviours related to health were excluded. In some cases, a theory's relevance to health was more obvious than others. For example, the relevance of the Theory of Alcohol Pre- and Post-Consumption (Moss & Alberry 2009) to health was obvious, and thus it was included. Yet also included was Theory of Stereotype Activation (Fein & Spencer 1998), because self-efficacy may involve comparing oneself to one's peers with regard to some health-related behaviour—such as drug or alcohol use.

Methods were determined *a priori*, articulated in a protocol, and followed the guidance of Bonell and colleagues in their theory systematic review and synthesis of literature on positive youth development and how it might reduce substance use and violence (2016). Studies were included in the overall review if they: were published since 1940; were in English; reported a theory of change that incorporated a dual-process model of cognition, process evaluation or experimental evaluation; and were relevant to one or more health-related behaviours.

3.2 Search methods for identification of studies

On 22 February 2016, the following databases were searched: MEDLINE with MEDLINE In-Process & Other Non-Indexed Citations (from 1946 to 29 February 2016), PsycINFO (from 1987 to March week 1 2016), and Embase (from 1974 to 29 February 2016), all on OvidSP; CINAHL on EBSCO: ISI Web of Science; and ERIC, Sociological Abstracts, ASSIA, and Thesis and Theses Global, all on ProQuest. A search string comprising terms for psychological model, context, and outcome was adapted to each platform's specifications regarding truncation, study

fields, and formatting. The search string for MEDLINE, Embase, and PsycINFO was as follows:

1. dual process OR dual-process
2. non-conscious OR automat* OR unconscious OR habitual OR impulsive OR instinct* OR intuitive OR involuntary OR unforced OR unintentional OR unmediat* OR ration*
3. conscious OR reflex* OR voluntary OR intent* OR rational OR reflect* OR premeditat* OR purpos* OR intent* OR intend* OR plan* OR reason* OR determ* OR will* OR autonomous OR uncompell* OR unconstrain* OR exp Volition OR unprescrib* OR will* OR irration*
4. model* OR theor* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formul
5. exp Behavior/ or exp Mental Processes/
6. exp Psychology/
7. exp Health/
8. OR (1 AND 4 AND 5 AND 6 AND 7)
9. OR (2 AND 4 AND 5 AND 6 AND 7)
10. OR (3 AND 4 AND 5 AND 6 AND 7)
11. Limit 8-10 to (abstracts and English language and human)

All other search strings, with number of hits by string, can be found in Appendix 1.2.

Additional search strategies were also used to locate studies and to recursively generate additional search terms in the string listed above. The reviewer also searched trial registries (metaRegister of Randomised Controlled Trials, Trials Register of Promoting Health Interventions) and systematic review libraries (Cochrane Database of Systematic Reviews and the Database of Promoting Health Effectiveness Reviews). In addition, the reviewer searched grey literature databases and organisational websites including those of the World Health Organisation, National Institute for Health and Clinical Excellence (UK) and Agency for Health Care Research and Quality (USA). Finally, the reviewer conducted snowball search techniques, including the search of reference lists and electronic citation tracking from published reports of eligible studies (Greenhalgh & Peacock 2005).

Abstracts generated from database searches were exported to EndNote and de-duplicated. The reviewer screened abstracts and titles for eligibility against inclusion criteria to assess for exclusion. If case of doubt, full-text versions of screened records were then obtained, after which the reviewer re-applied inclusion criteria.

3.3 Data extraction measures

After using the inclusion criteria to guide the search among possible dual-process models of health-related behaviours, the reviewer developed a template into which papers could be scanned and data extracted (Appendix 1.3). The reviewer collected information from each theory on its objective, study design, relevance to health behaviour, description, and links to other theories—focusing in particular on antecedent theories. He also extracted data regarding whatever theoretical constructs and causal pathways may have been outlined in an included theory.

3.4 Critical appraisal criteria

Perhaps the most difficult part of conducting a review of theory is critically appraising included theories in view of their relevance to a research question. Of greatest interest to this paper, Bonell et al. (2013) developed a set of criteria centred on a theory's relevance to a research question and the degree to which a causal pathway and theoretical constructs are articulated. Admittedly, such a focus on detail does not capture the predictive power or generalisability of a theory, but evaluating on the basis of clear reporting of causal relationships within a set of phenomena represents an initial step to developing critical appraisal tools for reviews of theory.

Included theories were quality-assessed on the basis of parsimony, clarity of theoretical constructs and relationships between constructs, and generalisability. Model descriptions and diagrams were extracted from included reports. From there, the reviewer assessed where or not 1) constructs were well specified, 2) causal pathways relating constructs were well specified, 3) the theory was 'simple' or 'complex', 4) the theory specified particular aspects of health that it helps to explain or predict, and 5) the theory may be used to explain multiple health-related phenomena (i.e. smoking cessation in addition to alcohol consumption amelioration).

These criteria assess several important aspects of theories. First, eliciting the theoretical constructs and causal pathways between them reveals the internal logic according to which a behavioural model is or is not activated. Second, determining if a theory is 'simple' or 'complex' reveals if it draws on macro-environmental or other structural factors (such as income) that may redound to the individual level. Third, indicating which particular aspects of health are targeted by certain theories reveal the extent to which those theories are or are not parsimonious. Fourth, the applicability of some theories to multiple domains of health speaks to a model's generalisability. Together, these aspects of theory—and the quality criteria that help to define them—help guide the analysis of individual theoretical components as well as the synthesis of multiple theories.

3.5 Analysis and synthesis of results

The main findings of the review were generated though the integration of standardised and iterative elements of synthesis common among systematic review methods. Upon data

extraction, the reviewer developed and refined a memo template—adapting the conceptual synthesis framework used in Baxter et al. (2010)—to aid in synthesising theories on the basis of shared theoretical constructs and causal pathways. Each paper was then screened for synthesis using the template, and the reviewer wrote memos to explain his rationale in identifying common themes as well as areas of conceptual disagreement among included theories. These memos were then integrated into a narrative synthesis which reflected conceptual refinements of the coding template as well as a summary of the emergent synthesis of theories. Theories were synthesised on the basis of core theoretical constructs and outcomes and the relationships between them (i.e. causal pathways; Thomas & Harden (2008).

4. RESULTS

4.1 Study selection summary and flowchart

Database searches yielded 15,667 records (Figure 4.1). After de-duplication, 12,198 records remained. Screening led to the exclusion of 12,036 records, with 162 records remaining. Assessment of full-text documents led to the exclusion of 141 records. Notably, 21 records were included in the review.

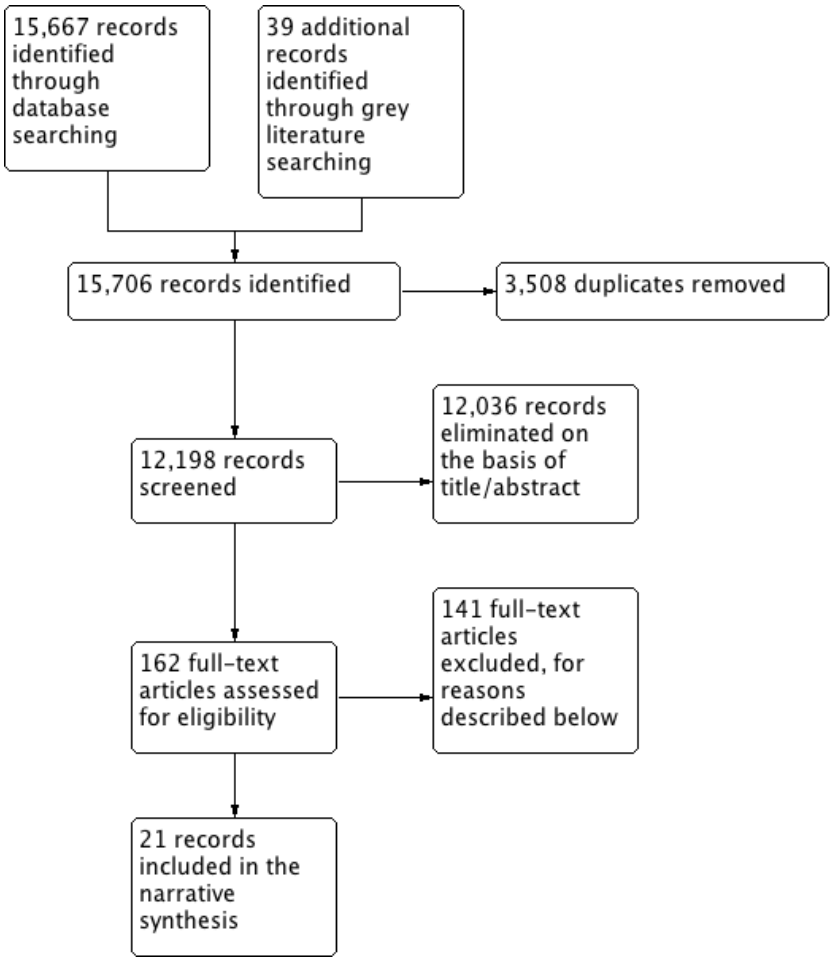


Figure 4.1 *Flow diagram for review of theory of dual-process models for health-related behaviour and cognition*

Documents detailing potential theories of interest were excluded if they did not incorporate both conscious and unconscious models of decision-making, or if they did not help to explain health-related behaviour. Records were excluded on the basis of not including a dual-process model of cognition and behaviour (57) or not relating to health (84). See Appendix 1.4 for more information.

4.2 Characteristics of included studies

The review identified 21 models of dual-process theories suitable for narrative synthesis (see Table 4.1). The theories are stratified on the basis of their treatment of an individual—irrational, as a social agent, as an agent in a physical environment, and/or as a self-regulated agent—for reasons discussed in the next section.

Table 4.1 *Characteristics of included theories*

Locus	Theory	Origination	Constructs and pathways
Individual as irrational actor	Prospect Theory	Tversky & Kahneman 1979	Individuals are risk-averse in considering losses and risk-seeking in considering gains
	Elaboration Likelihood Model of Persuasion	Petty & Cacioppo 1986	The central route of information processing involves message elaboration; the peripheral route considers positive and negative environmental cues.
	Risk as Feelings Model	Loewenstein et al. 2001	Emotional reactions to risky situations diverge from cognitive assessments
	Affect Heuristic	Slovic et al. 2002	In the need to make decisions quickly, emotions may influence decisions
Individual as social actor	Norm Activation Theory	Schwartz 1977	Behaviour is driven by executing one's personal norm—the result of awareness of consequences, ascription of responsibility, and subjective norms
	Social Identity Theory	Tajfel & Turner 1979	An individual's identity is driven by their self-perceived membership of a group, which prompts certain behaviours and discourages others
	Self-Categorisation Theory	Turner 1987	Recognition of group identity is driven in part by assignation of identity to collective behaviours and characteristics
	Focus Theory of Normative Conduct	Cialdini et al. 1990	Injunctive norms (others' approval) and descriptive norms (what others do) help to drive behaviour
	Theory of Stereotype Activation	Fein & Spencer 1997	Behaviour reflects that self-perception is maintained through inside-outside characterisations of social groups
	Uncertainty-Certainty Theory	Hogg 2007	One's uncertainty with regard to how they are perceived by others results in behaviour that conforms with the standards of a favourable group

Individual as actor in physical environment	Capability-Opportunity-Motivation—Behaviour Wheel	Michie et al. 2011	Behaviour is the result of capability interacting with opportunity interacting with motivation—constructs which are executed via education, persuasion, incentivisation, coercion, training, enablement, modelling, environmental restructuring, and restrictions
	Chameleon Effect	Bargh & Chartrand 2006	Internal thoughts about behavioural intention in addition to perceptions about one's behaviour from external perspective are brought to bear on a behaviour-relevant cognitive activity
	Perceptual Stimuli and Social Cues	Sheeran et al. 2005	Alcohol consumption is driven in part by conscious and unconscious sensory perception of alcohol-relevant cues, including social cues, in one's environment
	Theory of Alcohol Pre- and Post-Consumption	Moss & Albery 2009	During pre-consumption, propositional reasoning is filtered through cue exposure, association activation and resulting in alcohol consumption; after consumption, the influence of propositional reasoning is weakened
	Determinants of Social Behaviour	Strack & Deutsch 2004	Perception, motivational orientation, and behavioural schemata (constituting experiential awareness) interact with propositional categorisation, noetic decision-making and behavioural decision (constituting noetic awareness) to produce behaviour
Individual as self-regulated actor	Change Theory	Lewin 1951	Behavioural change is driven by the unfreezing and freezing of habits
	Theory of Interpersonal Behaviour	Triandis 1977	Intention is the result of attitude (combining past beliefs), social factors (norms, roles), and affect (emotional state), and leads to behaviour
	Prototype-Willingness Model	Gibbons et al. 2003	Behavioural intention is driven by behavioural willingness—the result of attitudes, subjective norms, and risk images
	Control Theory	Carver & Scheier 1982	Behaviour is executed after consideration of environmental impact and one's value of an alternative behaviour (including no action) but is subject to external disturbances
	Social Cognitive Theory of Self-Regulation	Bandura 1991	One's self-observation after behaviour, combined with judgemental processes (including personal standards, referential performances, valuation of activity, and performance determinants) result in a self-reaction (positive or negative)
	Implementation Intentions	Gollwitzer 1993	Implementation of behavioural intentions is driven by 'if-then' logical cues

4.3 Critical appraisal

Multiple data were extracted that related to critical appraisal. Relatively few reviews of theory include critical appraisal criteria. The criteria employed in this review were adapted from the standards used in the Bonell et al. (2013) review of school environment and student health as well as the Michie et al. (2016) methodological guidance on theories of behaviour change. In short, included theories were quality assessed on the basis of parsimony, clarity of theoretical constructs and relationships between constructs, and generalisability. Model descriptions and diagrams were extracted from included reports. From there, the reviewer assessed where or not 1) constructs were well specified, 2) causal pathways relating constructs were well specified, 3) the theory was 'simple' or 'complex', 4) the theory specified particular aspects of health that it helps to explain or predict, 5) the theory may be used to explain multiple health-related phenomena (i.e. smoking cessation in addition to alcohol consumption amelioration), and 6) assumptions undergirding theories were implicit or explicit. Results are indicated in Table 4.2.

Table 4.2 *Quality appraisal of included theories*

Theory ID	Well-specified theoretical constructs	Well-specified causal pathway	Simple	Particular aspect of health	Applicable to multiple domains of health?	Assumptions explicit or implicit?
Tversky & Kahneman 1979	Yes	Yes	Yes	No	Unclear	Explicit
Petty & Cacioppo 1986	Yes	Yes	Yes	No	Unclear	Explicit
Loewenstein et al. 2001	Yes	Yes	Yes	No	Unclear	Implicit
Slovic et al. 2002	Yes	Yes	Yes	No	Unclear	Explicit
Schwartz 1977	Yes	Yes	Yes	No	Unclear	Explicit
Tajfel & Turner 1979	Yes	Yes	Yes	No	Unclear	Explicit

Turner 1987	Yes	Yes	Yes	No	Unclear	Explicit
Cialdini et al. 1990	Yes	Yes	Yes	No	Unclear	Explicit
Fein & Spencer 1997	Yes	Yes	Yes	No	Unclear	Explicit
Hogg 2007	No	Yes	Yes	No	Unclear	Implicit
Michie et al. 2011	No	Yes	No	No	Yes	Explicit
Bargh & Chartrand 2006	Yes	Yes	Yes	Yes	Unclear	Explicit
Sheeran et al. 2005	Yes	Yes	Yes	Yes	Yes	Explicit
Moss & Albery 2009	Yes	Yes	Yes	Yes	No	Explicit
Strack & Deutsch 2004	Yes	Yes	Yes	No	No	Explicit
Lewin 1951	Yes	Yes	Yes	No	Unclear	Implicit
Triandis 1977	Yes	Yes	Yes	No	Unclear	Implicit
Gibbons et al. 2003	Yes	Yes	Yes	No	Unclear	Explicit
Carver and Scheier 1982	Yes	Yes	Yes	No	Yes	Implicit
Bandura 1991	Yes	Yes	Yes	No	Yes	Explicit
Gollwitzer 1993	Yes	Yes	Yes	No	Unclear	Explicit

Within these results, the reviewer found the following information to be of greatest interest:

1) Two of the 21 theories (Uncertainty-Certainty Theory, Hogg 2007; COM-B, Michie et al. 2011) were judged not to have clear or narrowly specified constructs in the sense that these might be operationalised in empirical research, but that the rest (n = 19) did.
2) Causal relations between constructs were judged to be clearly specified in all of the theories.
3) One model was categorised as complex rather than simple (COM-B, Michie et al. 2011). This is due in part to the fact that it offers an understanding of macro-environmental factors (both physical, social, and structural) that influence decision-making involving health.
4) The reviewer judged that all of the theories offer a framework delineating the

relationships between theoretical constructs that potentially affect health. However, only 2 models specify multiple domains of health that they might influence (COM-B, Michie et al. 2011; Perceptual Stimuli and Social Cues, Sheeran et al. 2005).

5) Of those, 3 particularly address alcohol consumption (the Chameleon Effect, Bargh & Chartrand 2006; Perceptual Stimuli and Social Cues, Sheeran et al. 2005; and the Theory of Alcohol Pre- and Post-Consumption, Moss & Alberry 2009).

It should be noted, however, that these criteria are necessarily subjective, requiring the reviewer's judgement. For example, the reviewer had to determine for himself whether or not a theory was simple (i.e. involving only individual-level factors, such as setting and environmental stimuli thought to activate behavioural cues). Because of this subjectivity, the reviewer did not 'count up' quality scores for each theory or exclude any theories identified in the search strategy on the basis of critical appraisal. Where these criteria mattered most was in the analysis and synthesis stages in order to form judgements about areas of agreement and disagreement within the narrative synthesis.

4.4 Analysis and synthesis of results

4.4.1 Main findings

The review now analyses and synthesises the theoretical literature for dual-process models of health-related behaviour. As demonstrated in Figure 4.2, synthesising identified theories indicates that health-related behaviour is the result of both propositional and unconscious

reasoning driven by an individual's response to internal cues (such as heuristics, attitude, and affect), physical cues (social and physical environmental stimuli) as well as regulating factors (such as habit) that mediate between them. Notably, all theories identified in the review may be located in relation to one or more elements of this general model. For example, the Focus Theory of Normative Conduct (Cialdini et al. 1990) draws a causal pathway between social factors, an individual's perceived notion as to how an intended behaviour may be judged, and their consequent behaviour. In the general model posited here, Cialdini et al. 1990 may be mapped onto the pathway linking external cues (which include social factors), self-regulating factors, and both conscious and unconscious reasoning processes that lead to a health-related behaviour.

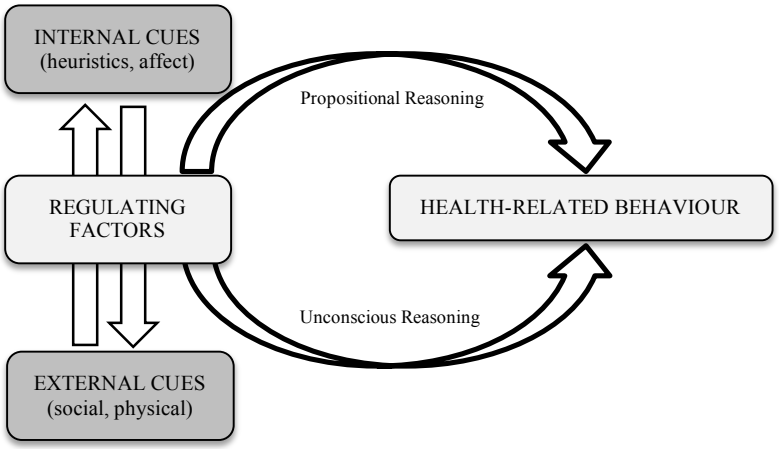


Figure 4.2 *Synthesised general dual-process model of health-related behaviour*

It is possible to generate this model (Figure 4.2) by focusing in part on essential assumptions present within each theory, namely the extent to which a theory views an individual as: 1) an irrational actor, 2) a social actor, 3) an actor situated in a physical environment and amenable to external cognitive cues, or 4) a self-regulated actor. Those theories that view individuals as irrational actors tend to focus on internal cues (such as heuristics and biases). Those theories that

conceive of individuals as social actors and those that conceive of individuals as actors in a physical environment tend to focus on external cues (including the physical and social environments that individuals inhabit). Meanwhile, theories that conceive of individuals as inherently self-regulated actors consider a range of other constructs, such as habit and routinisation.

4.4.2 The individual as an irrational actor

As seen in Figure 4.2, individual behaviour is driven in part by internal cues that include imperfect reasoning. As distinct from theories containing classical assumptions about rationality—discussed in section 2—recent dual-process theories understand individuals to be at least partially motivated by biases and heuristics, or mental 'short-cuts' that result from incomplete information and imperfect logical reasoning (Thaler & Sunstein 2006). Moreover, the influence of prior attitudes and beliefs—as well as shifts in affect—influence both the presentation of external information as well as propositional and unconscious reasoning processes.

When it comes to heuristics and 'analytic' decision-making, behavioural economics improves upon the assumptions made by classical economics with regard to an individual's propensity for expected utility maximisation by including evidence from psychology (Tversky & Kahneman 1979; Kahneman 2003; Leisar & Azar 2008; DellaVigna 2009). Under classical economic assumptions, individuals are consistent in their preferences and have access to full information about situations in which they pursue those preferences. Yet empirically, those assumptions are

cast into doubt by evidence which suggests—among other things—that individuals are inconsistent in pursuing their preferences over time (Thaler 1981) and in avoiding risks depending in part on reference points and decision framing (Tversky & Kahneman 1979). Moreover, individuals use 'shortcut' psychological principles in attempting to address difficult situations (Gabaix et al. 2006) and are open to influence by their emotional states (Loewenstein & Lerner 2003).

The most common expected utility maximisation model employed by behavioural economists attempts to take this empirical evidence into account. Decision-making is therefore made to incorporate inconsistent preferences, incomplete information, and biases in processing that information in pursuit of making decisions. First, when it comes to inconsistent preferences, DellaVigna (2009) focuses on the effects of time, risk, and social interactions. In general, an individual's time preferences are inconsistent in that the value s/he places on future consumptive behaviour is discounted in comparison to that associated with current consumptive behaviour. Moreover, as articulated in Prospect Theory individuals demonstrably avoid risks to gain benefits and seek risks to avoid costs (Tversky & Kahneman 1979). Second, individuals are rarely capable of obtaining full information relevant to a decision, and this can lead to—for example—seemingly myopic behaviour viewed from the perspective of a cost-benefit analysis done with complete information. Third, individuals are influenced by cognitive biases that may be triggered by the presentation of a decision. Those biases inform the heuristics with which which individuals confront both simple and difficult decisions. For example, a difficult decision may be simplified through an individual's focus on only the most salient details of a decision. Here too social influences may prompt an individual towards one decision over another given

his/her considerations of social factors (discussed later).

As dual-process models have developed from adjusted expectancy value theories, the role of affect has come under increasing scrutiny. This logic is encapsulated by the Elaboration Likelihood Model of Persuasion (Petty and Cacioppo 1986) and the Risk as Feelings Model (Loewenstein et al. 2001), which assume that affect influences an individual's attitudes. The Elaboration Likelihood Model holds that reasoning proceeds along two paths: a central route and a peripheral route. The central route of information processing involves message elaboration; the peripheral route considers positive and negative environmental cues. Similarly, the Risk as Feelings Model suggests that emotional information may actually influence behaviours more than non-emotional information, such as sensory processing. Under the Model, an individual's affect may drive their assignation of probabilities to the range of possible behavioural consequences even as their sensory perceptions filter environmental cues. Volitional reflection on behaviour ultimately interacts with the individual's feelings and attitudes in informing the consequent behaviour. The influence of timing, particularly when a behaviour is planned in the distant future, may interact with perceptions of risk as well. If a risk perception overwhelms other feelings and analytical considerations, the individual may choose a risk-averse behaviour. In this way, affect is ultimately presumed by the Risk as Feelings Model and other models like it to convey emotional information, which is at least as relevant to cognition as other types of information.

Slovic et al. (2002) also put forward the Affect Heuristic to account for the influence of an individual's emotional state on their beliefs. In particular, affect has been used by Slovic and

colleagues to explain how individuals behave with respect to the perspective of their emotional responses to situations entailing risk and *not* necessarily with respect to the probability of those situations obtaining. On this view too, then, an individual's emotional state is processed as relevant information in decision-making. This is true even if those emotions are known by the individual to be at odds with other relevant information. For example, an individual suffering from a phobia may well behave in accordance with their fearful affect and not in accordance with the deliberative calculation that suggests their fear is unwarranted by given information.

4.4.3 The individual as a social actor

Individual behaviour is also partly driven in response to external cues, which may include the stimuli associated with being an actor embedded within a social environment. As mentioned in section 2, one seminal innovation of the Theory of Reasoned Action is the provision for social expectations, or norms, to guide individual beliefs—which in turn shape attitude and behavioural intentions (Ajzen & Fishbein 1980). An individual's intention to be a member of one social group or another influences their behaviours insofar as groups do prescribe expected actions in a variety of situations. In particular, health-related behaviours (e.g. diet or physical activity) are influenced in part by the extent to which those behaviours conform with group expectations for how in-group and out-group members act. For example, a teenager who smokes may do so in part because their membership of a social clique is influenced partly by their smoking, regardless of other health considerations.

The Norm Activation Theory (Schwartz 1977) indicates how norms can be brought to bear on an individual's intrinsic values regarding a duty to behave in a certain fashion. For example, Schwartz uses norms to explain a range of altruistic behaviours—in which actions do not entail any obvious benefit to the actor—that expectancy value theories otherwise struggle to explain. The Theory holds that an individual consciously considers the range of likely outcomes arising from their behaviour and assigns normative weight to those outcomes from the perspective of if and how it will be viewed by other people. The question of 'if' society is able to view the behaviour is important for explaining circumstances in which an individual does or does not act. For example, if an individual assumes their seemingly altruistic behaviour will be unobserved, they may not engage in that behaviour. The reverse is true if an individual suspects they will be observed. Weighing likely consequences and social perceptions of those consequences forms part of the application of an individual's personal norms, resulting in a given behaviour.

Norms may be helpful for perpetuating social organisations and organisational standards by articulating the relationship between the group and the individual. Among other things, an individual may feel social pressure where there exists a discrepancy between their personal behaviour and the group's expectations of its members. The Social Identity Theory (Turner and Tajfel 1979) and Social-Categorisation Theory (Turner 1987) explain that this powerful dynamic results in part from the use of group expectations by a particular social group to distinguish it from other social groups. An individual is first introduced to a group and begins to form an idea about what it might mean to be in-group, drawing up a class of idiosyncratic beliefs and behaviours based on observations of the group. The extent to which an individual feels that their identity already does or could potentially conform to that of the group determines in part the

extent to which an individual may seek to become a member of that group. In this way, from the perspective of the individual, their personal identity and the group identity may become interlocking and mutually reinforcing. And in actualising identity, individual behaviour may be shaped. Therefore, the possibility of influencing individual behaviour may depend in part on identifying and emphasizing particular social norms of the group in which an individual believes they are a member.

Norms are distinguished into two classes in the Focus Theory of Normative Conduct (Cialdini et al. 1990). Within this framework, social norms are separated into descriptive and injunctive camps. Descriptive norms are held to detail "what individuals are like" in a given behaviour context, whereas injunctive norms are held to detail "what individuals should be like"—regardless of society—in a behaviour context. By way of example, public health campaigns around alcohol on behalf of youth may use descriptive norms in publically posting survey results in order to demonstrate to youth that underage drinking is less common than what is popularly thought (Lombardi 2010). Within some of those same campaigns, injunctive norms are invoked in order to explain why underage drinking ought not to occur—because, for example, youth may be ill-prepared to handle the effects of alcohol.

Closely related to Social Identity Theory and Self-Categorisation Theory is the Theory of Stereotype Activation (Fein & Spencer 1997). The authors argue that stereotypes are hardened perceptions of group norms which most keenly distinguish an in-group from out-groups. In this way, a particular stereotype about one or more out-groups can be a source of self-affirmation because it enables individuals to focus on their personal identity as mediated by their

membership of a particular group. Equally important, an individual who feels that their personal identity is threatened by their own recent personal behaviour which does not conform to in-group standards may seek to stabilise their identity through reconsideration about aspects that distinguish them from out-groups. This means of self-affirmation therefore adopts a much more agnostic view of stereotypes as compared to, for example, negative prejudice effects (Miller & Bugelski 1948) and Downward Social Comparison Theory (Wills 1981). In line with this view, Hogg (2007) puts forward an Uncertainty-Certainty Theory in order to explain why individuals may experience anxiety if they cannot determine how they measure up in relation to a particular social group—especially if it is a new group, or a new configuration of an extant group. Hogg argues that the Theory represents an extension and complication of Social Identity Theory, notably its motivational aspect. Uncertainty-Certainty may help to explain under what circumstances an individual feels stress with regard to their inability to determine where they stand in relation to a group and/or their inability to determine if they are conforming to a social norm.

4.4.4 The individual as an actor situated in a physical environment

In addition to external cues shaped by one's social environment, other external cues involve physical cues that influence behaviour through the structuration of an individual's ability and circumstances. Yet many social psychological theories do not explicitly account for environmental factors, or contextual cues, within their frameworks. Even as constructs such as norms and emotions may be enfolded within other constructs—e.g. 'evaluation of consequences' includes judgement about social norms—so too are environmental factors enfolded in other

constructs. For example, the Theory of Interpersonal Behaviour (Triandis 1977) makes provision for ‘facilitating conditions’, understanding that self-control constructs depend in part on material constraints. Yet it is possible to describe more fully those social and physical factors that influence individual decision-making leading to both intended and unintended behavioural outcomes.

In the Capability-Opportunity-Motivation—Behaviour (COM-B) Wheel, Michie and colleagues theorised that three factors are both necessary and sufficient for performing a particular behaviour: capability, opportunity, and motivation (2011). They go on to elaborate that an individual must possess: the cognitive and physical ability to perform the behaviour in question (capability), the material means with which the behaviour can be completed (opportunity), and the cognitive and emotional capacity in directing agency to accomplish a given task (motivation). What is more is that behaviour has a bidirectional relationship with all 3 factors, indicating that past behaviour naturally influences one’s current material and psychological circumstances. The COM-B Wheel is amenable to behavioural intervention designs because it incorporates within its logical system the possibility for an intervention to affect any or all three factors. It makes finer distinctions among capability, opportunity, and motivation through the inclusion of complementary features. For example, the authors incorporate both physical and psychological capability to delimit the ability of an individual to harness material and cognitive resources in pursuit of a particular task. Michie and colleagues also allows for situational individual behaviour within a prescribed set of physical and social opportunities using, for example, cultural symbols and societal norms to define for oneself one’s goals. Finally, the COM-B Wheel is compatible with other dual-process models because it ascribes to motivation both deliberative

and non-deliberative psychological processes with which an individual takes in and acts on stimuli consciously and unconsciously considered. The authors claim that some combination of the 3 factors is necessary to perform any given behaviour.

At a more granular level, three included dual-process models of behaviour are conditioned in part on micro-environmental physical stimuli. Bargh and Chartrand (1999) articulate one such model—the Chameleon Effect—that recalls the importance of behavioural representations, or patterns, in memory. According to their logic, environmental cues stimulate both controlled and unconscious responses which activate one or more behavioural pattern. In the case of controlled responses, environmental cues automatically activate some volitional cognitive process for an individual (e.g. conscious perception of targeted cues), who then reflects on their state of behaviour (e.g. they decide to maintain said behaviour or alter it). Alternatively, in the case of unconscious responses, environmental cues automatically activate some unconscious cognitive process resulting in changed behaviour. Notably, what helps to distinguish Bargh and Chartrand's model from others is their acknowledgement that cognitive perception of environmental cues prompts reflection of behaviour—regardless if that behaviour state is altered—without necessarily demanding more demanding cognitive activity.

At the heart of this model, then, is the role of automatic perception of environmental stimuli, which triggers conscious, unconscious, or both conscious and unconscious cognitive activity vis-à-vis behaviour. At a minimum, automatic perception activates reflection on behavioural patterns, objectives, intentions, and subsequent behavioural activity (Bargh & Chartrand 1996). Subsequent observational experiments on priming—or the structuring of environmental cues to

condition subsequent behaviours—appear to bear out the notion of automatic perception triggering behavioural patterns. For example, research into priming intended to prompt stereotyping (Banaji & Hardin 1996), 'snap' judgments of objects (Williams & Bargh 2008), and reflection on goals (Bargh et al. 2001) appear to demonstrate that behavioural patterns may be activated through conscious, unconscious, or both conscious and unconscious cognition.

In addition, Sheeran et al. (2005) posit a model of behaviour—the Theory of Perceptual Stimuli and Social Cues—that extends the simple dual process model by accounting for all classes of perceptual stimuli (e.g. visual or auditory stimuli) associated with the environment in which a target behaviour is also observed. This refined model encompasses cues associated with the immediately surrounding environment of a targeted behaviour (e.g. an environment in which two or more individuals are socialising). It also includes input stimuli that are more broadly relevant (e.g. seeing others socialise) to the targeted behaviour (socialising), which triggers cognitive activity around the activity with associated activities (e.g. consuming alcohol).

With regard to the behavioural pattern of alcohol consumption in particular, it is useful to consider a range of environmental cues that may prompt the decision to engage in alcohol intake both before and after alcohol consumption begins. Moss & Albery (2009) put forward a dual-process model of cognition targeted to alcohol intake that accounts for pre-consumption and consumption, justifiably called the Theory of Alcohol Pre- and Post-Consumption. During the pre-consumption phase, priming activates various cognitive patterns—including expectations for alcohol consumption based in part on short- and long-term memories associated with alcohol intake—and thereby accesses certain behavioural patterns. After alcohol consumption begins,

cognitive function becomes impaired. Such function is associated with effortful, explicit decision-making processes and is demonstrably harmed by alcohol consumption (Fillmore et al. 1999). Notably, Moss & Albery (2009) consider the effects of cognitive impairment induced by alcohol in both phases of consumption. As one would expect, in the pre-consumption stage an individual does not experience cognitive impairment of the sort that would interfere with information processing. However, environmental cues could trigger the individual to experience memories associated alcohol that could affect not just the individual's behavioural state but also his/her propositional reasoning process. Later in the consumption stage, the individual's propositional reasoning process is degraded more and more as the individual consumes an increasing amount of alcohol. The model asserts that activated cognitive associations between an individual's environment and alcohol influence the start of drinking.

4.4.5 The individual as a self-regulated actor

The synthesised model (Figure 4.2) indicates that external environmental cues (including social and physical stimuli) interact with internal cues (including heuristics, attitudes, beliefs, and affect) through mechanisms of self-regulation. Hence, mechanisms of self-regulation include habit and feedback factors that guide and shape individual action through both volitional and non-volitional reasoning processes. For example, an individual's decision to walk up stairs to their office instead of taking an elevator may be largely driven by unconscious force of habit. Or, an individual who engages in alcohol intake twice a week may have enough presence of mind even after consumption begins, when their propositional reasoning faculties are at least partially

impaired, to engage in self-monitoring and stop when they have reached their limit—when they feel that their affective and analytical states need not be further affected.

Lest habit be conceived of as immutable, it is useful to discuss ways in which habit may be disrupted. The Change Theory put forward by Kurt Lewin (1951) understands habit less as an unconscious, repeat, regular behaviour and more as a psychological construct that denotes behavioural inertia. Here, the inertia factor is manifested only through responses to changing environmental cues. It should be carefully noted that Lewin did not equate habit with volitional stubbornness but rather with the resilience of an individual's unconscious self-concept as a member of a social group. Hence, for an individual the foundation of behavioural inertia is their desire to meet a behavioural standard that they perceive to have been established by their social group. Changes in habit are thus attenuated by the individual's desire to conform to a new or evolving group standard. Self-monitoring is the critical means by which the individual adjudges themself in accordance or in conflict with what it means to share the identify of a group. Lewin argues that the degree to which a change in behaviour is obtained depends in part on the environment within which the change is fostered. Finally, behavioural maintenance is mediated through the individual's ongoing relationship with their social group's standards as well as environmental cues that make it easier or harder for them to perform the accepted behaviour.

Habit is also harnessed in one of the most widely used social psychological model of behaviour, the Theory of Interpersonal Behaviour (Triandis 1977). The Theory of Interpersonal Behaviour employs a definition of habit that views it as a series of events in which an individual interacts with their environment through behaviour that becomes unconsciously automated in an

individual's cognitive reasoning (Triandis 1977). Habit may be measured simply as the number of times a particular behaviour has been performed, often in response to contextual prompts. As a construct of the Theory, habit serves as a mental shortcut in an otherwise processing-intensive situation, and in this way a repeat behaviour becomes routinised. In relation to other psychological constructs, the Theory of Interpersonal Behaviour holds that habituation is engaged after conscious processing (involving evaluation and beliefs about outcomes) and unconscious processing (involving normative beliefs, self-concept, roles, and emotions) have been realised. Those dual tracks help to inform behavioural intentions, which in turn interact with habituated actions (i.e. repeat, regular behaviour in the past) in cueing a particular behaviour.

Similarly, habit features prominently in the Prototype-Willingness Model (Gibbons et al. 2003). In this model, habit serves as one of the touchstones for behaviour as it informs beliefs about both intentions and social comparisons. The Model indicates that both conscious and unconscious decision-making processes interact through the formation of subjective norms—notably, the self-conscious placement by the individual of themself in relation to a larger group—which in turn influences the setting of, and willingness to engage in, a given behaviour. A habit may becomes fixed in part because, as the Model shows, an individual performing a behaviour for the first time tends to opt for the a 'socially acceptable' behaviour that becomes fixed as that behaviour becomes 'intentional' through repeat performance (Gibbons et al. 2003). In this way—unlike in, say, the Theory of Interpersonal Behaviour—certain habits attain salience as the processing of such behaviours grows increasingly reflective and volitional.

Moving from self-regulating factors such as habit to feedback mechanisms, it is worth remembering from section 2 that social psychological theories which are based largely on iterations of the expectancy value theory of human behaviour tend to move uni-directionally in linear fashion. In contrast, theories that incorporate feedback mechanisms represent behaviour as constituent elements of mutually reinforcing pathways that incorporate individual mental and environmental factors. Key to feedback-based theories is the idea of self-monitoring—introduced already in relation to social norm and social identity models—which is one psychological construct by which behaviour is seen as a fulcrum in the relationship between an individual and their environment.

As an example of a feedback-based model, Control Theory incorporates a negative-reinforcing loop between input and output determinants of behaviour (Carver and Scheier 1982). Here, social and physical inputs—as well as individual attitudes and beliefs informed in part by social identity and previous behaviour—are used in consultation with some reference (which may or may not be a social standard) and thereby motivate behaviour. That behaviour is in turn evaluated for its effects on the individual's environment and, subject to further interference by other environmental factors, that evaluation is fed back into the individual's psychological conscious and unconscious processing. As a psychological construct, self-monitoring is viewed in this Theory as an automatic process which informs the continual attenuation of self-regulation and its effects on future behaviour. The authors note the importance of specifying precisely what reference is employed by an individual in adjudging their own behaviour. Consequently, outcomes are thought to result from the feedback of discrete cognitive processes at every step in the cycle. Notably, if there exists a discrepancy between the appropriate reference and an

individual's expected ability to conform to it, an individual may be prompted to commit greater cognitive and/or physical resources to performing that behaviour, or, to opt out entirely.

Changing habits through changing environmental cues is the focus of other social psychological theories as well. The Social Cognitive Theory (Bandura 1981) argues that an individual who attempts to change their behaviour engages in rehearsed responses in order to achieve a different behavioural outcome than they have experienced in the past. Notably, Bandura posited the Theory as one way to explain behavioural change and, explicitly, the ability of an individual to set for themself objectives about future behavioural outcomes. The Theory incorporates three stages: self-monitoring, which leads to self-judgement, which leads to self-reaction. Included within self-monitoring are constructs intended to measure behavioural outcomes as well as meta-constructs intended to inform the evaluation of the quality of that monitoring. Included within self-judgement are personal and group norms, similar to those of the Norm Activation Theory (Schwartz 1977). Finally, both monitoring and judging drive the individual's reaction to their behavioural outcome, including the assignation of value to that performance as well as an expectation of what, if any, benefits should accrue to it.

Along the same lines, the theory of Implementation Intentions (Gollwitzer 1993) uses a similar conditioned rehearsal system in order to lighten the cognitive load introduced by a particular behavioural scenario such that the desired behaviour becomes automatic. Again, the objective is to make individuals cognitively equipped to behave in response to their prepared intentions rather than routinised habits. Flowing from carefully considered behavioural intentions, repeat rehearsals are thought to help affix the new behaviour. And such rehearsals are conducted by

separating out a behavioural response into a linear sequence of well-defined discrete steps to perform the new behaviour.

5. DISCUSSION

5.1 Summary of main findings

The aim of this review was to identify and synthesise dual-process models of health-related behaviour. Its emphasis on conceptual rather than empirical evidence thus makes a substantive contribution to this thesis by characterising the theoretical landscape within which exists the programme theory of CA interventions into alcohol consumption. Reviews of theory such as this are intended to interpret and map theories in such a way that conceptual and empirical evidence are understood in new ways (Gough et al. 2012). Furthermore, comparing theories on the basis of key concept definitions, hypothesised causal pathways, temporal sequencing, outcomes, and a range of contextual factors helps to distinguish significant areas of conceptual overlap and difference (Hardin 2008).

In pursuing this research agenda, inclusion criteria were specified in order to identify all relevant dual-process models that explain decision-making in the context of decisions made about human health. Data analysis took the form of iterative template analysis (adapted from the conceptual synthesis framework used in Baxter et al. 2010), and in this way theories were synthesised on the basis of shared theoretical constructs and causal pathways. Notably, understanding each theory's epistemological pedigree aided in synthesis by making explicit many unelicited assumptions

about human behaviour. For example, the Prototype-Willingness Model (Gibbons et al. 2003) relies in part on the Theory of Planned Behaviour (Ajzen 1983), which understands decision-making to be driven by 'rational' decision-making entailing conscious consideration of all relevant information in a particular situation.

Other reviews of theory proved important in providing methodological guidance for prescribing a mode of theory synthesis. For example, Lorenc et al. (2012) sought to specify individual causal claims from a set of included theories, outline the relationships between those causal claims and factors, and organise the theories in a framework. In contrast, Bonell et al. (2013) focused on theories themselves—rather than just the individual causal claims contained within them—and organised them syncretically on the basis of shared assumptions. This review adopted the Bonell (2013) model: theories were organised on the basis of common themes and aims and related through a narrative synthesis. Notably, analysis and synthesis proceeded in turn, instead of moving uni-directionally from analysis of individual theories to synthesis of multiple theories. Namely, the reviewer considered and reconsidered individual theories and theoretical components in generating the narrative synthesis' main findings. Moving back and forth between analysis of individual theories and the synthesis of theories grouped on the basis of theme or focus yielded additional insights into the orientation of a theory to an individual. For example, it was possible to group together Norm Activation Theory, Social Identity Theory, and Theory of Stereotype Activation by reflecting on their shared assumption that an individual is an agent embedded within a social environment.

Twenty-one reports were included in this review. All offered some insights into how this subset of behavioural theories might affect health-related decision-making and behaviour. Synthesising identified theories into a general dual-process model indicated that health-related behaviour is the result of both propositional and unconscious reasoning driven by an individual's response to internal cues (such as heuristics, attitude, and affect), physical cues (social and physical environmental stimuli) as well as regulating factors (such as habit) that mediate between them. Notably, all theories identified in the review may be located in relation to one or more elements of the general model. It was possible to generate this model by focusing in part on essential assumptions present within each theory, namely the extent to which a theory views an individual as: 1) an irrational actor, 2) a social actor, 3) an actor situated in a physical environment and amenable to external cognitive cues, or 4) a self-regulated actor.

Four theories were grouped on the basis of their shared assumption that an individual is an 'irrational' actor (Prospect Theory, Tversky & Kahneman 1979; Affect Heuristic, Slovic et al. 2002; Risk as Feelings Model, Loewenstein et al. 2001; Elaboration Model of Persuasion, Petty & Cacioppo 1986). Namely, humans often reveal inconsistent time, risk, and social preferences; acquire information that is incomplete; and use heuristics in acting on that information (DellaVigna 2009). These effects explain some of the discrepancies observed between observed behaviour and a subset of rational behavioural theories, such as the Theory of Planned Behaviour, whereby individuals do not act in accordance with their goals. For example, by virtue of prioritising the present satisfaction of overeating, an individual may neglect to follow their diet plan to achieve some perceived future satisfaction. The Affect Heuristic and Risk as Feelings Model indicate that individuals are also subject to a range of affective states, which

affect their processing of sensory information drawn from their environment.

Six theories were grouped on the basis of their shared assumption that individuals are social actors (Norm Activation Theory, Schwartz 1977; Focus Theory of Normative Conduct, Cialdini et al. 1990; Social Identity Theory, Tajfel & Turner 1979; Self-Categorisation Theory, Turner 1987; Theory of Stereotype Activation, Fein & Spencer 1997; and Uncertainty-Certainty Theory, Hogg 2007). Collectively, these theories highlight just how much an individual considers the social consequences of their behaviour. For example, an individual may engage in a certain behaviour—such as smoking—in an unconscious attempt to manifest perceived characteristics of a group with which that individual identifies. Group characteristics form a core component of norms, which are included in the Norm Activation Theory and Focus Theory in particular. In that vein, descriptive norms ("what people in a group do") and injunctive norms ("what an individual ought to do") complement each other in explaining an individual's formation of behavioural intent (Cialdini et al. 1991). Self-Categorisation Theory and the Theory of Stereotype Activation also use norms to explain how individuals distinguish in-group members from out-groups. In the context of this review, then, conscious and unconscious considerations about social preferences serve as an important source of information processed by individuals in making health-related decisions.

Five theories were grouped on the basis of their shared assumption that individuals are actors embedded within a physical environment (COM-B Wheel, Michie et al. 2011; Chameleon Effect, Bargh & Chartrand 2006; Perceptual Stimuli and Social Cues, Sheeran et al. 2005; Theory of Alcohol Pre- and Post-Consumption, Moss & Alberry 2009; and Determinants of

Social Behaviour, Strack & Deutsch 2004). Unlike other theories identified in this review, the COM-B Wheel notes that physical resources serve as an important component of an individual's capability and opportunity to pursue one behavioural option over another. For example, the provision of a child-size portion plate to an adult necessarily affects how much food they consume. In considering whether to order more food, the adult may unconsciously recognise that they have already consumed one food allotment and neglect to order another. Moreover, reflecting this thesis's interest in the particular health-related behaviour of alcohol intake, the Theory of Perceptual Stimuli and Social Cues Theory of Alcohol Pre- and Post-Consumption incorporate alcohol-related physical cues (such as television commercials for alcohol products or the smell of alcohol) in explaining how propositional reasoning may be impaired. Moss & Albery (2009), for example, argue that physical cues become less important once consumption has initiated.

Six theories were grouped on the basis of their shared assumption that individuals are self-regulated actors (Theory of Interpersonal Behaviour, Triandis 1977; Prototype-Willingness Model, Gibbons et al. 2003; Change Theory, Lewin 1951; Implementation Intentions, Gollwitzer 1993; Control Theory, Carver & Scheier 1982). They recognise that behaviour is frequently influenced by the unconscious accreted effects of past behaviours (i.e. habit) that unconsciously constrain the perceived universe of behavioural options available to an individual (as explained by Lewin's Change Theory). Namely, the twin abilities of an individual to monitor and reflect on their past behaviour and to consider alternative behaviours enables them to consider if and how they should change their behavioural intentions in the future. For example, an individual's recognition that their consumption history clinically categorises them as a problem drinker may

prod them to consider avoiding potentially 'high-risk' situations in the future, e.g. avoiding group social interactions in which alcohol is served. Importantly, the theory of Implementation Intentions recognises that advanced planning tends to help individuals avoid environments that routinely induce unhealthy behaviours, e.g. smoking. For example, a regular smoker may consciously avoid smoking zones in her work environment to maintain fidelity to a smoking cessation treatment plan.

Across these themes, some included theories meaningfully implicated the importance of non-linear reasoning embedded in dual-process models. For example, the Theory of Alcohol Pre- and Post-Consumption highlights the importance of early intervention before consumption has started. Other theories, such as the COM-B Behaviour Change Wheel, helpfully describe various stages of behaviour—any of which may be the focus of an intervention targeting behaviour change. This implication usefully counteracts the simplistic impression that behavioural patterns thus lack a temporal dimension. Rather, theories of this kind suggest that health-related behaviours may be changed over time through interventions that target discrete steps along the behaviour's causal pathway.

5.2 Limitations of this review

The study has four primary weaknesses. First, although the reviewer determined *a priori* inclusion criteria and critical appraisal criteria, it is possible other review teams would disagree with the relative weight that has been attached to different theories in the narrative synthesis. Moreover, not all theories are created equal, and not all of them enjoy the same influence. For

example, the Theory of Interpersonal Behaviour (Triandis 1977) has attained significant salience in a range of fields—ranging from clinical psychology to business ethics—and yet it is incorporated into the narrative synthesis alongside dual-process models of much less influence (such as the Prototype Willingness Model; Gibbons et al. 2003).

Second, coding and analysis of included theories would likely have been improved through the judgements of multiple independent coders. Given the rigorous systematic methods employed in this review's construction, it joins several recent theories of review that have been constructed solely on the basis of existing literature (Baxter et al. 2010; Lorenc et al. 2012; Bonell et al. 2013; Bonell et al. 2016). Yet future work could further strengthen this review. Subjecting this review to revision through a double-coding process would 1) potentially identify other relevant dual-process models, 2) help refine it, and 3) possibly identify relevant gaps in the literature and the 'conceptual genealogy' that theories are born of (Bonell et al. 2013).

Third, it was difficult in some instances to adjudicate areas of disagreement among theories concerned with the same phenomena or theoretical constructs. The challenge lay in determining whether or not disagreement arose from conceptual vocabularies belonging to different theories that were simply contesting the same causal claim or that were actually incommensurable. For example, the theoretical construct of behavioural intent is a core component in Control Theory and the Social Cognitive Theory of Self-Regulation. Yet while Carver & Scheier (1982) treats self-control as the way to prioritise among the differential values an individual places on 2 competing behaviours, Bandura (1991) treats self-control as the product of self-observation in light of personal standards and perceived evaluation by others. In other words, it was not

immediately clear that what both theories call ‘self-control’ indeed refers to the same theoretical construct. Yet, here it is possible to borrow from meta-ethnography in arguing that the two theories are not incommensurable but rather explain the same causal pathway linking a set of related phenomena but focus on different stages along that pathway (Noblit & Hare 1988). In this way, perhaps what Bandura (1991) calls self-control is a first step in self-regulation in which—for example—an individual recognises that their behaviour is viewed with social opprobrium. Then, as a second step in that same pathway, the individual may engage in what Carver & Scheier (1982) calls self-control by identifying and adopting an alternative behaviour that matches their changed behavioural intent.

Fourth, searches incorporated into reviews of theory may yield a sample of theories that is less-than-comprehensive. While reviews of theory incorporate electronic searches in addition to expert consultations, forward- and backward-citation tracking, and perusals of reference lists among included papers, searches may miss important theories because, for example, theories may not be labelled as such and may not be mentioned in paper titles or abstracts (Campbell et al. 2014). It is thus possible that some theories relevant to this review may have been missed.

5.3 Strengths of this review

This review offers three strengths related to identification and generalisability, synthesis, and appraisal of dual-process models of health-related behaviour. First, to the reviewer’s knowledge this is the first review of theory to be conducted on dual-process models in health. Though it grounds this body of knowledge in traditional theories of behaviour underwritten by classical

assumptions of rationality, it demonstrates how dual-process models draw on both conscious and unconscious reasoning (Systems 1 and 2) to explain human action. As such, though it focuses on health-related behaviours in particular, most of the theories are generalisable and used to explain other behaviours as well. Indeed, some theories were developed to help explain a wider class of behaviour—such as Prospect Theory, one of the foundational conceptualisations in Behavioural Economics.

Second, this narrative synthesis of this review demonstrates how reviews of theory may be organised on the basis of shared epistemological assumptions and integrated into a general dual-process model of health-related behaviour. Indeed, the ability of a synthesis to return again and again to a single unit of analysis—in this review's case, the unit is an individual—represents an important organising principle in highlighting areas of agreement and disagreement for a group of included theories. Moreover, most theories are not conceived in a vacuum. Theoretical constructs created by one theory to explain some aspect of a phenomenon may be used by another theory to refine understanding of that same phenomenon or to explain other phenomena. In recognition of this, the review's synthesis proceeded to trace the development of some theoretical constructs (such as self-efficacy [Bandura 1977] or self-control [Carver & Scheier 1982]) over time and across related theories.

Third, this review usefully considers critical appraisal of theories, drawing on the methods used in the Bonell et al. 2013 review of theory. The reviewer drew on 5 criteria of critical appraisal in judging each theory's internal logic, parsimony, and generalisability. Such determinations were necessarily subjective in interpretation. However, critical appraisal in this review was not

intended to exclude theories but rather to determine how the best way to synthesise its theoretical components with those of other included theories. For example, 2 of the 23 theories (Uncertainty-Certainty Theory, Hogg 2007; COM-B, Michie et al. 2011) were judged not to have clear or narrowly specified constructs in the sense that these might be operationalised in empirical research. Yet the reviewer judged that these theories contributed rich insight to the synthesised dual-process model and so included them. Moreover, in each theory there existed a causal pathway between theoretical constructs and behaviour. Regarding causal pathways, one model was categorised as complex rather than simple (COM-B) as it offers an understanding of macro-environmental factors that influence decision-making involving health. As a further example, several theories did not meet the quality criterion of addressing particular aspects of health (such as alcohol consumption), but the reviewer judged them to be sufficiently useful in eliciting dual-process models and so opted to use them to inform the synthesis. Such a balance between using clear criteria and making overall judgements is acceptable and appropriate given that included theories aided in the development of a general model of health-related dual-process models.

5.4 Conclusions

The general dual-process model developed over the course of this review carefully considers the influence of internal and external cues that prompt a given health-related behaviour through the mediation of conscious and unconscious decision-making processes. Building upon the simplistic assumption that individuals act as ‘rational agents’ with consistent preferences across time and environments, dual-process models indicate that a wide range of contextual cues help

shape an individual's conscious and unconscious beliefs and attitudes. This review of theories indicates not only macro- and micro-environmental factors that shape behaviour (e.g. Perceptual Stimuli and Social Cues [Sheeran et al. 2005]) but also how behaviour change may occur along lines prescribed by the basic logic of dual-process models.

In this way, theories that draw on the causal logic embedded within dual-process models serve at least two purposes: explaining behaviour as well as implicating how behaviour may be changed. In view of this conceptual landscape, it is possible to help explain the kinds of effect sizes generated by a set of interventions in shaping behaviour (for example, CA interventions in alcohol consumption in public drink setting, the subject of chapter 5) and contextual factors and mechanisms through which those interventions operate (for example, CA interventions in alcohol consumption more broadly, the subject of chapter 6). This review of theory should therefore be understood in context: it begins to identify, describe, and organise for this thesis the theoretical littoral used in CA programme logic, as applied to alcohol use.

Chapter 5.
A Systematic Review and Meta-Analysis of CA Interventions on Reducing Alcohol Consumption in Public Drinking Settings

1. INTRODUCTION

Recognizing that most theories are useful only to the extent that they explain observed phenomena, this thesis now turns from discussing the operant dual-process theory undergirding health-related CA interventions to investigating the effectiveness of CA interventions in alcohol consumption in public drink settings. In line with the narrow Hollands et al. (2012) definition of a CA intervention, this systematic review assesses the effect of a CA intervention in the same micro-environment as the targeted behaviour (alcohol consumption) is observed. Though this thesis offers a more expansive definition of CA interventions in alcohol consumption by dropping the condition that the intervention and target behaviour must take place in the same micro-environment (see chapter 1), in this chapter alone the reviewer deemed it to be prudent to focus on a narrow range of CA interventions strategies given the vast variety of settings in which a CA intervention may influence alcohol consumption. It should be noted here that 'consumption' is taken to mean the volume of alcohol imbibed within one sitting, and as such, this review excludes other forms of consumptive behaviour, including purchases of alcohol that is not observed to be consumed in one sitting (e.g. purchases of alcohol in grocery or liquor stores). This review has been conducted in the service of greater conceptual clarity to 1) aid in the development of a relatively narrow typology of CA (CA) interventions within micro-environments in which alcohol use take place, and 2) evaluate the efficacy and effectiveness of such interventions.

1.1 Rationale

The Hollands et al. (2012) scoping review of evidence for the effects of CA interventions on public health identified a substantial number of observational and randomised controlled trials (RCTs) that investigated the effects of altering the properties or placement of alcoholic beverages on consumption behaviour. Evidence from these studies has yet to be synthesised systematically or assessed for the risk of bias. As such, there are not yet reliable estimates of the effects of altering the physical dimensions, packaging, placement, and advertising of alcoholic beverages on product selection and consumption.

Given the iterative process involved in developing a search strategy to comb an emergent research field—whose basic conceptualization is still under development—the reviewer intended to conduct an unregistered systematic review to scope available trial evidence that met his own definition of a CA intervention (adapted from the Hollands et al. 2013 scoping review). On the basis of this experience, one of the reviewer's next steps is to register a formal protocol and conduct an additional review as the definition is refined. For the review included here, the reviewer determined inclusion and exclusion criteria *a priori* and recorded an auditable methodological trail.

1.2 Objectives

The objectives of this review were as follows:

1. To assess the effects of interventions that involve manipulation of the physical

dimensions, packaging, placement and advertising of alcoholic beverages on *ad libitum* (at subjects' discretion) consumption of alcohol in one sitting as observed within public drinking spaces or naturalistic barroom settings.

2. To assess the extent to which the effects of such interventions may be modified by:
    a. study-level characteristics, such as target product type (wine, beer, spirits, etc.) and whether the target of the manipulation is the setting, advertisement, placement, and size of individual units of alcoholic beverages;
    b. participant characteristics, such as age and gender;
    c. intervention characteristics; and
    d. setting characteristics, such as environmental factors constituting barrooms, naturalistic barroom settings, or restaurants.

2. METHODS

2.1 Inclusion and exclusion criteria

This review's inclusion criteria of studies specify that primary findings must feature 1) participants engaged in an alcohol consumption behaviour which the CA intervention is intended to disrupt or change, 2) CA interventions that fit the operational definition posited by this thesis, 3) comparison groups including non-treatment or treatment-as-usual populations, 4) intervention settings that are licensed public drinking spaces, such as public houses or restaurants, or naturalistic barroom settings in which alcohol consumption is observed, and 5) behavioural outcomes related to alcohol consumption. A naturalistic bar setting is broadly defined as a room

in which researchers have explicitly arranged furniture and alcohol-related paraphernalia to induce a casual drink environment. Naturally such a setting may be created in any number of predictable ways, such as through the deliberate arrangement of couches and small-group tables next to a counter at which alcohol is served. It should be noted that for reasons of time, issues of implementation—such as cost, regulatory and legislative frameworks, and public opinion—were considered beyond the remit of this review (Ipsos MORI 2010).

2.1.1 Participants

Studies eligible for inclusion have targeted a particular alcohol consumption behavioural pattern that is not localized to a group or community. Using this standard, this review included studies irrespective of their focus on individuals, dyads, families, households, neighbourhoods, organizations, or areas. The author also applied no excludability constraints on the basis of individual-level data, including sex, age, health, clinical, and other demographic information.

2.1.2 Interventions

Included studies focused on interventions that were consonant with the operational definition of a CA intervention posited by Hollands et al. (2013). To wit, they included interventions that alter the intrinsic physical qualities or positioning of micro-environmental cues in an effort to alter health-related behaviour. This class of interventions are implemented within the same micro-environment in which the target behaviour is observed, may call on both automatic and volitional cognitive responses, and respect classical economic rational preferences by not excluding any

behavioural options that might otherwise be available if the intervention did not take place.

Two excludable types of interventions come to mind: first, studies of interventions administered remotely (e.g. a text-message-based reminder not to drink) and second, interventions that focus exclusive attention on alcohol purchasing. First, with regard to remote-delivery interventions this review excluded interventions that do not take place within the micro-environment within which the targeted behaviour is observed. For this reason, interventions focused solely on the provision of information through electronic media—e.g. text reminders or warnings that warn subjects not to drink—were excluded. Theoretically, intervention delivery via Internet or mobile technology is accessible in almost all environments—therefore rendering it difficult to assess the intervention's effects in isolation. Second, with regard to interventions that focus exclusive attention on alcohol purchasing, this review excluded studies in which the possibility existed in which subjects could acquire alcohol that may not have been consumed in one sitting. For example, this review neglected interventions that took place in grocery stores or shops given that consumers may choose to purchase quantities of alcohol that they do not plan to consume in one sitting.

Regarding search criteria for included interventions (section 2.2); the Hollands et al. 2013 scoping review indicated that pertinent trials would likely lack a common conceptual basis and terminology to describe CA interventions—thereby complicating systematic electronic search strategies. Therefore, this review adopted an extremely broad search strategy that captures the broad nature of potentially relevant interventions instead of simply focusing on specific labels such as 'CA' or 'nudge.' Terms that indicated manipulations of the physical properties of micro-

environments and products were to be included (e.g. change$, alter$, add$, decreas$).

2.1.3 Settings

This review specified that included studies must take place within licensed public drinking spaces or naturalistic barroom settings in order to measure the primary outcome in a natural setting. A naturalistic bar setting is distinguished from a 'laboratory' setting, in which no attempt to induce a casual drink environment has been made—meaning research subjects participate in experiments regardless of environmental cues external to the research protocol, e.g. they are seated at individual tables and complete computer-based tasks. It is likely possible to map a rough continuum of drink settings, from actual bars in which external researchers have arranged to come in and observe patrons as they are served by actual bar staff all the way to laboratories where researchers conduct experiments in sterile environments in which no attempt to induce 'true-to-life' public drinking cues has been made. This review made clear where along this spectrum the public drinking setting can be placed—actual bars to unadorned laboratories—by precisely specifying environmental factors that could have affected each included intervention.

This review was concerned with interventions that target consumption by volume or some proxy thereof, such as interventions that target purchases of alcohol beverages to be consumed in one setting. Therefore, interventions that targeted purchase of alcohol in which consumption took place in a controlled environment (such as in restaurant or pub) were included in this review. In contrast, interventions that only targeted purchase of alcohol in which consumption could not be observed (such as alcohol purchases in shops and grocery stores) were excluded. Moreover,

'private drinking' in, for example, private residences were excluded in order to 1) allow independent researchers to monitor and report alcohol consumption, and 2) control for some degree of homogeneity in outcomes, although contextual factors that may affect consumption public drinking spaces vary significantly as well.

2.1.4 Types of outcome measures

Included studies must have reported some behavioural outcome related to alcohol consumption. The primary outcome included some measure of the proximal direct result of alcohol or tobacco consumption (e.g. alcohol and tobacco intake). Secondary outcomes included any indication of engagement in behaviours related to the use of alcohol, including purchase of alcohol beverages to be consumed in one setting.

2.2 Search methods for identification of studies

2.2.1 Creation of search strategies

Given the variation of terms to describe CA, it was necessary to employ both sensitive electronic searches along with snowball searches. The systematic review posited inclusion criteria targeting CA, related terms, as well as other terminology that may implicate CA in alcohol use. The year 2008 marked the entrance of 'CA' into public discourse with the publication of *Nudge: Improving Decisions About Health, Wealth and Happiness* by Thaler & Sunstein. Naturally, however, behavioural intervention strategies in alcohol use that predate CA may well be

classified retroactively as CA interventions and so should be included in a systematic review. For that reason, snowball searches were critical for the development of inclusion criteria in the preliminary stages.

2.2.2 Electronic searches

On 1 April 2015, the following databases were searched: MEDLINE with MEDLINE In-Process & Other Non-Indexed Citations (from 1946 to 31 March 2015), PsycINFO (from 1987 to April week 1 2015), and Embase (from 1974 to 31 March 2015), all on OvidSP; CINAHL on EBSCO: ISI Web of Science; and ERIC, Sociological Abstracts, ASSIA, and Thesis and Theses Global, all on ProQuest. A search string comprising terms for study design, outcome, and setting was adapted to each platform's specifications regarding truncation, study fields, and formatting. Outcome terms were consistent with those used in other search strategies in this thesis. The search string for MEDLINE, Embase, and PsycINFO was as follows:

1. exp Drinking Behaviour/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR exp Alcoholism OR drink* OR drunk$ OR alcohol$ OR beverage$ OR beer$ OR lager$ OR wine$ OR cider$ OR alcopop$ OR alco-pop$ OR spirit$ OR tequila$ OR distilled beverage$ OR schnapps OR brandy OR brandies OR liquor$ OR liqueur$ OR whisky OR whiskey$ OR whiskies OR gin$ OR rum$ OR vodka$ OR cocktail$ OR exp Recommended Dietary Allowances/ OR exp Caloric Intake/
2. exp Cooking and Eating Utensils OR (size$ OR dimension$ OR capacity OR capacities OR volume$ OR shape$ OR height$ OR width$ OR length$ OR depth$ OR portion$ OR serving$ OR product$ OR package* OR unit$ OR drink$ OR tableware OR drinkware OR dinnerware OR crockery OR cup$ OR glass OR glasses OR mug$ OR pitcher$ OR jug$ OR decanter$ OR receptacle$ OR container$ OR can$ OR carton$ OR bottle$)ti,ab.
3. exp Product Packaging/ OR exp Food Packaging/ OR exp Automatic Food Dispensers OR exp Food Storage OR exp Product Labeling OR exp Food Labeling OR exp Drug Labeling
4. exp Advertisements OR exp Posters OR exp Audiovisual Aids/ OR Sensory Feedback OR Auditory Perception/ OR Illusions/ OR Visual Pattern Recognition OR exp Video-

Audio Media/ OR exp Visual Perception/ OR exp Auditory Perception/ OR exp Photography/ OR exp Medical Illustration OR exp Multimedia/ OR exp Spatial Analysis/ OR Spatial Behaviour/ OR exp/ Spatial Learning/ OR exp Spatial Memory OR Space Perception/ OR exp Spatial Navigation OR Spatial Processing OR exp Perceptual Distortion/ OR Form Perception/ OR Olfactory Perception/ OR Social Perception/ OR exp Taste/ OR Taste Perception OR Touch Perception/ OR Weight Perception OR exp Health Education/ OR Health Promotion/ OR exp Communication/ OR exp Information Dissemination/ OR Repetition Priming/ OR Aversive Therapy OR exp Attention OR exp Psychological Feedback/ OR exp Sensory Feedback/ OR exp Psychomotor Performance/ OR (visual adj (aid* OR presentation OR representation* OR information OR media OR display* OR stimuli))ti,ab. OR (auditory adj (aid* OR presentation OR representation* OR information OR media OR display* OR stimuli))ti,ab. OR (information OR message* OR education OR promotion)) OR (risk communication$ OR health warning$ OR warning message$ OR image* or pictur* or pictorial or illustrat* or cartoon$ or graphic* or photograph* OR aversi* OR negative OR affective OR threat* OR danger* OR disgust* OR distast* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* or repuls* OR repugnan* OR conditioning OR emotion* OR fear* OR warn* OR risk* or motivat* OR persuas* OR presentation$ OR select* OR proxim*).ti,ab.

5. (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice$ OR choose OR option$ OR consum* OR intak* OR perform* OR behavio* or attidu* OR habit*).ti.ab.
6. exp Restaurants/ OR pub OR public house OR bar OR barroom OR drinking establishment OR drinkhouse OR cafe OR cafeteria OR diner OR inn OR dive OR eatery OR grill OR eating houseOR night club OR shop OR tavern OR bistro OR lounge OR saloon OR alehouse OR canteen OR tap OR taproom OR beer garden OR drinkery OR watering hole
7. RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR (random* OR placebo* OR trial OR wait-list OR waitlist OR blind method OR single blind OR double blind OR triple blind OR blind procedure OR dummy OR experiment* OR intervention* OR pre test OR pretest OR post test OR posttest OR pre-intervention OR preintervention OR post-intervention OR postintervention OR assign* OR allocat* OR volunteer* OR control* OR compar*).ti,ab. OR exp Systematic Review/ OR exp Meta-Analysis OR (meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative$ OR meta-narrative$).ti,ab.
8. OR/ 1 AND 2
9. OR/ 1 AND 3
10. OR/ 1 AND 4
11. AND/ 5-10
12. Limit 11 to (English language and humans)

All other search strings, with number of hits by string, can be found in Appendix 2.1.

Additional search strategies were also used to locate studies and to recursively generate additional search terms in the string listed above. A scoping review of CA interventions in public health (Hollands et al. 2012), a systematic review of interventions for severe intoxication in licensed premises (Brennan et al. 2011), a systematic review of environmental factors in drinking venues and alcohol-related harm (Hughes et al. 2011), and a review of research into the impacts of alcohol warning labels on behaviours (Stockwell 2006) were hand-searched. The author also searched trial registries (metaRegister of Randomised Controlled Trials, Trials Register of Promoting Health Interventions) and systematic review libraries (Cochrane Database of Systematic Reviews and the Database of Promoting Health Effectiveness Reviews). In addition, the author searched grey literature databases and organizational websites including those of the World Health Organization, National Institute for Health and Clinical Excellence (UK) and Agency for Health Care Research and Quality (USA). Finally, the author conducted snowball search techniques, including the search of reference lists and electronic citation tracking from published reports of eligible studies (Greenhalgh & Peacock, 2005).

Abstracts generated from database searches were exported to EndNote and de-duplicated. The author screened abstracts and titles for eligibility against inclusion criteria to assess for ‘definite’ exclusion—that is, if studies definitively did not meet at least one inclusion criterion. Full-text versions of screened records were then obtained, to which the reviewer applied the inclusion criterion. Full-text versions of screened records were then obtained, to which the reviewer applied the inclusion criteria independently.

The reviewer extracted data from each study on the basis of: objective; study design; population; unit of analysis; sample size; gender; age; intervention conditions; session duration; available drink options; drink setting; and outcome measurements (see Appendix 2.2 for the data extraction template). Additionally, data were extracted for meta-analysis treating alcohol consumption as a dependent variable.

2.3 Quality assessment and assessment of risk of bias in included studies

Because of the lack of widely accepted critical appraisal guidance capturing the breadth of designs covered here and to capture the broadest possible range of studies, quality assessment was not undertaken *a priori*.

2.4 Summary measures of outcome data

Examining standardized mean-difference (SMD) effect sizes across interventions enable comparisons of an intervention's effect size to the total variability of the intervention type's effectiveness as assessed by the meta-analysis (Higgins & Green 2011: 9.2.3.2). SMDs were used in this review in order to situate each study's results into a commensurable scale before they were aggregated with the results of other studies (Higgins & Green 2011: 9.2.3.2). In order to correctly understand a composite SMD score across studies, a researcher must believe that differences in individual SMD scores measuring the same intervention type must be due only to diverse measurement scales across each study and not systemic differences in the demographic data of each study's population (Higgins & Green 2011: 9.2.3.2).

2.5 Synthesis of results

A random-effects model was employed by this meta-analysis in order to generate a composite SMD effect size across studies. The random-effects model is more conservative than the fixed-effects model and was thus appropriate for this meta-analysis given the range of anticipated differences in CA intervention strategies and environmental factors (Higgins & Clark 2011: 9.5.3). This review generated forest plots comparing the SMDs of each study using a random-effects model for each of the following sub-groups: alcohol consumption, CA interventions via commercials, CA interventions via sound level, and CA interventions via setting.

Heterogeneity in outcomes was to be expected given the disparate CA intervention types on alcohol consumption. The chi-squared test indicates if reported differences in review-level results are consistent with expectations of chance (Cochrane Handbook: 9.5.2). The author hypothesised that a large percentage of variability in study-level effects due to heterogeneity would be elevated due to the wide range of perception stimuli—including visual, auditory, and tactile—affected by different CA intervention types, e.g. differential pub music sound levels and television commercials.

2.6 Assessment of risk of bias across studies

The author constructed a protocol designed to uphold the research ideals of transparency and unbiasedness before conducting a search of studies. A data extraction form was created to reflect the protocol's inclusion and exclusion measures as per the Cochrane Collaboration's tool for

assessing risk of bias (Higgins & Green 2011, section 2.8.5) Consequently, this review established five criteria to evaluate the range of possible studies to investigate if 1) random assignment of subjects was used via sequence generation; 2) research subjects were blinded as to their assignment to treatment or control arms of the study; 3) researchers involved in control and treatment conditions were aware of their own role; 4) imputed data from subjects who have dropped out of the study were incorporated using intent-to-treat analysis; and 5) all data appeared to have been reported in the study.

3. RESULTS

3.1 Study selection summary and flowchart

Database searches yielded 10,283 records. After de-duplication, 6,158 records remained. Screening led to the exclusion of 5,995 records, with 163 records remaining. The full list of excluded studies is detailed in Appendix 2.4. An initial mapping of the 152 studies excluded at the stage of full-text review helps to underscore the comparative relevance of exclusion criteria:

- 2 studies that did not include human subjects
- 2 studies examined an intervention (text message-warning) that was not observed in the same micro-environment as that of the targeted behaviour (Buis et al. 2013; Edwards et al. 2014)
- 4 studies examined the effects of a pharmaceutical intervention designed to discourage alcohol use through the administration of naltrexone, an alcohol suppressant

- 8 studies examined an intervention was targeted to alcohol servers (training them, for example, not to over-serve apparently intoxicated subjects)
- 10 studies did not examine alcohol consumption
- 126 studies examined interventions that took place in environments other than public drinking settings, such as laboratories (in which no attempt has been made to induce a casual drink environment) or in private home settings (where study participants offered self-report measures on their alcohol consumption).

Assessment for inclusion with full-text documents led to a total of 11 studies, 6 of which were eligible for meta-analysis. See Figure 5.1 for a PRISMA flow diagram.

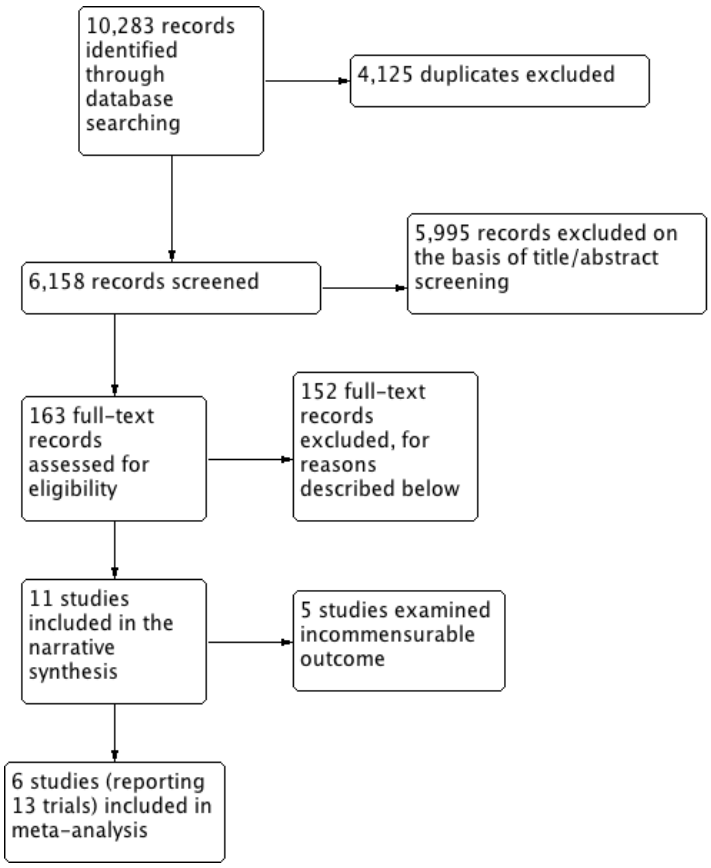


Figure 5.1 *PRISMA flow diagram for systematic review of CA interventions on reducing alcohol consumption*

3.2 Characteristics of included studies

The review identified 11 studies suitable for narrative synthesis, of which 6 studies (reporting 13 trials) were amenable to meta-analysis (see Table 5.1).

3.2.1 Characteristics of non-meta-analysed studies

The other 5 studies did not measure alcohol consumption by volume, making them incommensurable with the meta-analysed studies. Engels et al. (2011) examined the total purchases of alcohol beverages in the span of 2 hours during 46 evenings in three bars in The Netherlands. Jacob (2006) examined the amount of time and money spent by 93 randomly selected patrons in a bar of a mid-sized French coastal town. Kohn & Smart (1984) examined the percentage of 125 patrons ordering alcohol every 30-minutes during a 2-hour American football game. In a test of the balanced placebo design—examining the difference between a laboratory setting and a naturalistic drink setting—Wigmore & Hinson (1991) examined the number of drinks ordered within a single 30-minute time horizon.

3.2.2 Demographic information of participants

Of the 11 studies included in the narrative synthesis—reporting results for 33 trials, containing different participants for each trial—3 were conducted on samples recruited in The Netherlands, 3 in France, 3 in Canada, and 1 each in the US and UK. The sample sizes of 2 studies ranged between 39 and 40 subjects (Gueguen et al. 2008; Leeman & Corbin 2013), and the size of 7

studies ranged between 80 and 125 subjects (Engels et al. 2009; Gueguen et al. 2004; Jacob 2006; Kohn & Smart 1984; Otten et al. 2013; Sobell et al. 1986, Wigmore & Hinson 1991). One study was slightly larger, examining 225 subjects in 8 trials (Moss et al. 2015). The single remaining study did not collect information on sample size but rather examined total payment for alcohol collected by the bar in which the experiment was conducted (Engels et al. 2011).

The sample in 6 studies (reporting 13 trials) only included men (Engels et al. 2009; Gueguen et al. 2008; Kohn & Smart 1984; Otten et al. 2013; Sobell et al. 1986; and Wigmore & Hinson 1991), and men made up the majority of the sample in 2 other studies (Jacob 2006 and Leeman & Corbin 2013). Notably, the unit of analysis in the majority of included studies was individual subjects as compared to 5 other studies in which the unit of analysis was male-male or male-female dyads (Engels et al. 2009; Gueguen et al. 2008; Gueguen et al. 2004; Jacob 2006; Otten et al. 2013).

3.2.3 Characteristics of CA intervention types

Included studies could be organized by intervention type, meaning sensory perceptions (e.g. visual perception, auditory perception) affected by CA intervention. For example, 3 studies reported the impact of setting on alcohol consumption, e.g. bar versus laboratory (Gueguen et al. 2004; Moss et al. 2015; Wigmore & Hinson 1991). In this intervention type, a combination of CA intervention stimuli—such as the provision of bar stools versus laboratory couches—combined to constitute the comparison of the experimental group (public drinking setting) versus the control group (laboratory setting). Moreover, 4 studies examined the effects of altering music

type (Jacob 2006), music sound level (Gueguen et al. 2008; Gueguen et al. 2004), and music lyrics (Engels et al. 2011). Three studies reported the primary outcome on the basis of exposing subjects to alcohol-related commercials (Engels et al. 2009; Kohn & Smart 1984; Sobell et al. 1986). Subjects in 2 studies viewed movie and television programming with alcohol-related themes and commentary (Engels et al. 2009 and Sobell et al. 1986). One study examined the effects of visual perception on the primary outcome by exposing subjects to posters bearing responsible drinking health messages (Moss et al. 2015). Another study asked subjects to track their alcohol consumption after completion of a depletion or control task (Otten et al. 2013). Finally, 1 study provided the subjects with a payment disincentive to drink whereby subjects performed cognitive and psychomotor tasks after drinking, facing fixed potential deductions of their recruitment award on the basis of their performance (Leeman & Corbin 2013).

3.2.4 Consumption setting

Intervention arms across all included 11 studies took place in actual barrooms or naturalistic bar settings. A naturalistic bar setting is broadly defined as a room in which researchers have explicitly arranged furniture and alcohol-related paraphernalia to induce a casual drink environment. With regard to the first group, of the meta-analysed trials Leeman et al. (2013) directed participants to sit at one table or two adjacent tables off to one side of the bar. The bar had televisions, a pool table, jukebox, video games, playing cards and table games. Similarly, Gueguen and colleagues employed 2 bars situated in a medium-size city located on the western coast of France. Of the non-meta-analysed trials, Gueguen et al. (2004) observed participants in two bars in France, one located in a rural zone and one in an urban zone. Jacob (2006) also

observed participants in a bar of a middle-size town on the western coast of France. Engels et al. (2011) conducted their study at three bars in Nijmegen, a middle-size town in The Netherlands. Wigmore & Hinson (1991) observed participants at a popular on-campus bar that contained low-level lighting, tables, a small stage, and a television screen.

Table 5.1 *Characteristics of included studies*

Study ID	Country	Unit of analysis	Collection method	Duration (min) of observation	Sample size	Percent-age of men	Nudge stimuli	Intervention conditions	Alcohol consum-ption measure
Engels et al. 2009*	Nether-lands	Dyad**	Observation, self-report, measure of alcohol consumed	90	80	100%	Movie, commercial	(1) Alcoholic movie with neutral and alcohol commercials (2) Alcoholic movie with neutral commercials (3) Non-alcoholic movie with neutral and alcohol commercials (4) Non-alcoholic movie with neutral commercials.	Drinks ordered
Engels et al. 2011	Nether-lands	Individual	Pay collection	120	N/A	N/A	Music lyrics	(1) Music with lyrics referencing alcohol (2) Music without lyrics referencing alcohol	Total money spent
Guegue n et al. 2008*	France	Dyad	Observation, measurement of alcohol consumed	N/A	40	100%	Sound level	(1) Sound level of 72 decibels in 2 bars (2) Sound level of 88 decibels in 2 bars	Drinks ordered
Guegue n et al. 2004*	France	Dyad	Observation, drinks ordered	N/A	120	50%	Setting, sound level	(1) Rural bar and sound level of 72 decibels (1) Rural bar and sound level of 88 decibels (2) Urban bar and sound level of 75 decibels (2) Urban bar and sound level of 91 decibels	Drinks ordered
Jacob 2006	France	Dyad	Observation, pay collection	30	93	81.7%	Music type	(1) Cartoon music played for 30 min in bar (2) Top 40 music played for 30 min in bar (3) Drinking songs played for 30 min in bar	Total money spent
Kohn & Smart 1984	Canada	Individual	Observation, number of beers collected	90	125	100%	Commercials	(1) Zero commercials during football match (2) Four commercials during football match (3) Nine commercials during football match	Number of subjects ordering alcohol at 30-min intervals

Leeman & Corbin 2013*	USA	Individual	Timeline Followback Interview (TLFB), Impaired Control Scale, self-report, psychomotor tasks	180	39	69.2%	Payment distinctive to drink	(1) Subjects informed that for each of the 4 psychomotor tasks they did not perform comparably with initial screening, they would draw from a hat for a possible pay reduction ($0, $6, $12) for potential loss up to $48. (2) No payment reduction	Drinks ordered
Moss et al. 2015*	UK	Individual	Taste preference task, alcohol intake	N/A	225	29.3%	Posters, setting	(1) Natural bar setting (2) Laboratory setting (3) Responsible Drinking Message poster (4) Control poster (5) Online priming + RDM poster (6) No online priming + control poster (7) RDM poster + subject verbalization of message (8) Control poster + no verbalization of message	Alcohol intake
Otten et al. 2013	Nether-lands	Dyad	Observation, self-report, alcohol intake	60	108	100%	Self-tracking	(1) Depletion task + self-tracking task (2) Depletion task + no self-tracking task (3) No depletion task + self-tracking task (4) No depletion task + no self-tracking	Alcohol intake
Sobell et al. 1986*	Canada	Individual	Observation, self-report, alcohol intake	60	96	100%	Television program, commercials	(1) Beer commercial + alcohol TV scenes (2) Beer commercial + no alcohol TV scenes (3) NA beverage com. + alcohol TV scenes (4) NA beverage com. + no alcohol TV scenes (5) Food commercial + alcohol TV scenes (6) Food commercial + no alcohol TV scenes	Alcohol intake
Wig-more & Hinson 1991	Canada	Individual	Self-report, alcohol intake	30	84	100%	Information cue, setting	(1) Told alcohol + given alcohol + lab setting (2) Told alcohol + given no alcohol + lab setting (3) Told no alcohol + given alcohol + lab setting (4) Told no alcohol + given no alcohol + lab (5) Told alcohol + given alcohol + nat. bar setting (6) Told alcohol + given no alcohol + nat. bar (7) Told no alcohol + given alcohol + nat. bar (8) Told no alcohol + given no alcohol + nat. bar	Alcohol intake

* Included in meta-analysis

** 2 drinking partners observed

With regard to the second group (laboratories designed to look like bars), 5 studies reported trials that were meta-analysed to examine the effects of CA interventions in naturalistic barroom settings. Otten et al. 2013 used the bar laboratory of Radboud University Nijmegen, which is furnished as an ordinary small pub. Similarly, Engels et al. (2009) designed a natural drinking setting by placing a leather couch, an easy chair and a small table in front of a large screen and a projector. A refrigerator with soft-alcoholic beverages (i.e. beer and wine) and soft drinks (i.e. cola and orange soda) was placed within a meter's reach of the chair. Moss et al. (2015) observed participants in a purpose-built laboratory facility which was built to resemble a bar-like environment with a 6 foot by 5-foot bar counter and bar stools, beer taps, and other alcohol-related paraphernalia displayed. Participants were sat at the bar counter. Another room in the psychology laboratory was used for the lab context condition. These rooms were of similar size and on the same side of the building, ensuring a near-identical view from the window. Sobell et al. (1986) conducted their study in a small room at the Addiction Research Foundation in Ontario, Canada, designed to look like a television or family room, containing a couch, chairs, pictures, tables, a television set and low lighting. Similarly, Kohn & Smart (1984) conducted their study in a faculty lounge at York University, and it featured an enclosed bar, comfortable overstuffed chairs and subdued lighting.

3.2.5 Outcome data collection methods

Studies demonstrated a small variety of collection methods. Five studies reported trials that asked for subjects to respond to self-report measures, such as the Alcohol Use Disorder Identification Test, after initial screening in order to gauge the average amount of alcohol intake

in one setting and on a weekly basis (Engels et al. 2009; Leeman & Corbin 2013; Otten et al. 2013; Sobell et al. 1986; and Wigmore & Hinson 1991). In 7 studies, researchers reported observation measures on experimental subjects ordering drinks (Engels et al. 2009; Gueguen et al. 2008; Gueguen et al. 2004; Kohn & Smart 1984; Leeman & Corbin 2013; Otten et al. 2013; Sobell et al. 1986), and in 3 of those studies researchers manipulated experimental conditions on the basis of those observations, such as manipulating a bar's playlist of music (Gueguen et al. 2008; Gueguen et al. 2004; Jacob 2006).

3.2.6 Primary outcome measures

Primary outcome measures could be organized in 3 groups. Four studies reported trials that examined the number of drinks ordered by subjects irrespective of drink type, such as wine, beer, spirits, etc. (Engels et al. 2009; Gueguen et al. 2008; Gueguen et al. 2004; Leeman & Corbin 2013). Kohn & Smart 1984 tallied the number of subjects ordering alcohol at fixed half-hour time points during a 90-minute football match. In 2 studies, the bars in which the experiment took place reported the total amount of money collected during the data collection period (Engels et al. 2011; Jacob 2006). Only 4 studies reported trials that actually examined the total amount of alcohol consumed by volume (Moss et al. 2015; Otten et al. 2013; Sobell et al. 1986; Wigmore & Hinson 1991).

3.3 Characteristics of excluded 'boundary' cases

Six 'boundary' studies were identified, meaning they underwent full-text screening but were ultimately excluded because they did not measure effects on the primary outcome, alcohol consumption (Forsyth 2008; Kohn et al. 1984; Murphy & MacKillop 2014; Teunissen et al. 2012; Wansink & van Ittersum 2003; Wansink & van Ittersum 2005). They are worth noting, however, because they each investigated CA interventions in alcohol use and so better illuminate the range of micro-environmental cues that may be manipulated in service of altering health-related behaviour. For example, 3 studies examined the impact of changing or eliminating glassware on subjects' disorder-related harm and expectancy of consumption (Forsyth 2008; Wansink & van Ittersum 2003; Wansink & van Ittersum 2005). One study examined the effects of printed alcohol advertising hand sheets on consumption but was excluded because the advertising took place in a different environment than that of subsequent alcohol consumption (Kohn et al. 1984), which violated the instrumental criterion that CA interventions should take place within the same environment in which the targeted behaviour is observed. Another study examined the effects of exposing subjects to positive or negative stereotypic information about drinkers on subsequent alcohol intake, but the study was excluded because it lacked a control group (Teunissen et al. 2012). Finally, one study examined the effectiveness of mindfulness as a strategy to moderate cue-elicited cravings for alcohol (Murphy & MacKillop 2014).

3.4 Risk of bias within studies

Table 5.2 indicates the study-level risk of bias, in which bias is represented with the negative sign. None of the trials reported pre-registration of protocols. On the topic of random sequence generation, Gueguen et al. (2004a), Gueguen et al. (2004b), and Gueguen et al. (2008) examined the influence of sound level on alcohol consumption but apparently did not randomly allocate their selection as to which pub would play music at 72 decibel and 88 decibel levels. Sobell (1984a) and Sobell (1984b) also did not randomly allocate the exhibition of alcohol-related television commercials versus non-alcohol-related commercials to the two arms. Moreover, due in part to the nature of the interventions used by Engels et al. (2009a), Engels et al. (2009b), Gueguen et al. (2004a), Gueguen et al. (2004b), Sobell (1986a), and Sobell (1986b), personnel were not blinded to the treatment groups, which may have affected their handling of research participants. In the case of the latter group (Sobell 1986a and Sobell 1986b), the outcome assessment was not fully blinded to research participants. In addition, Wigmore & Hinson (1991) altered their protocol upon realization that many subjects became aware of the trial's purpose given that questions related to personal alcohol consumption history were administered at the beginning of the study. Beginning with subject 49 of 96 subjects, the researchers therefore administered the same questions after the trial—opening up the possibility of variation between the treatment effects both halves of the sample.

Publication bias plagues systematic reviews, and it is difficult to rule out the possibility that results indicating ‘failed’ CA interventions, or interventions with minimal effects went unreported—thus skewing this review. Given that the causal mechanisms for CA interventions

are still being tested, it is possible that researchers were unable to publish the results of CA interventions on alcohol use. To at least partially ameliorate this issue, the reviewer consulted the Cochrane Central Register of Controlled Trials (CENTRAL) in order to find as many registered trials as possible but it could be that there exist inaccessible trials whose results would influence this analysis.

Table 5.2 *Risk of bias in studies*

Study	*Random sequence generation*	*Allocation concealment*	*Blinding: participants/ personnel*	*Blinding: outcome assessment*	*Incomplete outcome*	*Selective reporting*	*Other*
Engels et al. 2009a	+	+	-	+	+	+	+
Engels et al. 2009b	+	+	-	+	+	+	+
Gueguen et al. 2004a	-	-	-	+	+	-	-
Gueguen et al. 2004b	-	-	-	+	+	+	-
Gueguen et al. 2008	-	-	-	+	+	+	+
Leeman & Corbin 2013	+	+	+	+	+	+	?
Moss et al. 2015a	+	+	+	+	+	-	?
Moss et al. 2015b	+	+	+	+	+	+	-
Moss et al 2015c	+	+	+	+	+	+	-
Moss et al. 2015d	+	+	+	+	+	-	?
Moss et al. 2015e	+	+	+	+	+	+	-
Sobell et al. 1986a	-	+	-	-	+	+	-
Sobell et al. 1986b	-	+	-	-	+	+	-

+ indicates low possibility of bias;
indicates high possibility of bias
? indicates unknown possibility of bias

3.5 Synthesis of results

3.5.1 Main findings

Study-level findings of the review were synthesised narratively, and the 13 trials reported in 6 studies were synthesised in a meta-analysis (Engels et al. 2009; Gueguen et al. 2008; Gueguen et al. 2004; Leeman & Corbin 2013; Moss et al. 2015; Sobell et al. 1986). As mentioned above, because of the diversity of study designs and analytic methods and heterogeneity in outcome-level variables and covariates, study-level findings for 5 studies (Engels et al. 2011, Jacob 2006, Kohn & Smart 1984, Otten et al. 2013, and Wigmore & Hinson 1991) were not meta-analysed.

This review now turns to the results of comparing interventions on the primary research outcome, alcohol consumption. The meta-analysis of 13 trials is summarised in Figure 5.3. Pertaining to the main effect, the mean of all 6 included studies (reporting outcomes for 13 total trials) demonstrated a statistically non-significant, moderate effect size for CA interventions on the primary outcome (SMD = 0.63) given the variance of results (95% confidence interval: -0.06 and 1.31, with a p value = 0.07). Notably, the heterogeneity for this outcome appeared to be quite high (I squared = 93%). In the comparison of standardized mean differences, 2 trials (Engels et al. 2009a; Sobell et al. 1986a) demonstrated high effects, and 3 additional trials reported moderate effects (Engels et al. 2009b; Gueguen et al. 2004b; Gueguen et al. 2008), all with wide variance. In contrast, 4 trials reported no effects (Gueguen et al. 2004a; Moss et al. 2015a; Moss et al. 2015b) and 3 trials reported effects that favoured the control treatment (Leeman & Corbin 2013; Moss et al. 2015e; Sobell et al. 1986b).

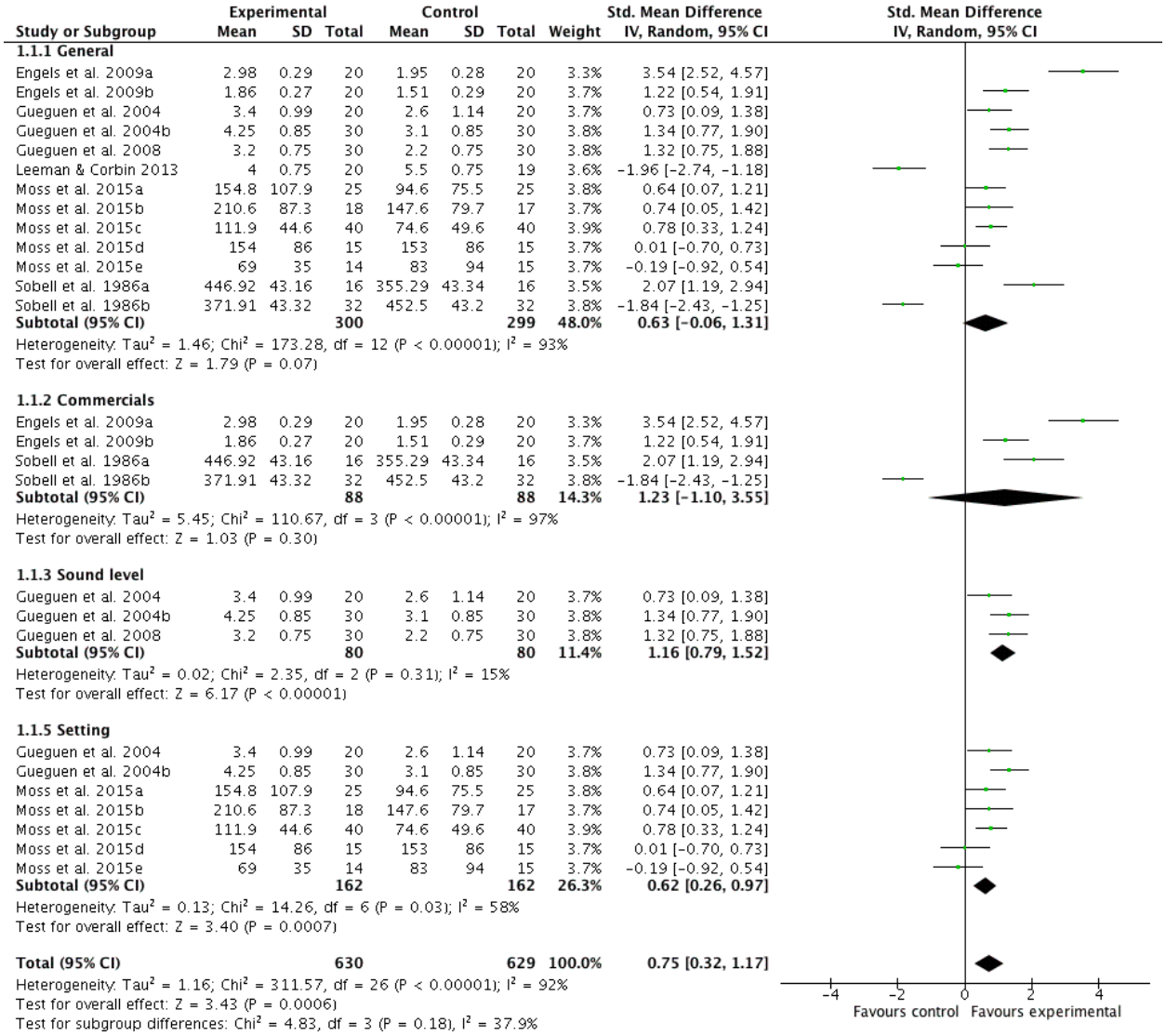


Figure 5.3 *Composite- and stratified-effects of CA interventions in alcohol use in public drink spaces*

There were various intervention strategies identified in this review (e.g. commercials, sound-level, setting) that might have otherwise lent themselves to subgroup analysis. However, this review did not conduct subgroup analysis on the basis of statistical and scientific rationale. First, given that there were only 13 trials of not more than 40 participants each, there were too few trials to analyse potential covariates of interest (Higgins & Green 2011). Second, and equally important, there was a significant risk of cofounding because different strategies involved

manipulation of the same environmental stimuli. For example, the intervention strategy involving manipulation of 'setting' necessarily entails the manipulation of alcohol-related paraphernalia (e.g. advertisements) and music or sound level. Given that 'commercials' and 'sound-level' could each represent different subgroups, it would be difficult to disentangle their influences on intervention effect as compared to that of setting as well.

3.5.2 Stratification of CA intervention type rationale and analysis

3.5.2.1 Commercials stratified group

Four trials assessed the impact of CA interventions via alcohol-related commercials on alcohol consumption (Engels et al. 2009a; Engels et al. 2009b; Sobell et al. 1986a; Sobell et al. 1986b). The stratified meta-analysis (Figure 5.3) confirmed a non-significant effect (SMD = 1.29) given the outcome variance (95% CI: -1.10, 3.55 with a p value = 0.3), and this composite effect is accompanied relatively high degree of heterogeneity (I squared = 97% and p value = 0.3). Three trials report high effects for the respective intervention arms (Engels et al. 2009a; Engels et al. 2009b; Sobell et al. 1986a), and 1 trial reports high effects for the control treatment (Sobell et al. 1986b).

3.5.2.2 Sound level stratified group

As listed in Figure 5.3, 3 trials evaluated the effect of CA interventions via sound level on alcohol intake (Gueguen et al 2004a; Gueguen et al. 2004b; Gueguen et al. 2008). A statistically

significant, large composite effect size was reported (SMD = 1.16; 95% CI: 0.79, 1.52 with p value = less than 0.00001) accompanied with relatively low heterogeneity (I squared = 15%). Two trials reported high effect sizes for the intervention treatment (Gueguen et al 2004a; Gueguen et al. 2004b), whereas the third trial reported a moderate effect (Gueguen et al. 2008). It should be noted, however, that the 2 Gueguen et al. trials used the same research methodology in examining the effects of sound level—e.g. observations of bar patrons within a 2-hour window across sound-level thresholds. Differences between the 2 trials were limited to setting and population, which may help to explain the relatively low degree of heterogeneity.

3.5.2.3 Setting stratified group

Finally, 7 trials indicated a statistically significant, moderate composite effect (SMD = 0.62; 95% CI: 0.26, 0.97 and p value = 0.0007) for CA intervention via setting on alcohol intake as listed in Figure 5.3 (Gueguen et al. 2004a; Gueguen et al. 2004b; Moss et al. 2015a; Moss et al. 2015b; Moss et al. 2015c; Moss et al. 2015d; Moss et al. 2015e). In each of these studies, the setting of a public drinking space, such as a laboratory bar, was compared with a control setting, such as an empty laboratory. Heterogeneity appeared moderately high (I squared = 58%). One trial reported a moderate effect size for the intervention treatment (Gueguen et al. 2004b), 1 trial reported a small intervention effect (Moss et al. 2015c), and 3 trials reported no statistically significant effect size (Gueguen et al. 2004a; Moss et al. 2015a; Moss et al. 2015c). In contrast, 2 studies reported moderate to high effect sizes favouring the control treatment (Moss et al. 2015d; Moss et al. 2015e).

3.6 Risk of bias across studies

Across studies, the possibility of bias due to random sequence generation existed for 3 studies (Gueguen et al. 2004, Gueguen et al. 2008, and Sobell 1986) and detection bias was possible in 4 studies (Engels et al. 2009, Gueguen et al. 2004, Gueguen et al. 2008, and Sobell 1986). There was, however, relatively little risk of attrition or reporting bias across trials. Five studies did not report which alcoholic beverages were available to subjects (Engels et al. 2009; Engels et al. 2011; Gueguen et al. 2004; Jacob 2006; Moss et al. 2015). In the case of Gueguen et al. (2004), this mattered because subjects in the rural bar appeared to drink significantly more alcohol than the urban bar, but that may have been because of varying drinks selection. Similarly, the primary outcome results of Moss et al. (2015) may have been affected by the availability of different drinks to subjects. The authors indicate that there was no significant difference in the mean amounts of beer (M = 56.9 ml, SD = 55.8) and wine (M = 67.8 ml, SD = 57.8) consumed, so they did not differentiate between alcoholic drinks.

4. DISCUSSION

4.1 Summary of main findings

In summarising review-level results of the primary outcome—alcohol intake—the 6 studies, or 13 included trials, demonstrated a non-significant, moderate effect size of CA interventions on the primary outcome (SMD = 0.63) given the variance of results (95% CI: -0.06 and 1.31, with a p value = 0.07). The high level of heterogeneity (I squared = 93%) across trials is unfortunate

but also unsurprising, given—among other things—the wide range of contextual factors affecting subjects' sensory faculties. Although the reviewer attempted to identify *a priori* justification for sub-group analysis, search results turned up too few trials to analyse. Moreover, because some potential sub-groups, such as 'setting', incorporate the same or similar components as other potential sub-groups (e.g. 'television commercials'), results of sub-group analysis would be extremely difficult to interpret at best and misleading at worst.

The narrative synthesis indicated a lack of clarity related to CA—including causal mechanisms for intended behaviour change—as well as a lack of consistent terminology related to CA. In addition, significant variation in reporting the primary outcome underscored the extent to which researchers privileged different aspects of drinking-related behaviour. For example, 5 studies were excluded from the meta-analysis because their ways of reporting alcohol consumption proved incommensurable with each other and with the 6 included studies because they did not measure alcohol consumption by volume but rather by some other metric (such as money spent).

4.2 Limitations of review

At least four limitations—relating to search strategy, risk of bias, results, and generalizability—should be considered alongside review-level evidence. First, the difficulty in assigning labels related to 'CA' and 'nudge' could mean that this review unnecessarily excluded trials that would otherwise be of interest to it. In comparison, a reviewer examining a narrower range of CA intervention types, such as textual warnings on alcohol contains, would likely feel slightly more confident in her search strategy given the large number of terms associated with micro-

environmental stimuli affecting a range of conscious and unconscious senses. Perhaps a more extensive search strategy would include even more terms related to specific sensory faculties, extending beyond the visual, auditory, gustatory, tactile, and olfactory senses.

Second, these studies demonstrated risk of bias given the nature of interventions involved. On the topic of random sequence generation, Gueguen et al. (2004) and Gueguen et al. (2008) examined the influence of sound level on alcohol consumption but apparently did not randomly allocate their selection as to which pub would play music at 72 decibel and 88 decibel levels. Sobell (1986) also did not randomly allocate the exhibition of alcohol-related television commercials versus non-alcohol-related commercials to the two arms. Moreover, due in part to the nature of the intervention used by Engels et al. (2009)—focused on provision of alcohol-related versus non-alcohol-related music lyrics in a pub setting—in addition to those of Gueguen et al. (2004) and Sobell (1986), personnel were not blinded to the treatment groups, which may have affected their observation of research participants. Moreover, in the case of the latter group (Sobell 1986), the outcome assessment was not fully blinded to research participants.

Third, the statistically non-significant, moderate effect size of 0.63 was accompanied by a relatively large degree of heterogeneity in outcomes (I squared = 93 percent and p value = 0.07). A high level of heterogeneity indicates that the variability in review-level results is due to large systematic differences in intervention types (e.g. interventions targeting sound level as distinct from interventions targeting print advertising on alcohol containers) instead of random chance. One reason heterogeneity matters is because a high score may weaken the logic for trying to combine and meta-analyse different trials. Given the lack of statistical significance, then, one

interpretation of such a score is that each intervention type affects subject behaviour (especially alcohol consumption) differently, which makes sense given that each intervention type manipulated various features of the micro-environment in which alcohol was consumed. For example, 2 included studies tested the influence of aversive images and text (Leeman & Corbin 2013, Moss et al. 2015), 2 studies examined the influence of music sound level and type (Gueguen et al. 2008, Gueguen et al. 2004), and 2 examined the influence of alcohol-themed commercials (Engels et al. 2009, Sobell et al. 1986).

Fourth, quite separate from review-level results, study-level characteristics indicated that conclusions drawn from such evidence has limited generalisability. Among other things, among meta-analysed trials there was a disproportionate number of male subjects (369 out of 600 total subjects, or 61.5 percent). Moreover, all of the trials were conducted in northern Europe or North America. Of the 11 included studies here 3 were conducted on samples recruited in The Netherlands, 3 in France, 3 in Canada, and 1 each in the US and UK. Results for, for example, trials conducted in low- and middle-income countries may report different effects.

4.3 Strengths of review

There are at least 3 strengths associated with this review. First, insofar as the reviewer is aware, this is the first Cochrane-style systematic review and meta-analysis of CA interventions in alcohol use. It joins a growing number of reviews (e.g. Hollands 2015) that attempt to quantify the effect of CA interventions in public health, and in so doing provide an important empirical basis on which future interventions may be designed. Moreover, this is one of the first reviews to

consider any alcohol intervention within public drink settings that was not limited to the effects of mass media campaigns or advertisement bans.

Second, this review presents an interesting challenge to Cochrane-style reviews in that it groups together a heterogeneous mix of intervention types on an explicitly theoretical basis. Though this comes with substantial risks in the form of limited generalisability, it nonetheless represents a compelling case study in theory-driven intervention design from the perspective of meta-analysis. Given the increasing salience of dual-process models in public policy (see next chapter), this challenged represented by this review could foreshadow future attempts to collate evidence from intervention types linked by a causal logic that is not immediately apparent in their execution.

Third, the main findings of this review form the basis of new research agenda in the effects of otherwise little-known intervention types—namely, interventions that draw explicitly on manipulation of setting, lighting, sound level, music type, and drinking implements (such as glasses). While the evidence base for each of these types is relatively small, this review gestures to the possibility that subgroups such as sound-level and setting may have a greater effect on alcohol consumption in public drink spaces as compared to other groups.

4.4 Conclusions

This review indicates that identified CA interventions in alcohol use in public drink settings are of limited effectiveness. However, this may be because reviewed strategies encompass a large

spectrum of manipulated environmental stimuli (embedded within the intervention conditions). Although subgroup analysis might have indicated what, if any, particular CA intervention strategies—among all those that affect alcohol consumption in public drink settings—are effective, this review identified too few trials to render subgroup analysis prudent. While this review stratified CA intervention types on the basis of manipulated environmental stimuli (e.g. music type or lighting level), as discussed in Caldwell & Welton (2016) alternatively it would have been possible to use candidate middle-range theories identified and tested in a realist review (discussed in chapter 6) to partition intervention components.

More broadly, this review represents an attempt to grapple with the conceptual nuance offered by this thesis by expanding upon the definition of CA interventions posited by Hollands et al. (2012). On the basis of micro-environment, the authors' definition enabled the reviewer to identify a narrow range of CA interventions to test for effectiveness. Moreover, the degree of heterogeneity generated by the composite effect size helps motivate this thesis's turn to explanatory and predictive methods—such as those offered by realist review (chapter 6)—in seeking to explain the causal logic according to which alcohol-related CA interventions operate. Not only that, but because of the distinct aims of Cochrane-style review and realist review, it is possible to nest the 11 included studies of this Cochrane-style review into the included study sample of the realist review in the interest of informing an emergent programme logic that undergirds CA interventions in alcohol use.

Chapter 6.
A Realist Review of CA Interventions in Alcohol Consumption

1. INTRODUCTION

This realist review grows out of the Cochrane-style systematic review and meta-analysis for CA interventions in alcohol consumption in public drinking settings (chapter 5), which found a moderate but statistically non-significant composite effect. Upon considering the sources of heterogeneity in the particular CA intervention types identified in that meta-analysis—for example, some interventions manipulated sound level whereas others manipulated print advertisements for alcohol—the reviewer began to try to understand how different alcohol-related CA interventions differed in their causal logic. Given that the unit of analysis for realist review is theory of change, the author deemed it appropriate to conduct a realist review for the purposes of articulating and building theory. And given that CA interventions are premised on dual-process models of behaviour, it was necessary to generate and curate the universe of relevant health-related dual-process models, for which the reviewer conducted a review of theory focused on theoretical literature of dual-process models (chapter 4). Thus, this review complements the results of the Cochrane-style meta-analysis (chapter 5) and the review of theory (chapter 4).

Realist philosophy assumes that the interaction between human agency and environments sometimes make it possible to predict, with varying degrees of certainty, what outcomes may be produced. This is due in part because environments constrain human agency in predictable ways, which means that—faced with finite behavioural options—individuals may act in a predictable

fashion. Predictable finite behavioural options have been called ‘demi-regularities’ by Pawson (2006), and realist review attempts to understand and explain these demi-regularities by fitting them into a comprehensive programme theory. Using theoretical and empirical literature—largely irrespective of study design—a realist review attempts to organise these demi-regularities in such a way that some range of each of contexts, mechanisms, and outcomes may be predicted. This degree of abstraction and organisation may be neatly enfolded into middle-range theories that function at the level of conceptualisation but that nonetheless draw on granular observed data in offering testable hypotheses (Merton 1968).

1.1 Rationale

Researchers have documented a gap between knowledge and policy action in articulating the causal logic behind behaviour change implicit in ‘choice architecture’ (CA) interventions (Hollands et al. 2013; House of Lords 2011). Yet, the operant logic of CA interventions implemented by different ‘nudge units’—such as the US Social & Behavioural Sciences Team, the UK Behavioural Insights Team, the Behavioural Economics Teams of Australia, and others—has been a particularly neglected area of study. While nudge units have been active in prescribing policies in certain areas of public health—including smoking cessation, diet, physical activity, and alcohol use—it remains to be precisely specified how the context, mechanism, and outcomes associated with CA interventions interact. The results of this realist review are expected to inform the generation of a qualitative taxonomy (chapter 7), which will help to map the causal mechanisms of behaviour change for CA interventions.

1.2 Objective

The reviewer sought to extract theories from a dataset of primary studies which would explain, what are the causal mechanisms undergirding CA interventions to reduce alcohol use as they interact with an intervention's context? Namely, the reviewer sought to understand the interaction between the causal mechanisms of CA interventions aimed at influencing alcohol consumptive behaviours with intervention contextual factors to produce outcomes. More broadly, the reviewer attempted to gain insights and explanations that would be generalisable across a whole range of different types of alcohol-related CA interventions. Thus, this review's focus was broader than theories that related to specific aspects of such interventions, e.g. CA interventions that affected sound levels in public drinking spaces.

2. METHODS

This realist review began with the development of a research question—again, informed by the results of chapter 5, the meta-analysis of CA interventions in alcohol consumption in public drink spaces. The reviewer then created a protocol which was subject to multiple iterative revisions as new understandings emerged from the analysis of demi-regularities and candidate theories among included papers (Pawson et al. 2005). Iterative revision allowed the reviewer to engage with previously unexplored data regarding relevant context, mechanism, and outcome configurations and test newly identified 'candidate' middle-range theories in light of reading and internalising new knowledge over the process of screening included papers.

2.1 Changes in the review process

Naturally all revisions to the initial protocol were documented in the interest of transparency and to better explain the process of knowledge generation inspired by this review (Appendix 3.1).

2.2 Scoping the literature

The reviewer initiated a preliminary 'territory mapping' exercise to explore different areas of possibly relevant research through unstructured search methods. To this end, the reviewer spoke to colleagues at the US Social & Behavioural Sciences Team and the UK Behavioural Insights Team, academic staff conducting primary trials examining CA interventions in public health at University College London, the University of Cambridge, and Warwick University; sent emails to academic and professional listservs; and browsed physical and electronic libraries and the Internet.

2.3 Inclusion and exclusion criteria

This review sought to include documents that might implicate the causal connection between CA intervention theory and alcohol consumption in humans. The core components—discussed in the research proposal—of 'choice architecture' were applied to interventions, including the fact that CA relies on dual-process models of cognition and behaviour, is non-coercive and responsive to environmental cues, and does not proscribe behavioural options. Moreover, the target behaviour was alcohol consumption, which might be measured in a variety of ways, including *ad libitum*

consumption (i.e. consumption at the individual's sole discretion) but also—for example—bulk purchases of alcohol. Inclusion criteria also specified that the theory of change discussed in included documents posited some causal connection between a change in external environment (e.g. louder music in a pub as compared to another pub) and a change in alcohol consumption (e.g. individuals observed to drink more or less as compared to the controlled setting).

In determining inclusion criteria, the reviewer first returned once again to the definition of a CA intervention offered in chapter 1, which itself had been articulated through the synthesis of 'seminal' papers that have been pivotal for the emergence of public-sector-driven behavioural science. Two such seminal papers included Thaler & Sunstein (2006), *Nudge: Improving Decisions about Health, Wealth and Happiness* (which first codified the approach of CA interventions) and Hollands et al. (2012), which is the first scoping review conducted on CA interventions in public health. Moreover, the goal of this thesis is to better articulate the causal logic according to which CA interventions interrupt one specific outcome—alcohol consumption—and thus outcome measures related to alcohol consumption served as a second inclusion criterion.

The reviewer then considered inclusion criteria in view of capturing all relevant contextual factors and mechanisms (Pawson & Tilley 2004) that may play a role in CA intervention in alcohol consumption. A paper had to describe some association between the components of an identified CA intervention and alcohol consumption, whether a causal pathway was described or not. Papers that described complex interactions—such as feedback loops and multi-stage pathways—between CA intervention components and mechanisms with outcomes were also

included. On this point, this review borrowed search terminology used in the Cochrane-style meta-analysis on CA interventions in alcohol consumption in public drinking settings (chapter 5). Naturally, papers that did not specify a CA intervention or some proxy outcome measure measuring alcohol consumption were excluded.

2.4 Search strategy for identification of studies

At the level of study selection, it was the objective of this review to generate a representative 'maximum variety sample' within which middle-range theories may be identified, challenged, and refined (Wong 2012, in Hannes & Lockwood 2012). A maximum variety sample allowed for the possibility of capturing both effective and ineffective case study interventions. Such a sample was generated in part using broad inclusion criteria, irrespective of research design, collected from all relevant databases given the specific research question posed by this review. By examining interventions along a spectrum of effectiveness and efficacy, this review was able to imagine a universe of possible contexts within which an alcohol-related CA intervention may be situated (Wong 2012, in Hannes & Lockwood 2012). And in these contexts, it was possible to identify channels that promote or inhibit mechanisms through which outcomes are produced. Search methods used by other systematic review methods—including 'snowball' searching and combing through electronic databases (Haig & Dozier 2003)—were used in this review as well.

The objective was to identify studies that make a core conceptual or empirical contribution to the understanding of CA interventions. Notably, the 11 included studies and 7 boundary cases identified in the alcohol CA interventions systematic review (chapter 5) met the inclusion criteria

for this review, and thus all 20 trials were included. This is understandable given that the meta-analysed trials in chapter 5 represent a subset of trials reporting effects of CA interventions in alcohol consumption—each of those trials was examined in the context of public drinking spaces.

It was necessary to develop an iterative search process for the purpose of narrowing the locus of attention to theories of change behind alcohol-related CA interventions, across distinct populations, environments, and consumption outcomes. The reviewer conducted electronic searches for eligible studies—regardless of study design—within each of the following databases: Cochrane Central Register of Controlled Trials (CENTRAL) in The Cochrane Library (1992 to present); Cochrane Public Health Group Specialised Register; MEDLINE (OvidSP) (including MEDLINE In-Process) (1946 to present); EMBASE (OvidSP) (1980 to present); PsycINFO (1806 to present); Applied Social Sciences Index and Abstracts (ProQuest) (1987 to present); Food Science and Technology Abstracts (Web of Knowledge) (1969 to present); Science Citation Index Expanded (Web of Knowledge) (1900 to present); Social Sciences Citation Index (Web of Knowledge) (1956 to present); and the Trials Register of Promoting Health Interventions (EPPI Centre) (2004 to present).

In addition, the reviewer conducted electronic searches of the following grey literature resources including the Conference Proceedings Citation Index Science (Web of Knowledge) (1990 to present); Conference Proceedings Citation Index Social Science & Humanities (Web of Knowledge) (1990 to present); and OpenGrey (1997 to present). Finally, the reviewer searched trial registers (ClinicalTrials.gov and the World Health Organisation [WHO] International

Clinical Trials Registry Platform [ICTRP]) to identify registered trials, and the websites of key organisations in the area of health and nutrition including the following: UK Department of Health; Bureau of Alcohol, Tobacco, Firearms and Explosives, USA; Centres of Disease Control and Prevention, USA; and the World Health Organisation. There were no restrictions for publication date or format, and—importantly—no study design filters were applied.

An example of such a search string applied within the PsychINFO (Ovid SP; 1967 to November week 1 2015) is included below:

1. ((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*)).ti.ab.
2. (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*)
3. exp Mental Processes/
4. exp Music OR (music adj (typ* or genre* OR class*)) OR exp Sound OR volume* OR loud* OR soft* OR sound level*
5. Advertisements OR exp Posters OR exp Lighting OR exp Audiovisual Aids/ OR exp Video-Audio Media/ OR exp Photography/ OR exp Medical Illustration OR exp Multimedia/ OR exp Health Education/ OR Health Promotion/ OR exp Communication/ OR exp Information Dissemination/ OR (visual adj (aid* OR presentation OR representation* OR information OR media OR display* OR stimuli))ti,ab. OR (information OR message* OR education OR promotion)) OR (risk communication$ OR health warning$ OR warning message$ OR image* or pictur* or pictorial or illustrat* or cartoon$ or graphic* or photograph* OR aversi* OR negative OR affective OR threat* OR danger* OR disgust* OR distast* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* or repuls* OR repugnan* OR conditioning OR emotion* OR fear* OR warn* OR risk* or motivat* OR persuas* OR presentation$ OR select* OR proxim*)
6. exp Cooking and Eating Utensils OR exp Product Packaging/ OR exp Food Packaging/ OR exp Automatic Food Dispensers OR exp Product Labeling OR exp Food Labeling OR exp Drug Labelling OR size$ OR dimension* OR capacity OR capacities OR

volume* OR shape* OR height* OR width* OR length* OR depth* OR portion* OR serving* OR product* OR package* OR unit* OR drink* OR tableware OR drinkware OR dinnerware OR crockery OR cup* OR glass OR glasses OR mug* OR pitcher* OR jug* OR decanter* OR receptacle* OR container* OR can* OR carton* OR bottle*

7. exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR (meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*
8. OR/ 1 AND 2 AND 3
9. OR/ 1 AND 2 AND 4
10. OR/ 1 AND 2 AND 5
11. OR/ 1 AND 2 AND 6
12. 8-11 AND/ 7
13. Limit 12 to (English language and humans)

Other search strategies are included in Appendix 3.2.

2.5 Selection and appraisal of documents

Title and abstract records retrieved by the electronic searches were imported to EndNote. Duplicate records were identified, reviewed manually and removed using EndNote's automatic de-duplication feature. Title and abstract records were coded as 'provisionally eligible', 'excluded', or 'duplicate' by applying the eligibility criteria described above. The full text of all papers that were deemed to be at least provisionally eligible at the title/abstract screening stage were extracted and read. The inclusion criteria described above were used to screen out any papers that did not address the research objectives of this review, and reasons for exclusion were recorded.

This review did not apply critical appraisal criteria for several reasons. Unlike other review methods, such as Cochrane-style systematic reviews, in realist review the judgement of the rigor

of, for example, a primary trial is not categorically accepted or rejected on the basis of its comparison to some external quality criterion (Pawson 2006). Rather, what is most important is the 'best-fittedness' of a study's contribution to theory building or theory testing through the provision of data which serve one of those two purposes (Wong et al. 2013). For example, a study may well yield findings that do not appear methodologically rigorous, but for the purposes of the realist review that same study's conceptualisation of a model of behaviour could yield an important nuance to a middle-range theory that appears to be borne out by the findings of a more rigorous primary trial. In a realist review, data may well be extracted from methodologically rich and theoretically rich (or both) studies as they serve different purposes and lend different strengths to the review.

2.6 Data extraction and management

An electronic data extraction form was developed based on the RAMESES realist template (Wong et al. 2013) and modified to allow extraction of all data required for this review (see Appendix 3.3). An initial draft of this form was piloted using a sample of included documents to ensure that it enables reliable and accurate extraction of appropriate data. The reviewer extracted the following information from each paper: author(s); journal name; study design; population; intervention description (including content, setting, delivery, delivery provider, and theoretical basis of intervention if stated); numbers of participants in each trial arm; outcome measure(s); time(s) at which point outcomes were assed; analysis methods; and additional comments.

2.7 Analysis and synthesis processes

In the next section, the reviewer describes and summarises the findings of included studies to address the stated objectives of the review. Namely, the reviewer mapped the realist programme theory of CA interventions by analysing the conceptual and theoretical models of CA causal logic onto the study characteristics and results of relevant CA trials in alcohol use. Because different researchers in different traditions generally conceptualise their topic differently, use different language to describe CA interventions, ask different questions, privilege different methods, and use different criteria to judge 'quality' and 'success,' the reviewer used narrative technique to bring together each trial's results and logic in an overarching synthesis. The narrative approach highlighted the similarities and differences of the findings from different trial populations, micro-environments, and outcomes, and considered the reasons for the differences. In this way, the heterogeneity of approaches and 'contradictions' in findings was captured in data and analysed systematically.

It was vital to distinguish contextual factors, mechanisms, and outcomes in analysis in order to begin constructing possible CMO configurations. Concurrently, identifying candidate middle-range theories helped to elicit testable arguments about mechanisms 'firing' by the precise interaction of an intervention's human and non-human components. And yet, even as such theories were immediately relevant to one particular context-mechanism-outcome (CMO) configuration, they were abstract enough to apply to other configurations—gesturing to some element of the causal logic on which the wider programme theory undergirding CA interventions operates.

During synthesis, identifying demi-regularities in included trials helped to elicit additional CMO configurations and to indicate the possible explanatory power of candidate middle-range theories. Synthesis gestured to a logic scheme that could be interrogated at several points. Did the programme theory adequately describe the range of contextual-level factors, mechanisms, and outcomes observed by a particular type of complex intervention? To put a finer point on it, were there any unexplained observable phenomena associated with the intervention? Were there any demi-regularities that were unaccounted for by middle-range theories? Was there any part of a middle-range theory that contradicted or went beyond the scope of the programme theory? As the reviewer considered these questions, the maximum variety sample of included studies was considered again and again from the perspective of each candidate theory. A candidate theory was duly substantiated if it made sense of and organised some set of demi-regularities and, in do doing, explained under what circumstances (including which mechanisms are operating and to what degree) the outcome of alcohol consumption was observed given some set of contextual factors.

3. RESULTS

3.1 Study selection summary and flowchart

Database searches yielded 13,829 records. An additional 17 records identified through the systematic review on CA interventions in alcohol consumption in public drinking spaces (chapters 5) and were included. After de-duplication, 10,657 records remained. Screening led to the exclusion of 10,486 records, with 171 records remaining. One hundred twenty-one

documents were excluded on the basis of not including a CA intervention (99 documents)—including 42 that tested brief interventions that relied solely on System II reasoning and 6 that tested a pharmacological intervention—as well as not testing alcohol consumption as a primary outcome (22 documents). Assessment for inclusion with full-text documents led to a total of 50 documents. See Figure 6.1 for a flow diagram.

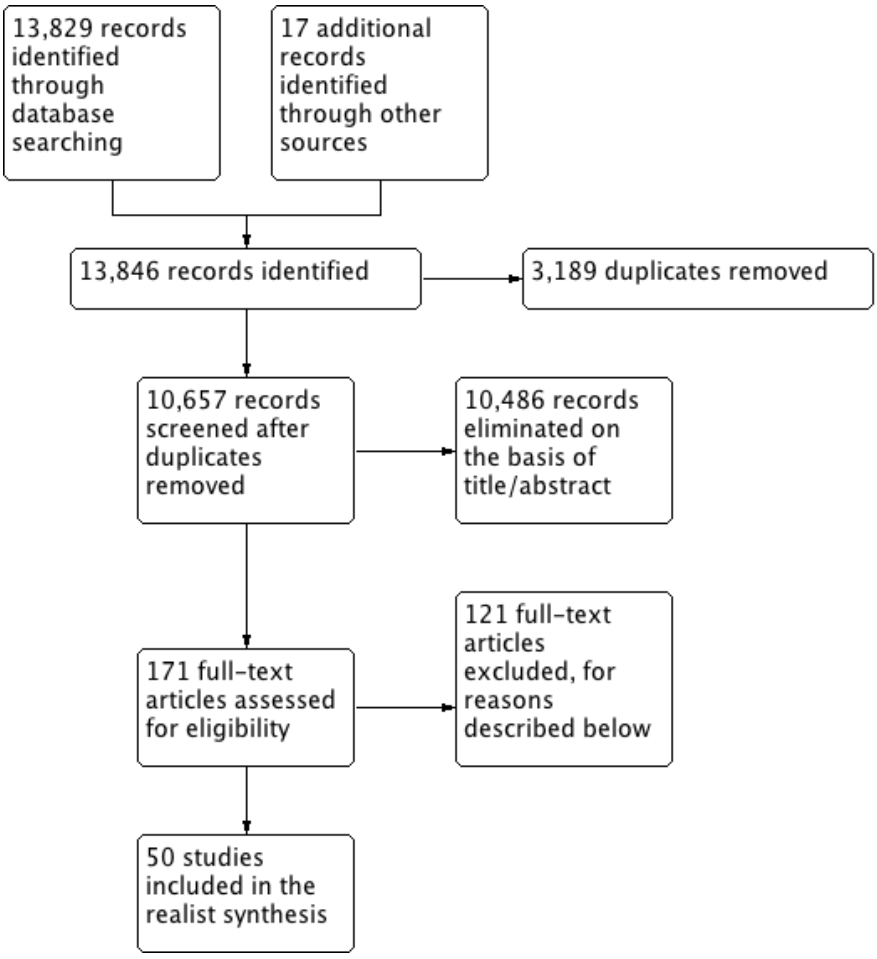


Figure 6.1 *Flow diagram for realist review*

3.2 Characteristics of included studies

The 50 articles were published in 38 different journals (Table 6.1). In all, 70 percent (35/50) of studies were randomised trials; 16 percent (8/50) non-randomised controlled studies (usually

controlled before and after studies); 10 percent (5/50) were systematic reviews and meta-analyses; and 5 percent (2/50) were literature reviews. In extracting relevant data, the reviewer noted further candidate theories and proceeded to test these as well. In part because no realist review has ever previously been conducted on CA interventions, the reviewer did not know to what extent included papers would help to answer his initial research question. Consequently, various limitations in the theoretical data were observed and recorded (see discussion, section 4.2). The emergence of 11 CA intervention strategies prompted the reviewer to focus on a narrow subset of candidate theories discussed in main findings (section 3.3).

Table 6.1 *Characteristics of included documents*

Intervention strategy	**Study ID**	**Study design**	**Primary outcome(s) (measure)**
Internet-based intervention	Blankers et al. (2013)	RCT	Treatment response
	Blankers et al. (2011)	RCT	Alcohol consumption; Treatment response
	Cunningham et al. (2014)	Literature review	N/A
	Finfgeld-Connett et al. (2009)	Observational	Website use
	Neighbors et al. (2010)	RCT	Alcohol consumption (weekly consumption; alcohol-related problems index; heavy episodic reporting)
	Portnoy et al. (2008)	SR & MA	Psychological outcomes of health prevention Behavioural outcomes
	Riper et al. (2007)	RCT	Alcohol consumption (problem drinking; weekly consumption)
	Van Deursen et al. (2013)	RCT	Change in alcohol consumption
	Wallace et al. (2011)	RCT	Alcohol consumption
Text-based intervention	Agyapong et al. (2015)	RCT	Beck Depression Index change Cumulative Abstinence Duration change
	Litvin et al. (2013)	Review of reviews	N/A
	McTavish et al. (2012)	RCT	Smartphone system use
Personalised feedback	Batel et al. (1995)	RCT	Treatment response (schedule alcoholism consultation; appeared at consultation)
	Cunningham et al. (2012)	RCT	Alcohol consumption (number of standard drinks consumed in last 7 days; highest number of drinks on one occasion; AUDIT-C)

	Freyer-Adam et al. (2014)	RCT	Alcohol consumption (AUDIT-C score; total number of drinks consumed in last 7 days)
	Larimer et al. (2007)	RCT	Alcohol consumption (number of drinks and hours spent drinking on a peak drinking occasion during the past month; how many days of the week they had drunk alcohol in the past month; average daily consumption)
Mindfulness techniques	Murphy & MacKillip 2014	RCT	Craving (alcohol craving; urge distress; mood)
	Ostafin et al. (2012)	RCT	Alcohol consumption (Heavy Drinking Behaviour calendar, including quantity consumed per occasion and binge drinking episodes) Alcohol motivation (Implicit Association Test)
	Witkiewitz & Bowen (2010, 2013)	RCT	Drug and alcohol consumption (Timeline Follow-Back scores, reporting the number of days alcohol was consumed over the past 60 days); craving (Penn Alcohol Craving Scale); Depression (Beck Depression Inventory-II)
	Vinci et al. (2014)	RCT	Craving (Urge to Drink; intended time to next drink) Negative Affect (PANAS)
	Zgierska et al. (2009)	SR & MA	N/A
Auditory (music type) (sound level)	Engels et al. 2011	RCT	Alcohol consumption (money spent over 2 hours)
	Jacob 2006	RCT	Alcohol consumption (money spent over 30-min)
	Gueguen et al. 2008	RCT	Alcohol consumption (number of drinks ordered)
	Gueguen et al. 2004	RCT	Alcohol consumption (number of drinks ordered)
Digital advertising	Engels et al. 2009	RCT	Alcohol consumption (number of alcoholic units over 1-hr)
	Kohn & Smart 1984(a)	RCT	Alcohol consumption (number of subjects ordering alcohol at 3x 30-min intervals)
	Sobell et al. 1986	RCT	Alcohol consumption (number of alcoholic units over 1-hr)
Drink implements	Hollands et al. (2015)	SR & MA	Consumption (daily energy intake from food; purchase selection)
	Pechey et al. (2016)	RCT	Alcohol consumption (mean daily volume sold by restaurant)
	Wansink & van Ittersum 2003	Observational	Difference between amount of liquid poured and amount estimated
	Wansink & van Ittersum 2005	Observational	Difference between amount of liquid poured and amount estimated
Social norm messaging	Hustad et al. (2014)	Observational (survey)	Beliefs about personality (Substance Use Risk Profile Scale); descriptive norms (Drinking Norms Rating Form); injunctive norms ('most common attitude' survey); role of drinking in college (College Life Alcohol Salience Scale)
	Lombardi (2010)	RCT	Self-reported alcohol consumption (on basis of anchored information)
	Taylor et al. (2015)	Observational	Alcohol consumption (over previous week); request for information/consultation
	Teunissen et al. (2012)	Observational	Alcohol consumption (drinker prototypes; weekly alcohol use; binge drinking; observed alcohol use)
Attentional	Schoenmakers et	RCT	Attentional bias (visual-probe task score); Craving

retraining	al. (2010)		(Desires for Alcohol Questionnaire); Time to relapse (questionnaire); Treatment response (discharge)
	Schoenmakers et al. (2007)	RCT	Attentional bias (visual-probe task score); Craving (Desires for Alcohol Questionnaire); Preference task (soft drinks or alcohol)
Self-control	Leeman et al. (2013)	RCT	Alcohol consumption (number of alcohol units over 3-hrs)
	Otten et al. (2014)	RCT	Alcohol consumption (alcoholic units over 1-hr)
	Vinson (2000)	RCT	Alcohol consumption (Addiction Severity Index)
Setting	Moss et al. (2015)	RCT	Alcohol consumption (liquid intake)
	Wigmore & Hinson (1991)	RCT	Alcohol consumption (alcoholic units over 30-min)
Other	Bickel et al. (2014)	Literature review	N/A
	Kohn & Smart 1984(b)	RCT	Alcohol consumption (number of drinks consumed)
	Murphy et al. (2012)	Observational	Alcohol consumption (total number of standard drinks that they consumed on each day during a typical week in the past month)
	Nakamura et al. (2015)	Observational	Alcohol consumption (total purchases)
	Siegfried et al. (2014)	SR & MA	Alcohol consumption (total number of glasses)
	Varvil-Weld et al. (2014)	RCT	Alcohol consumption (change between 4 categories: non-drinkers, light weekend drinkers, heavy weekend episodic drinkers, heavy drinkers)

3.3 Main findings

Identified empirical and theoretical evidence implicating the causal logic behind a wide range of CA interventions in alcohol use is organised here (Table 6.2). The programme theory undergirding CA interventions suggests that such interventions are imagined to alter behaviour though the conscious re-framing of behavioural options to make more appealing the prescriptive optimal behaviour. Candidate middle-range theories undergirding each CA intervention reflect this programme logic, and CMO configurations help to actualise them. As applied to alcohol use, a CA intervention is normally (but not always) intended to encourage individuals to consume less alcohol in one sitting than they would in the absence of such an intervention. The CA

approach does not presume to override the basic dual process system of cognition and behaviour, but rather it seeks to improve the basic incentives—conscious or unconscious—surrounding the 'optimally healthy' behavioural option in such a way as to make that option's uptake more likely.

Fifty studies yielded evidence that was synthesised to generate the programme logic according to which the causal pathway for CA-influenced alcohol consumption operates (Figure 6.2). This causal pathway is presented in a similar format to that of Ford et al. (2016), who develops a programme logic from discrete CMO configurations for socioeconomically disadvantaged older people who are seeking access to primary care in rural areas. When it comes to alcohol consumption, for problem drinkers as well as other drinkers who think they may be alcohol abusers, the first 3 stages include self-recognition of a problem, an effort to find help, and preparation for alcohol craving management and avoidance of potentially problematic situations (such as those in which alcohol cravings are predictably induced). For all drinkers, identified studies helped to generate 3 additional stages that may or may not lead directly to an outcome behaviour, such as no alcohol consumption, moderate consumption, or overconsumption.

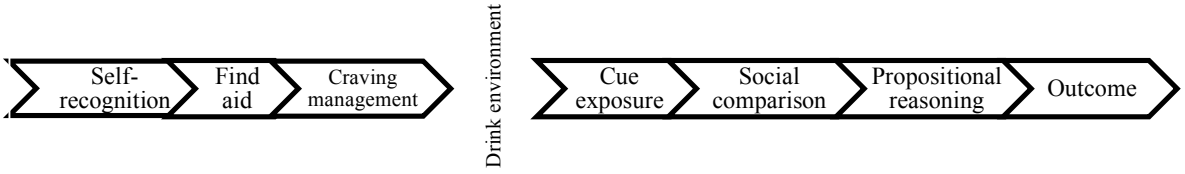


Figure 6.2 *Simple logic model for CA-influenced alcohol consumption*

Table 6.2 *Main findings of realist review*

Intervention strategies	Study ID	Alcohol consumption-relevant conditions described in study	Theoretical context
Internet-based intervention	Blankers et al. (2013)	(1) Internet Therapy (2) Internet Self-help (3) Waiting list control	Cognitive-Based Therapy / Motivational Interviewing (Miller & Rollnick 1991)
	Blankers et al. (2011)	(1) Therapy Alcohol Online (2) Self-help online (3) Waiting list control	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
	Cunningham et al. (2014)	Review of meta-analysis on Internet therapy (brief internet-based interventions)	[Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)]*
	Finfgeld-Connett et al. (2009)	Online treatment consisting of reference modules, decision-making modules, and bulletin board and chat features	Harm Reduction Model (Marlatt 1998) Self-Efficacy Theory (Bandura 1997) Transtheoretical Model of Change (DiClemente 2003)
	Neighbors et al. (2010)	(1) Gender-specific personalised normative feedback (2) Gender-nonspecific personalised normative feedback (3) Control	Social Comparison (Festinger 1954) Social Identity (Tajfel 1982) Self-Categorisation (Turner et al. 1987)
	Portnoy et al. (2008)	Computer-delivered interventions for health promotion and behavioural risk reduction (not specific to alcohol consumption)	N/A
	Riper et al. (2007)	(1) Self-help online (2) Control (web-based psychoeducational brochure on effects of alcohol)	Guided Self-Change Treatment (Sobell & Sobell 1993) [Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)] *
	Van Deursen et al. (2013)	(1) Web-based Cognitive Bias Modification (CBM) therapy (2) Placebo CBM therapy (3) Web-based CBM therapy + alcohol training (4) Placebo CBM therapy + alcohol training (5) Web-based CBM therapy + no-go training (6) Placebo CBM therapy + no-go training (7) Web-based CBM therapy + approach bias retraining (8) Placebo CBM therapy + placebo approach bias retraining	Incentive Sensitisation Theory (Robinson & Berridge 2008) Control and Motivation (Gladwin et al. 2011) Attentional Bias Theory (MacLeod et al. 1986)
	Wallace et al. (2011)	(1) Down Your Drink website (2) Control comparator website	Cognitive Behavioural Relapse Prevention Model (Marlatt & George 1984) [Cognitive Behavioural Therapy / Motivational Interviewing (Miller &

			Rollnick 1991)]*
Text-based intervention	Agyapong et al. (2015)	(1) Twice-daily supportive SMS text messages for 3 months + daily supportive text messages for next 3 months (2) No text messages + telephone call every 2 weeks to express gratitude for remaining in study	[Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)]*
	Litvin et al. (2013)	Brief alcohol technology-based intervention	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
	McTavish et al. (2012)	(1) Standard residential alcohol treatment + possession of Alcohol-Comprehensive Health Enhancement Support System (A-CHESS) smartphone for 8 months (2) Control (standard residential alcohol treatment)	Self-Determination Theory (Ryan & Deci 2000) Cognitive Behavioural Relapse Prevention Model (Marlatt & George 1984) Self-Efficacy (Bandura 1977) Social Learning (Rhodes et al. 1997) Persuasive Communication (Hovland et al. 1964) Motivational Interviewing (Miller & Rollnick 1991) Theory of Reasoned Action (Ajzen & Fishbein 1977) Stages of Change (Prochaska & DiClemente 1983)
Personalised feedback	Batel et al. (1995)	(1) Received personalised letter remanding to alcoholic counselling (2) No letter	N/A
	Cunningham et al. (2012)	(1) Personalised feedback pamphlet (2) Control (Educational pamphlet) (3) Control	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
	Freyer-Adam et al. (2014)	(1) Stage-tailored intervention delivered via computer-generated feedback letters and self-help manuals delivered at baseline and after 3 months (2) Non-stage tailored intervention (Planned Behaviour) delivered via computer-generated feedback letters and self-help manuals delivered at baseline and after 3 months (3) Control (no letters or manuals)	Transthereotical Model of Intentional Behaviour Change (Prochaska & Velicer 1997) Theory of Planned Behaviour (Ajzen 1991)
	Larimer et al. (2007)	(1) Mailed feedback in the form of 10 postcards with information about alcohol's effects and protective strategies (2) Control (non-feedback postcards with information about alcohol's	Motivational Interviewing (Miller & Rollnick 2002) Transtheoretical Model (Prochaska &

		effects and protective strategies)	DiClemente 1986; Miller & Rollnick 2002)
Mindfulness techniques	Murphy & MacKillip (2014)	(1) Alcohol cue* + no treatment (2) Alcohol cue + distraction task (3) Alcohol cue + mindfulness task *Incorporated audio recordings incorporating auditory, visual, olfactory, procioceptive, and tactile cues to prompt the subject to think about alcohol	Mindfulness Therapy (Marlatt 2002; Bishop et al. 2004) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Witkiewitz et al. 2005)
	Ostafin et al. (2012)	(1) Three mindfulness training sessions: 10-, 20-, and 25-min sessions dedicated to breathing, sounds, and mountain imagery (2) Control (audio recordings) training sessions: 10-, 20-, and 25-min sessions dedicated to readings of passages from a research methodology textbook (Rosenthal & Rosnow 1991)	Dyscontrolled Use (Widiger & Smith 1994; Tiffany 1990; Wiers & Stacy 2006; Deutsch & Strack 2006; Fazio 1990) Mindfulness Therapy (Bishop et al. 2004)
	Witkiewitz & Bowen (2010, 2013)	(1) Mindfulness-based relapse prevention sessions over the course of 2-hr sessions over 8 weeks delivered to groups of 6-10 participants (2) Treatment-as-usual sessions, including rolling admission outpatient aftercare including work in the 12-step model, process-oriented groups, relapse prevention skills, and psychoeducational materials	Craving (Kozlowski & Wilkinson 1987) Negative-reinforcement Withdrawal Model (Wikler 1948) Mindfulness Therapy (Marlatt 2002; Bishop et al. 2004; Teasdale et al. 2000) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Witkiewitz et al. 2005; Marlatt & Gordon 1985)
	Vinci et al. (2014)	(1) Mindfulness + Negative Affect (NA*) Stimuli (2) Relaxation + NA Stimuli (3) Control + NA Stimuli (4) Mindfulness + Neutral Stimuli (5) Relaxation + Neutral Stimuli (6) Control + Neutral Stimuli *NA manipulation included provision of alcohol-related images intended to prompt craving	Negative Affect (Watson et al. 1988) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Brewer et a. 2009; Witkiewitz & Bowen 2010) Mindfulness Therapy (Marlatt 2002; Kabat-Zinn 1994; Baer 2003; Shapior 1982)
	Zgierska et al. (2009)	Vipassana Meditation Mindfulness-Based Stress Reduction Spiritual Self Schema Therapy Acceptance and Commitment Therapy Dialectical Behaviour Therapy	Mindfulness (Breslin 2002; Marlatt & Chawla 2007) Mindfulness-based Stress Reduction (Kabat-Zinn 1990) Meditation (Kutz 1985)
Auditory (music type)	Engels et al. 2011	(1) Music with lyrics referencing alcohol (2) Music without lyrics referencing alcohol	Arousal Hypothesis (Smith & Curnow 1966) Stereotype Activation (Bargh et al. 1996;

			Dijksterhuis et al. 2005)
Auditory (sound level)	Jacob 2006	(1) Cartoon music played for 30 min in bar (2) Top 40 music played for 30 min in bar (3) Drinking songs played for 30 min in bar	Arousal Hypothesis (Smith & Curnow 1966)
	Gueguen et al. 2008	(1) Sound level of 72 decibels in 2 bars (2) Sound level of 88 decibels in 2 bars	Arousal Hypothesis (Smith & Curnow 1966)
	Gueguen et al. 2004	(1) Rural bar and sound level of 72 decibels (1) Rural bar and sound level of 88 decibels (2) Urban bar and sound level of 75 decibels (2) Urban bar and sound level of 91 decibels	Arousal Hypothesis (Smith & Curnow 1966)
Digital advertising	Engels et al. 2009*	(1) Alcoholic movie with neutral and alcohol commercials (2) Alcoholic movie with neutral commercials (3) Non-alcoholic movie with neutral and alcohol commercials (4) Non-alcoholic movie with neutral commercials.	Situational Norms (Aarts and Dijksterhuis 2003) Modelling (Quigley and Collins 1999) Automaticity (Bargh & Chartrand 1999)
	Kohn & Smart 1984(a)	(1) Zero commercials during football match (2) Four commercials during football match (3) Nine commercials during football match	
	Sobell et al. 1986*	(1) Beer commercial + alcohol TV scenes (2) Beer commercial + no alcohol TV scenes (3) NA beverage com. + alcohol TV scenes (4) NA beverage com. + no alcohol TV scenes (5) Food commercial + alcohol TV scenes (6) Food commercial + no alcohol TV scenes	
Drink implements	Hollands et al. (2015)	(1) Larger-sized portion, package, individual unit or item of tableware (2) Smaller-sized portion, package, individual unit or item of tableware	Environmental influences (Das 2012; Marteau 2012; Neal 2006) Choice architecture interventions (Hollands 2013a; 2013b) Influence of size (Herman 2015; Steenhuis 2009; Pratt 2012; Wansink 2005; Scisco 2012) Social norms (Young 2002) Unit Bias (Geier 2006)
	Pechey et al. (2016)	(1) Standard 300 ml glass used in restaurant (2) Larger 370 ml glass replaced standard glass (3) Standard 300 ml glass used (4) Smaller 250 ml glass replace standard glass	Portion size (Benton 2015; English et al. 2015; Herman et al. 2015; Kerr et al. 2009) Volume perception (Walker et al. 2014; Raghubir & Krishna 1999) Choice architecture (Hollands et al. 2016) Unit Bias (Geier 2006)
	Wansink & van	(1) Pour spirit into short/wide glass	Mechanisms of Perception (Piaget 1969)

	Ittersum 2005	(2) Pour spirit into tall/narrow glass (3) Bartender pour spirit into short/wide glass (4) Bartender pour spirit into tall/narrow glass	
	Wansink & van Ittersum 2003	(1) Child + short/wide glass (2) Child + tall/narrow glass (3) Adult + short/wide glass (4) Adult + tall/narrow glass	N/A
Social norms	Hustad et al. (2014)	Path analysis in which personality variables (impulsivity, sensation seeking, hopelessness, and anxiety sensitivity) were modelled as distal determinants of alcohol outcomes, and perceived drinking norms (descriptive and injunctive) and the role of drinking were modelled as more proximal antecedents to alcohol use and alcohol-related problems	Personality traits (Maisto, Bishop, & Hart, 2012; Littlefield et al. 2009; Simons et al. 2005; Cyders et al. 2009; Woicik et al. 2009; DeMartini & Carey, 2011; Cox and Klinger 1988) Theory of Planned Behaviour (Ajzen 2011 Descriptive and injunctive norms (Cialdini et al. 1991; Borsari & Carey, 2003; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007) Perceptions (Osberg et al., 2010; Osberg et al. 2011; Osberg et al., 2012) Subjective norms (Fishbein & Ajzen 2010
	Lombardi (2010)	Experiment I: does subject drink more/less than average student? (1) High anchor at top of questionnaire: norm for students is to drink 19 standards drinks per week (2) Low anchor at top of questionnaire: norm is 1 drink per week (3) Control (questionnaire without norm statement) Experiment II: how many drinks does subject consume per week on average? (1) High anchor questionnaire: norm for students is to drink 16 standards drinks per week (2) Low anchor at top of questionnaire: norm is 4 drink per week (3) Control (questionnaire without norm statement) Experiment III: how many drinks does subject consume when they party? (1) Provision of poster indicating most university students drink 4 or fewer drinks when they party (3) Control (questionnaire without norm statement)	Social Norms (Perkins & Berkowitz 1986; Perkins 1997) Anchoring (Tversky & Kahneman 1974; Jacowitz & Kahneman 1995)
	Taylor et al. (2015)	(1) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + official guidelines for alcohol	Choice architecture (Thaler & Sunstein 2008)

		consumption (2) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + comparison of subject's alcohol consumption with official guidelines (3) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + comparison of subject's reported units per week with the mean number of units per week consumed by others of the same gender in the sample (4) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + comparison of subject's consumption in units per week ranked compared with others of the same gender in the sample	Rank-framing (Stewart et al. 2006; Vlaev et al. 2011) Social Norm Message (Moreiera et al. 2009; Walters & Neighbors 2005; Chan et al. 2007; Dimeff et al. 1999; Neighbors et al. 2004)
	Teunissen et al. (2012)	(1) Positive prototype condition: subject read a seemingly well-known popular science magazine article that describes drinkers as generally sociable, attractive, and successful (2) Negative prototype condition: subject read a seemingly well-known popular science magazine article that describes drinkers as generally unsociable, unattractive, and unsuccessful	Prototypes (Cantor and Mischel 1979; Niedenthal et al. 1985) Gender prototypes (Prentice and Miller 1993; Suls and Green 2003; Gibbons and Gerrard, 1995; Chassin et al. 1985) Social influence on drinking (Bot et al. 2007; Spijkerman et al. 2010) Experimental (Chassin et al. 1985; Spijkerman et al. 2004; Andrews et al., 2008; Blanton et al. 1997; Gerrard et al. 2002; Spijkerman et al. 2007; Gibbons and Gerrard 1995; Norman et al., 2007; Spijkerman et al. 2010; Spijkerman et al. 2010)
Attention modification	Schoenmakers (2010)	(1) Attention Modification Training: 5 tasks in which subject classified a target image as alcohol- or non-alcohol-related and in which picture pairs represented alcoholic and 'probe' pictures (2) Control: 5 tasks in which subject classified a target image as alcohol- or non-alcohol-related and in which picture pairs represented alcoholic and 'neutral' pictures	Attentional Bias (Field 2005; Franken 2003; Robinson & Berridge 1993; Weinstein & Cox 2006) Incentive Sensitisation Theory (Robinson & Berridge 1993, 2001)
	Schoenmakers (2007)	(1) Attention Modification Training: subject classified 60 target images as alcohol- or non-alcohol-related, and in which picture pairs represented alcoholic and 'probe' pictures (2) Control: subject classified 60 target images as alcohol- or non-alcohol-related, and in which picture pairs represented alcoholic and 'neutral' pictures	Attentional Bias (Franken 2003; Robinson & Berridge 1993; Weinstein & Cox 2006; Cox et al. 2006) Incentive Sensitisation Theory (Robinson & Berridge 1993, 2001)
Self-control	Leeman et al. (2013)	(1) Subjects informed that for each of the 4 psychomotor tasks they did not perform comparably with initial screening, they would	Impaired Control (Heather et al. 1993; Kahler et al. 1995)

		draw from a hat for a possible pay reduction ($0, $6, $12) for potential loss up to $48. (2) No payment reduction	Self-Control
	Otten et al. (2014)	(1) Depletion task + self-tracking task (2) Depletion task + no self-tracking task (3) No depletion task + self-tracking task (4) No depletion task + no self-tracking	Self-Control (Baumeister et al. 1994; Ego Depletion (Muraven et al. 1998; Baumeister et al. 1998) Self-Regulation (Muraven & Baumeister 2000; Bagozzi & Edwards 1982; Carver & Scheier 1981; Baumeister et al. 2007) Self-Control Strength Model (Muraven et al. 2002)
	Vinson (2000)	(1) Brief intervention + contract options + print, sign, review with physician (2) Brief intervention	Adherence (Putnam et al. 1994; Ossip-Klein et al. 1984; Swain & Steckel 1981)
Natural drink setting	Moss et al. (2015)	(1) Natural bar setting (2) Laboratory setting (3) Responsible Drinking Message poster (4) Control poster (5) Online priming + RDM poster (6) No online priming + control poster (7) RDM poster + subject verbalisation of message (8) Control poster + no verbalisation of message	Attentional Preferences (Schoenmakers & Wiers 2009)
	Wigmore & Hinson (1991)	(1) Told alcohol + given alcohol + lab setting (2) Told alcohol + given no alcohol + lab setting (3) Told no alcohol + given alcohol + lab setting (4) Told no alcohol + given no alcohol + lab (5) Told alcohol + given alcohol + nat. bar setting (6) Told alcohol + given no alcohol + nat. bar (7) Told no alcohol + given alcohol + nat. bar (8) Told no alcohol + given no alcohol + nat. bar	Social Learning Theory (Bandura 1977; Collins et al. 1985; Garlington & Dericco 1977; Hendricks et al. 1978) Expectancy Theory (Marlatt & Rohsenow 1980; Southwick et al. 1981; Vuchinich 1978)
Other (Delay discounting)	Bickel et al. (2014)	Person-level factors: delay discounting Environmental factors: availability of alternative reinforcement cues Repair of reinforce pathologies: constrain unhealthy choices	Reinforcer Pathology (Bickel et al. 2011) Discounting (Mazur 1987; Rachlin et al. 1991; Jones & Rachlin 2006) Delay discounting (Chung & Herrnstein 1967; Herrnstein 1961; Baum & Rachlin 1969)
Other (Print advertising)	Kohn & Smart 1984(b)	(1) No advertisement (2) Flyer (3) Tombstone hand sheet	N/A

Other (Personalised feedback)	Murphy et al. (2012)*	(1) Brief Alcohol Intervention + Substance-Free Activity Session (50-min individual counselling session designed to increase the salience of the student's academic and career goals, draw attention to the potentially negative relationship between substance use and goal accomplishment and increase engagement in substance-free alternative activities) (2) Brief Alcohol Intervention + Relaxation Training control (30-min session involving diaphragmatic breathing exercise followed by a progressive muscle relaxation protocol)	Motivational Interviewing (Miller & Rollnick, 2002) Substance-free Reinforcement (Carroll et al. 2009; Higgins et al. 2004 Delayed Reward Discounting (Madden & Bickel, 2010; Vuchinich & Simpson, 1998; Murphy et al. 2006)
Other (Alcohol product placement)	Nakamura et al. (2015)	Shelf space, price, price promotion and weekly sales volume in 3 alcohol categories (beer, wine, spirits) and 3 non-alcohol categories (carbonated drinks, coffee, tea)	Product placement (Chevalier 1975; Curhan 1974; Frank & Massy 1970; Klein & Wright 2007; Park et al. 1989; Sorenson 2008; Wilkie et al. 2002; Wilkinson et al. 1982)
Other (Advertisement media ban)	Siegfried et al. (2014)	Restriction or banning of alcohol advertising to reduce the consumption of alcohol and raise the age of initiation of drinking	N/A
Other (Pyscho-educational)	Varvil-Weld et al. (2014)	(1) Pre-college matriculation parent-based intervention (PBI) handbook, parent survey, and informed consent form (2) Pre-college matriculation PBI handbook, parent survey, and informed consent form + booster (3) Post-college matriculation PBI handbook, parent survey, and informed consent form (4) Parent survey and informed consent form	Parent-Based Intervention (Cleveland et al. 2012; Testa et al. 2010; Turrisi et al. 2009; Wood et al. 2010) Parent Typing (Abar 2012; Varvil-Weld)

These stages include exposure to alcohol-related cues, social comparisons made by an individual to a group of people (such as a group of friends who are drinking), and propositional reasoning—a reflective decision-making process into which conscious and unconscious factors are channelled to produce an outcome behaviour.

In the interest of clarity, the pathway is exhibited here as linear and stochastic but naturally the decision-making that determines alcohol consumption tends to incorporate feedback mechanisms and dynamism. For example, even after consumption begins an individual may be persuaded to drink more or less than they originally anticipated as a reflection of, for example, changes in the presentation of alcohol-related cues or social comparisons. Not to mention, of course, the biochemical influence of alcohol itself on an individual's physiological and mental conditions. The reviewer generated a CMO configuration for each of these 6 stages leading to an outcome behaviour of interest.

3.3.1 CMO configuration for self-recognition of problem

For harmful drinkers, the initial step is self-recognition of problematic behaviour stemming from alcohol consumption. Contextual factors such as social environment and self-esteem may interact through the mechanism of an individual's self-comparison with others that lead them to realise they, for example, drink more than other people—thereby exhibiting harmful drinking (see Figure 6.3). Or an individual's high degree of self-confidence may lead them to refuse to believe they have a problem drinking, particularly as they consider the behaviour of others around them. Alternatively, an individual may be shielded from self-diagnosing a problem given a low level of

health literacy linked to the individual's educational status and ignorance about how their physiological wellbeing is affected by regular alcohol consumption. In addition, the status of an individual's physiological condition and iterative harmful drinking episodes may cause them to reconsider their evaluation of their satisfaction with drinking—thus leading to realisation of a problem.

Table 6.3 *CMO configuration for self-recognition*

Context	**Mechanism**	**Outcome**
Social environment Self-esteem Educational background Health impacts Troubling experience(s)	Self-comparison Denial Health literacy Judgment of ongoing experiences	Self-recognition

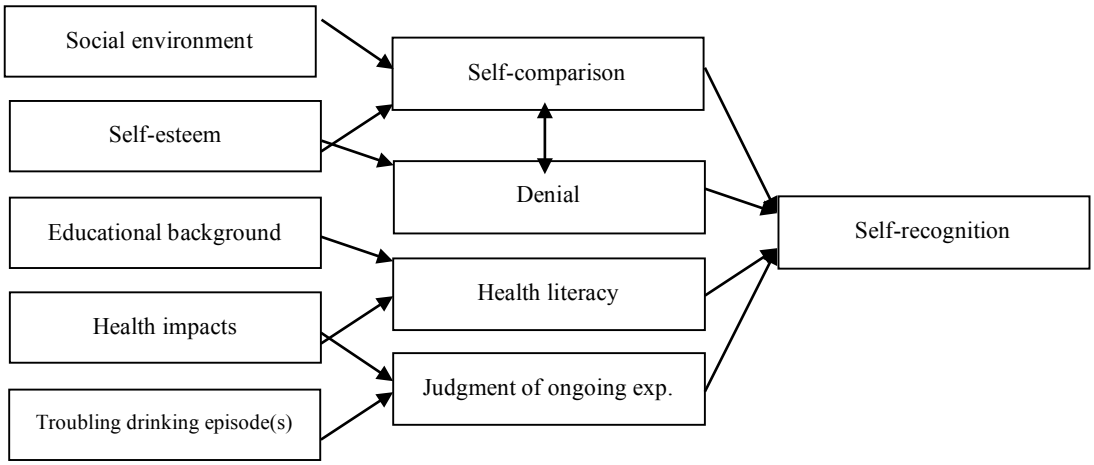


Figure 6.3 *CMO configuration for self-recognition*

In an effort to aid self-recognition of harmful drinking, mailed personalised feedback represents one type of multi-component CA intervention that is thought to offer similar benefits to individuals as in-person individualised feedback (e.g. in a brief intervention). Yet the intervention delivery is thought to cost less per-person and potentially access more intervention-

eligible individuals. Five included studies (Batel et al. 1995; Cunningham et al. 2012; Freyer-Adam et al. 2014; Larimer et al. 2007; Neighbors et al. 2010) investigated the effects of CA interventions incorporating personalised feedback on alcohol consumption.

The Transtheoretical Model of Intentional Behaviour Change (Prochaska & DiClemente 1983) helps to explain the interaction of the contexts of educational background and health impacts with the mechanism of health literacy in 5 included studies (Cunningham et al. 2012; Freyer-Adam et al. 2014; Batel et al. 1995; Larimer et al. 2007; Neighbors et al. 2010). At its heart, the popular Model attempts to locate an intended behaviour change precisely within the relevant activity stage of a behaviour. Notably, the Model distinguishes pre-contemplation and contemplation stages before offering 4 additional steps for possible intervention: preparation, action, maintenance, and termination.

Because the Transtheoretical Model is a stage-managed intervention programme, it is perhaps ideally suited for helping to identify the personal needs of a harmful drinker and address them using the appropriate intervention components (e.g. first identifying there is a need to consume less alcohol). Freyer-Adam et al. 2014 tested the effects of a personalised feedback letter that solicited self-report data based on an individual's readiness to change, self-efficacy, and assessed stage of change. In line with the Transtheoretical Model, this data was used to generate a personalised feedback letter that was stage-tailored to the individual's need. Notably, the text of each letter was conditional on the stage of change suggested for each individual, and participants were referred to a stage-tailored manual for additional suggestions and exercises. Data resulting from that assessment were used to inform feedback sent back to individuals (Ajzen 2006), who

were also referred to additional resources.

The Transthereotical Model is adept in identifying when an individual is at the stage of needing to realise their alcohol consumption has physical and social impacts. CA interventions incorporating personalised feedback may help to elicit this realisation by comparing an individual's consumption level with the average person. It thus helps to explain the results observed in Batel et al. (1995) and Larimer et al. (2007). Batel et al. (1995) tested the effects of a personalised feedback letter on alcohol consumption among patients who exhibit signs of drunkenness and alcohol abuse at an emergency unit. Many such individuals typically do not request treatment for alcohol disorder and are only accessible to primary care professionals for a relatively short period of time. In response to this perceived need, Batel and colleagues designed this study to examine the effects of a referral personalised letter sent to individuals screened for alcoholism at an emergency unit. The letter was sent no more than 2 days after the participant's release from the emergency unit. It reminded participants that on the basis of their blood alcohol content and medical examination, they were eligible for a free visit to a treatment clinic (the contact information of which was provided).

Larimer et al. (2007) tested the effects of a printed personalised feedback letter sent to college students and intended to moderate alcohol consumption on campuses. Larimer and colleagues hypothesised that women and heavy drinkers would exhibit reduced consumption as compared to men and light-to-moderate drinkers, respectively. Participants were recruited through random assignment at a medium-sized, 4-year US college and received a plea to take part in an Internet survey. That data was integrated into a system which provided personalised feedback that was

then printed and posted to each participant in the experimental condition. Over the course of the subsequent 14 days, the first of 10 postcards were sent to all participants, and the intent of the postcard was to provide additional information about alcohol, alcohol abuse, and various consumption strategies adopted by light-to-moderate drinkers. Participants received a series of personalised feedback postcards that noted their alcohol consumption patterns, percentile rank in relation to the student average at that university, and forecasted blood alcohol content level at peak consumption points. The last of these was accompanied by information about the physical and social impacts of alcohol at different blood alcohol content levels. In line with perceived student drinking norms solicited by the baseline survey, participants were notified about actual alcohol consumption patterns and levels across the university.

The mechanism of self-comparison was related with the contexts of social environment and self-esteem. These interactions are modelled to varying degrees by three closely related candidate theories—Social Comparison (Festinger 1954), Social Identity (Tajfel 1982), and Self-Categorisation (Turner et al. 1987)—which were tested by Neighbors et al. (2010) in an Internet-based intervention that incorporated social norms surrounding college drinking among students. Notably, while these middle-range theories cannot account for the actualisation of contextual factors and mechanisms in other Internet-based interventions included in this CMO configuration, they are incorporated into other alcohol-related CA interventions (discussed later). For now, suffice to say that Neighbors et al. (2010) found that an Internet-based CA intervention helped to correct misconceptions among college students who routinely overestimate 1) how many of their peers drink alcohol and 2) how much their peers drink (Carey et al. 2006; Lewis & Neighbors 2007).

Neighbors et al. sought to investigate the application of Personalised Normative Feedback (PNF), an intervention that aims to improve understanding about alcohol consumption among youth and employ social norms to moderate drink habits. Together, Social Comparison (Festinger 1954), Social Identity (Tajfel 1982), and Self-Categorisation (Turner et al. 1987) are manifested in the Personalised Normative Feedback to explain how an individual orients themself in relation to 'normative referents' in choosing to engage in alcohol consumption. In this vein, the authors also investigated the influence of at least one kind of 'normative referents'—same-sex referents—given that past research has found that an individual's personal drink habits (overall consumption and frequency) appear to be affected in part by referents that identify as the same-sex as the individual (Lewis & Neighbors 2007).

The Internet-based Personalised Normative Feedback treatment combined soliciting of data with presentation of peer group data. First, the online system solicited data about an individual's previous history of alcohol consumption perceptions of their peers drinking habits and history. Second, in contrast with individual's perceptions, it presented the actual self-reported behaviour of student peers. Three graphs were presented to participants: 1) a graph representing the campus group weekly mean of frequency and consumption amount, 2) a graph representing the weekly mean perception of frequency and consumption amount among students, and 3) a graph representing each individual's own weekly mean of frequency and consumption amount. In general, the authors found that students overestimated the prevalence and degree of alcohol consumption among college students, and male students most of all.

3.3.2 CMO configuration for finding aid

After individuals realise they engage in harmful drinking, they may then seek help. The interaction of an individual's access to the Internet or a mobile phone and obstacles getting to regular treatment may—through the mediation of convenience—affect how they prepare (see Figure 6.4). Namely, they may engage in online counselling and support fora in aid of their ongoing treatment. Moreover, seeking aid could result from a feeling of empowerment that comes in part from an access to mobile-phone SMS text messaging. For example, an individual could receive regular SMS-text messages (e.g. from family members) reminding them what are the stakes of their treatment. In addition, an individual's lifestyle habits could come into contact with a mechanism of expectancy, producing varying levels of treatment maintenance. Moreover, the person delivering the intervention (i.e. messenger) to an individual could interact with the individual's preconceived notion of accountability to the messenger, determining how much they prepare for craving management. For example, a college student who receives an intervention from a parent may feel a greater sense of responsibility not to drink, or to drink in moderation.

Table 6.4 *CMO configuration for preparation*

Context	**Mechanism**	**Outcome**
Internet access SMS access Distance to clinic Lifestyle habits Messenger	Convenience Participant empowerment Expected benefit Accountability	Preparation

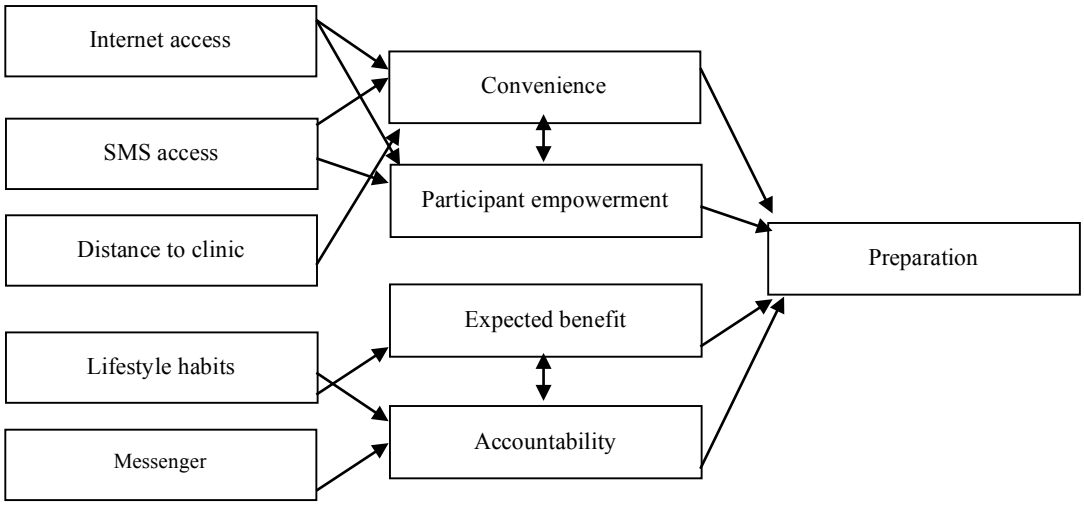


Figure 6.4 *CMO configuration for preparation*

The contexts of Internet access and distance to a treatment facility interact via the mechanism of convenience to help determine intervention uptake. As an intervention strategy to offer counselling—among other services—Internet-based interventions are frequently targeted to populations that may be considered to be 'hidden' yet suffer from mild alcohol-related problems (Blankers et al. 2008; Cunningham et al. 2009; Postel et al. 2005; Riper et al. 2008). Such interventions are thought to enable individuals to access medical support in a secure setting at relatively low economic cost (Blankers et al. 2011). Two studies represented review-level evidence on Internet-based interventions (Cunningham et al. 2014; Portnoy et al. 2008). In addition, 8 included studies investigated aspects of specific Internet-based CA interventions (Blankers et al. 2011; Blankers et al. 2013; Cunningham et al. 2014; Finfgeld-Connett et al. 2009; Neighbors et al. 2010; Riper et al. 2007; van Deursen et al. 2013; and Wallace et al. 2011). Of these, 5 of the 8 included Internet-based studies incorporated some aspect of brief alcohol interventions delivered over the Internet (Blankers et al. 2013; Blankers et al. 2011; Cunningham et al. 2014; Riper et al. 2007; and Wallace et al. 2011).

As discussed in chapter 3, brief interventions incorporate both cognitive-behavioural therapy (such as Bandura's Theory of Self Efficacy [1977]) and motivational interviewing (Miller & Rollnick 1991) to drive conscious goal-planning in reducing one's alcohol intake. As incorporated in Internet-based therapy, such an intervention typically involves individualised feedback delivered by a therapist in either a synchronous or asynchronous delivery system. Through a synchronous system, one-on-one therapy sessions are delivered in real time through, for example, text-based messaging. Through an asynchronous system, treatment is delivered through a non-automatic messaging service (much like email). In the treatment conducted by Blankers et al. (2011), for example, the intervention was delivered in up to 7 synchronous text-based-chat therapy sessions of 40-minute duration. Participants were expected to complete assignments before each therapy session, given that each of the 7 sessions was dedicated to a different them. They included: 1) a general introduction to Internet-based therapy, 2) cost-benefit analysis of alcohol use and personal consumption goal setting, 3) self-control training, 4) skills in recognizing 'risky' drink environments, 5) introduction to craving and affective states that lead to alcohol consumption, 6) craving and relapse management, and 7) review of all topics.

For hard-to-reach populations, the contexts of Internet access and distance to clinic interact via the mechanism of convenience help predict intervention uptake (Finfgeld-Connett et al. 2009; Riper et al. 2007). One included paper (Finfgeld-Connett et al. 2009) targeted an Internet-based intervention to U.S. women in rural areas exhibiting alcohol misuse problems. The authors note that approximately 19 percent of American women have engaged in alcohol abuse at some point in their lives (Hasin et al. 2007). Yet the Internet as a mode of delivery offers substantial access to women in hard-to-reach places, including those who live in rural areas (Koski-Jannes et al.

2007). Notably, the online self-help treatment intervention tested by the authors also featured components incorporating the Harm Reduction Model (Marlatt 1998) and Transtheoretical Model of Change (DiClemente 2003). Through the synchronous Internet forum, the research coordinator offered positive reinforcement (to encourage and celebrate a participant's progress), encouragement (to suggest reference materials and additional consumption goals), reflection (to encourage self-monitoring), and probes (to prompt a participant to think about their future consumption in hypothetical environments).

Similar to Finfgeld-Connett et al. (2009), a second included paper (Riper et al. 2007) targeted an Internet-based intervention to individuals identified as harmful drinkers in emergency units. The authors note that individuals screened for alcohol misuse who appear in emergency units may represent a 'hidden' population for whom traditional brief alcohol interventions are inaccessible—either because their stay in the emergency unit is too brief or because they are not recognised by primary care professionals as alcohol abusers (Cunningham & Breslin 2004; Andrews et al. 2004). Again, the intervention incorporates elements from cognitive-behavioural therapy and self-control principles (Hester et al. 1995; Sobell & Sobell 1993).

Similar to the demi-regularity mentioned above, the interaction of contextual factors such as mobile messaging access and distance to clinic also help to drive participant engagement in maintaining behaviour change. SMS text-message-based interventions are thought to access a wide range of populations afflicted with mild alcohol-related difficulties in a low-cost manner in 3 included studies (Agyapong et al. 2015; Litvin et al. 2013; McTavish et al. 2012). Such interventions are intended in part to offer timely information about the effects of alcohol and to

prompt participants to think about their goals regarding their consumption levels. Drawing again on motivational principles thought to increase self-efficacy, Agyapong et al. (2015) describes an intervention in which participants received twice-daily text messages designed to improve their affective state and encourage uptake of additional prescribed treatment for alcohol, such as medication or abstinence, for 3 months. Participants had been recruited from addiction counselling sessions in which cognitive-behavioural therapy had been practiced, and the text messages were drafted to reflect lessons learned in those sessions. For example, one message noted, "If you keep on going, maintaining your hope and belief that something good will happen, it generally does. One day at a time" (Agyapong et al. 2015, 4).

The Theory of Self-Efficacy and Motivational Interviewing were actualised in McTavish et al. (2012), which tested a text-message-based intervention drawing on the Cognitive Behavioural Relapse Prevention model (CBRP; Marlatt & George 1984). CBRP indicates that proximal and distal factors can lead to relapse. Proximal factors include components, such as alcohol paraphernalia, in high-risk environments that prompt alcohol craving, depleted self-efficacy, and a compromised coping strategy. Distal factors include imbalances in an individual's personal habits and living space. To counterbalance the effects of factors contributing to relapse, the model details strategies to address each of these factors, such as identifying and avoiding high-risk environments in advance as well as designing lifestyle habits and a living space that have not been previously associated with alcohol cravings.

To test the effects of this model delivered via a text-based CA intervention, McTavish et al. (2012) reports that for a period of 8 months problem drinkers enrolled in an aftercare program

were given a smartphone that included a system (Alcohol-Comprehensive Health Enhancement Support System, or A-CHESS) designed to mitigate the possibility of relapse. A-CHESS services included text messaging and video, Internet surfing, GPS, and voice recognition and calling. Of greatest note, alcohol users could record their daily alcohol consumption and interact with training modules designed to prevent relapse. In doing so, A-CHESS offered participants resources to manage craving and withdrawal symptoms, access to counselling and social support by fellow participants, and planning materials to set goals for themselves. Data was automatically transferred to each participant's case manager and referred to log entries, A-CHESS services used, access to and duration of Internet webpages, and whether or not participants sent or received SMS texts.

The mechanism of expected benefit interacts with the contextual factor of lifestyle habits in 2 CA interventions in alcohol use incorporating behavioural economics (Bickel et al. 2014; Murphy et al. 2012). First, Bickel et al. (2014) offers a literature review on the theoretical contribution of reinforcer pathology to help explain certain behavioural patterns within substance use disorders. Reinforcer pathology denotes an individual's premium valuation of some object or behaviour combined with a persistent desire to enjoy that object or behaviour over and against potential costs. The authors explain how reinforcement is at least partly the product of the interaction between an individual's belief and affective state with micro-environmental stimuli. In this way, the authors offer a model of behaviour that may explain at least a subset of substance use behaviours, including alcohol consumption.

Second, Murphy et al. (2012) test the effects of an enhanced brief alcohol intervention on alcohol consumption. The authors sought to improve the efficacy of brief interventions by incorporating insights from behavioural economic literature, using in particular the idea of delayed reward discounting (Madden & Bickel 2010; Vuchinich & Simpson 1998). For young people, such a strategy involves highlighting the long-term benefits that come from substance-free activities (e.g. attending work or classes) in such a way as to limit the discounted value many substance abusers place on future happiness relative to present happiness (e.g. consuming alcohol). The authors designed an enhanced brief intervention with a substance-free activity motivational interviewing session and tested its efficacy compared to that of a control brief alcohol intervention treatment on alcohol consumption among harmful student drinkers. The enhanced brief intervention included a motivational interview session as well as a 50-minute personalised feedback session that occurred 1 week later. Feedback included discussion of the student's academic and career goals as well as the ways that alcohol abuse may interfere with achieving those outcomes.

Contextual factors such as messenger and lifestyle habit combine with the mechanism of accountability to drive counselling in 1 trial (Varvil-Weld et al. 2014). Namely, the authors examine the effects of variable timing and dosage of a parent-based intervention on alcohol consumption of their children during their first year at college. The intervention included a handbook designed to educate parents about the effects of alcohol and rates of alcohol consumption across college campuses, as well as suggest tips to parents in discussing alcohol with their children. The authors sought to manipulate the timing and dosage of the intervention, choosing separate times (starting the summer before the child's first year at college and running

through their first semester) to deliver the handbook in 4 experimental arms. Overall, parents were asked to read and discuss the handbook with their children. Results indicated that high-risk students reported the greatest effect in lower alcohol consumption.

3.3.3 CMO configuration for craving management

After individuals have sought help, over the course of counselling they may be told to prepare themselves for managing cravings and preventing relapse. Contextual factors such as craving, self-esteem, and individual resource endowment may interact in forming an expectation about the kind of benefits that would accrue to mastering alcohol cravings (see Figure 6.5). Moreover, craving management may stem from an individual's inherent biological predilection for alcohol craving along with specific training designed to treat that training with dispassion. For example, as discussed below, individuals who receive mindfulness training are taught to engage their craving in a calm, agnostic manner that neither denies nor gives into the prompting.

Table 6.5 *CMO configuration for craving management*

Context	**Mechanism**	**Outcome**
Self-esteem Resources Craving Training	Expected benefit Agnostic attention	Craving management

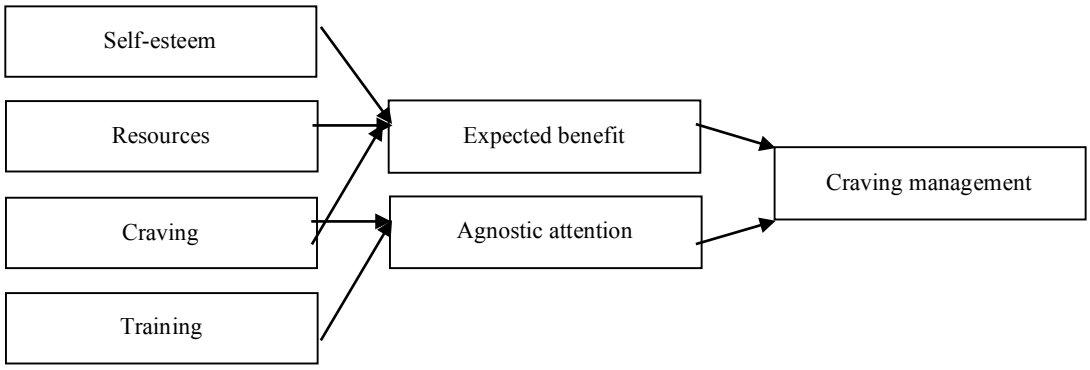


Figure 6.5 *CMO configuration for craving management*

The mechanism of agnostic attention (i.e. dispassionate focus on one's bodily experience) when combined with contextual factors such as craving for alcohol as well as training may generate an outcome of adherence to an alcohol-reduction plan. Six included studies reported CA interventions that incorporated mindfulness (Murphy & MacKillip 2014; Ostafin et al. 2012; Witkiewitz & Bowen 2010; Witkiewitz et al. 2013; Vinci et al. 2014; Zgierska et al. 2009). The mindfulness practice suggests that developing a calm, dispassionate disposition and intense focus on one's present experience helps to relieve stress and cravings, among other things (Kabat-Zinn 1994). Though rooted in Buddhist practice, the theory has been adopted by multiple cultures and even used as a therapeutic technique. And it is easy to understand why. From a mindfulness perspective, craving—such as craving for alcohol—represents a transient affective experience that an individual may calmly recognise in themselves and then intentionally disregard without negative reaction or judgement (Witkiewitz et al. 2013).

The inclusion of mindfulness practice into CA interventions designed to reduce alcohol consumption is intended in part to allow individuals experiencing alcohol craving to accept their physical and affective experience and move beyond it (Marlatt 2002). In this way, mindfulness

has been integrated with cognitive-behavioural therapy and relapse prevention strategies to enable individuals to adapt with alcohol triggers and cravings. Such a strategy has been called Mindfulness-Based Relapse Prevention (MBRP; Marlatt 2005) and it has been used as a treatment offered to heavy drinkers particularly after some other intervention (such as residential care) has been applied.

MBRP as well as other mindfulness interventions are reported in 5 included studies (Murphy & MacKillip 2014; Ostafin et al. 2012; Witkiewitz & Bowen 2010; Witkiewitz et al. 2013; Vinci et al. 2014). In these interventions, multiple mindfulness sessions tend to incorporate both mindfulness exercises as well as cognitive-behavioural exercises intended to identify and mitigate risky situations that may trigger relapse. Earlier sessions are focused on bringing the awareness of individuals to their real-time experiences, including physical and affective reactions to situational stimuli. Individuals are then trained to focus their attention on isolated environmental stimuli as well as their reactions to each one. After the first session, individuals are brought to the stage of eliciting and slowly managing their craving by concentrating fully on 1) the experience of craving but also on 2) the impermanence of that experience. Notably, individuals are not told to avoid or suppress their craving but rather to treat it—to the extent possible—with gentle indifference. Marlatt (2002) identifies the ability to objectively encounter craving without acting on it as ‘urge surfing’. In later sessions, individuals are trained to identify situations in which they are likely to feel intensive craving—as mediated by affective or social anxiety—and plan how they may avoid those situations, or, if that is not possible, how they may manage the high-risk environment. In sum, the goal of mindfulness is to enable individuals to consider their affective, cognitive, and physical experiences with dispassionate, disinterested

consideration.

Mindfulness is tested against the effects of craving and negative affect in 3 included studies (Witkiewitz & Bowen 2010; Witkiewitz et al. 2013; Vinci et al. 2014). The authors in each study report that the practice appears to hold up well in explaining relapse-prevention. First, in the context of craving, a harmful drinker's urge may grow in intensity over the long-term use of substances that provide temporary relief to, for example, depressive symptoms. To counteract that effect, Witkiewitz et al. (2013) notes that mindfulness enables individuals to bring their awareness to their alcohol craving and, over the course of repeat sessions, develop a mindfulness heuristic to interrupt their conditioned reaction to that craving. Second, as a construct, negative affect has been defined as the general experience of distress in engagement with one's environment, incorporating negative feelings such as anger, disgust, and fear (Watson et al. 1988). Theoretical evidence has attempted to integrate negative affect into sequelae of substance use, especially maintenance of use habits (Baker et al. 2004; Conger 1956; Cooper et al. 1995). Yet Vinci et al. (2014) report that a mindfulness-based CA intervention appeared to relieve negative affect among college students reporting substance use, including alcohol. The authors explain that mindfulness techniques could bring participants' attention to their affective and cognitive state and—among other things—lead participants to understand that their state is transient, and therefore substance use is unnecessary to satiate their craving.

In contrast, craving management may stem from the mechanism of expected benefit interacting with contextual factors such as resources and self-esteem, as appears to be the case in 2 included studies (Schoenmakers et al. 2010; Schoenmakers et al. 2007). Both interventions tested the

effects of attentional bias modification (ABM) training on alcohol consumption. Moreover, the Internet-based CA intervention reported in van Deursen et al. (2013) incorporated ABM as well. ABM assumes in part that individual perception is skewed by what mental or physical stimuli appear to be the most salient—thus, capturing and holding an individual's attention. In the context of alcohol craving, ABM may lead an individual to focus on their craving for alcohol to the neglect of other factors, such as a pre-conceived plan to avoid high-risk situations in which alcohol-related cues may prompt an individual to drink. More to the point, the relationship between attentional bias and craving is thought to be mediated through an incentive sensitisation model, whereby the iterative direct associations of alcohol-related environmental stimuli and consumption effects lead an individual to unconsciously develop a sensitised response to alcohol (Robinson & Berridge 1993).

Schoenmakers et al. (2010; 2007) make use of the computerised ABM training task used by van Deursen et al. (2013) above, whereby participants are trained to ignore or push away alcohol cues (such as images of alcoholic beverages) in favour of non-alcoholic cues. Namely, the training program is designed to draw the attention of an individual away from an image of an alcoholic beverage and towards the image of a non-alcoholic beverage using a variety of methods. The authors hypothesised that the effect of alcohol bias modification training on craving would be increased via an increased amount of both alcoholic and non-alcoholic stimuli as well as an increased number of training sessions.

ABM appears to help explain the effects of both trials (Schoenmakers 2007; Schoenmakers et al. 2010) included in this review. The authors report in both trials that the effect of ABM

disassociating from alcohol cues could be increased through personalised feedback, the provision of new stimuli, and an increased number of treatment sessions. Even more notably, Schoenmakers et al. (2007) took the additional step of priming participants by asking participants to drink a sip of beer before completing the training programme. It was thought that the subsequent craving response among heavy drinkers would be especially pronounced. Results indicated that participants who had received ABM training grew to ignore alcohol stimuli in favour of non-alcoholic stimuli and consumed less alcohol after treatment as compared to individuals in the control arm.

While it satisfactorily explains these results, ABM appears to be of limited applicability in explaining or predicting demi-regularities observed in other included papers. In short, the experimental contexts in which ABM was manifested in these experiments are so contrived—involving laboratory-controlled computerised tasks—that one would be hard-pressed to use it in explaining how other interventions identified as following the overall CA programme logic (entailing dual-process models of behaviour) work and under what conditions.

3.3.4 CMO configuration for cue exposure

For all drinkers, serious consideration of the decision to imbibe alcohol usually comes in response to an external cue. Identified documents in this review indicated that a range of environmental stimuli—including lighting, sound level, music type, advertising, and drinking implements—impacts the spectrum of alcohol-related cues that prompt a decision to drink. These external contextual factors may interact via a relevant perceptual process (e.g. unconsciously

noting the lighting level in a public drink space) in determining the palate of conscious and unconscious cues that prime drinking behaviour (see Figure 6.6). Moreover, many alcohol-related outcomes are mediated via social engagement, which can interact with such cues as alcohol-related paraphernalia, music sound level, and lighting level to prompt more or less drinking.

Table 6.6 *CMO configuration for cue exposure*

Context	**Mechanism**	**Outcome**
Alcohol-related paraphernalia Background music Lighting level Advertisements Drinking implements	Self-comparison Social engagement Engagement with relevant perceptual process	Cue exposure

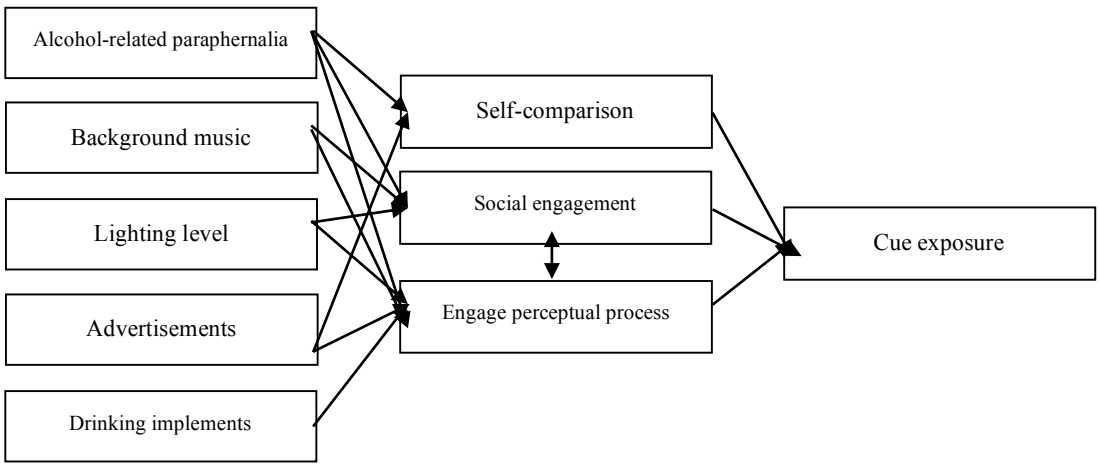


Figure 6.6 *CMO configuration for cue exposure*

Cue exposure depends in part on the immediate drink environment. Contextual cues such as alcohol-related paraphernalia, music, lighting, advertisements, and drinking implements may all interact with perceptual processes to prompt drinking behaviour given an individual's perception of being in a dedicated drink environment. This appears to be the case for 2 included studies

testing the effects of setting on consumption (Wigmore & Hinson 1991; Moss et al. 2015). In both cases, the authors draw on evidence regarding the importance of ecological validity for cuing alcohol craving and drinking behaviour. In doing so, they argue that settings, such as laboratories, in which it does not appear that alcohol is regularly consumed may unconsciously turn individuals off from drinking as much alcohol as they would if they were in a natural bar setting (Schoenmakers & Wiers 2009). Notably, the results of the balanced placebo design reported in Wigmore & Hinson (1991) suggest that participants directed to drink *ad libitum* in a natural bar setting consumed more of both alcoholic and non-alcoholic beverages in comparison to those consuming beverages in a laboratory setting.

It is perhaps a little strange that there is no candidate theory included in this review that appears to explain the results reported above. It could be the case that 'natural drink setting' encompasses such a wide variety of social or physical stimuli that no middle-range theory would attempt to explain or predict all demi-regularities observed there. Certainly, a theory attempting to do so would struggle to meet quality standards of coherency and consistency given the vast amount of observed phenomena relating to consumption it would have to encompass and organise. Naturally, however, although this review did not identify a candidate theory that was able to explain CA interventions into alcohol consumption that incorporate natural drink settings, it perhaps remains the focus of future research to identify and investigate such a theory.

A similar CMO configuration is at work in Nakamura et al. (2014), in which alcohol-related paraphernalia interacts with a psychological process of perception to cue purchase behaviour. The authors consider the effects of altering end-of-aisle store displays of alcohol on alcohol

purchases in a UK grocery store. Nakamura and colleagues focused on altering the placement of alcohol products after controlling for a range of product characteristics, including price, price promotion, and number of display locations. Notably, the end-of-aisle displays were placed in two adjoining aisles separated only by a thoroughfare down the centre of the store. Treatment products included 3 alcoholic beverages (beer, wine, spirits), and they were compared to 3 control non-alcoholic products (carbonated drink, coffee, and tea). Regression results indicated that sales volume of each of the 3 alcoholic beverages and 3 non-alcoholic beverages increased when those products were marketed in end-of-aisle display locations.

In contrast, the specific contextual factors of background music interact with the mechanisms of social engagement and perception in generating some consumption outcome in 4 included studies (Gueguen et al. 2004; Gueguen et al. 2008; Jacob 2006; Engels et al. 2011). These interventions test the effects of CA interventions that manipulate auditory stimuli. Of these, 2 studies reported effects of altering music type (Engels et al. 2011; Jacob 2006) and 2 studies reported effects of altering sound level (Gueguen et al. 2004; Gueguen et al. 2008).

The Arousal Hypothesis (Smith & Curnow 1966) is cited by 3 of these papers as a middle-range theory to explain why increased sound level, or variation in music type, appears to lead individuals to drink more (Gueguen et al. 2004; Gueguen et al. 2008; Jacob 2006). Namely, research has shown that music styles or structural components of the music (e.g. sound level, tempo) affect consumers' behaviour by increasing their sensitivity to physical stimuli (i.e. arousal). Two included observational studies (Gueguen et al. 2004; Gueguen et al. 2008) tested the effects of altering sound level in a natural setting. Study results indicated that high sound

level did indeed lead subjects to order more alcohol and drink more quickly as compared to control conditions in both studies, in which music was played a lower volume. The authors speculated that higher sound levels serve primarily as a source of distraction from—or an impediment to—social interactions, thereby prompting subjects to focus more of their attention on their alcohol consumption. Both included studies also note that an important aspect of the structural components of music that has been studied less with respect to customers' behaviour is the tempo. Similar to sound level, it is thought that tempo similarly increases arousal, as expressed in the enhancement of their behavioural response toward the stimulus.

The Arousal Hypothesis also suggests that along with sound level, tempo, and other structural components of music, sound type (such as musical genre) can serve to increase an individual's responsiveness to their surroundings (e.g. heart rate). The theory appears to help explain the results of one other included study—Jacob (2006)—which examined how changing music type would affect alcohol consumption in a public drink setting. Jacob observed participants at a pub over the course of 2 evenings during which time a 'Top 40' popular music playlist was alternated with a Cartoon Music playlist. In line with her hypothesis, the author noted that more alcohol was consumed when Top 40 music was played and attributed the effect to priming, for similar reasons mentioned by Engels et al. (2011). In particular, Jacob speculated that popular Top 40 music could induce feelings connoted with conviviality and festivity in comparison to Cartoon Music, and thus subjects may feel more comfortable consuming alcohol. The author also noted that subject dyads (the unit of study) tended to spend more time in the bar when Top 40 music was being played as compared to when Cartoon Music was being played.

On the other hand, the Arousal Hypothesis does not help to explain the results of Engels et al. (2011), which investigated whether listening to music that contained references to alcohol prompted increased level of alcohol intake among consumers in public drink settings in The Netherlands. The researchers created 2 curated 2-hour playlists to be alternately played at 3 pubs. Songs selected for each playlist were selected if they shared musical characteristics, including tempo and sound volume—the primary difference between the two playlists was that one playlist contained alcohol references and the other did not. The authors found that subjects who listened to the playlist of songs referencing alcohol consumed more alcohol as compared to those listening to the other playlist.

Notably, this effect may be attributed to a different candidate theory: Stereotype Activation (Bargh et al 1996; Dijksterhuis et al. 2005). As actualised through the mechanism of priming, stereotypes associated with alcohol consumption appeared to be activated among participants consciously or unconsciously listening to music containing alcohol references (Bargh et al 1996; Dijksterhuis et al. 2005). On balance, though, the authors acknowledge that specificity among alcohol references varied. Some songs referencing only ‘drinks’ may have had less of a priming effect than songs referencing, for example, brands of alcohol, but the experiment was not set up in such a way to investigate this possible heterogeneity even within one playlist.

The mechanisms of perception process and self-comparison interact with the contextual factor of advertisements in driving cue exposure as well in 4 included studies (Engels et al. 2009; Kohn & Smart 1984a; Kohn & Smart 1984b; and Sobell et al. 1986). In general, the relationship between alcohol consumption and advertising of alcohol is thought to be well-established (Anderson et al.

2009). Notably, as reported by this review, three included studies (Engels et al. 2009; Kohn & Smart 1984; Sobell et al. 1986) examined the effects of CA interventions incorporating television programming incorporating alcohol references on alcohol consumption.

Three closely related candidate theories—Situational Norms (Aarts & Dijksterhuis 2003; Everett et al. 1998), Modelling (Quigley & Collins 1999), and the Chameleon Effect (Bargh & Chartrand 1999)—help to explain this demi-regularity in 1 included study (Engels et al. 2009). Broadly speaking, the theories suggest that alcohol-related cues—as well as portrayals of drinking—engender interest among individuals in alcohol consumption given a predicted positive social effect that consumption would produce. One of the included studies—Engels et al. (2009)—tests these 3 middle-range theories in comparing the effects on consumption of showing an alcohol-related movie to a treatment population and a non-alcohol-related movie to a control population. The Theory of Situational Norms suggests that positive television portrayals of alcohol use that show an attractive person drinking in an appealing social setting may lead a viewer to desire engaging in a similar social environment in a similar fashion. For example, in an advertisement, protagonists—to whom an audience can relate—ostentatiously 'relax' by drinking alcohol. With regard to Modelling, the theory suggests that in groups in which one or more members are consuming alcohol, an individual's drinking pace is influenced by the pace set by other individuals (Quigley and Collins 1999). The Chameleon Effect suggests that when an individual is seen to perform a particular behaviour (e.g. drink from a container containing alcohol), the cognitive portrayal of that behaviour is activated in an observer's mind as if they are engaging in that behaviour as well. For example, an individual observing an alcohol-related television

advertisement who observes the advertisement character take a drink understands that behaviour in part because they imagine they are about to take a drink themselves.

On the other hand, these 3 candidate theories do not appear to explain the ambiguous effects observed in Kohn & Smart (1984a), Kohn & Smart (1984b), nor Sobell et al. (1986), which similarly report the effects of observational studies of advertising on subsequent consumption. Kohn & Smart (1984a) conducted an observational trial in which 2 groups of college male students were showed a football match with alcohol-related commercials and the same match in which alcohol-related commercials were absent. In the first experimental condition, immediate access to beer and other refreshments was understood to be part of the viewing experience (as compared to delayed-access in the second experimental condition). The authors hypothesised that assignment to the first experimental condition would be predictive of alcohol consumption levels, and though they found a moderate effect, the result was not statistically significant. Similarly, Sobell et al. (1986) reports the effects of viewing a television program with and without alcohol scenes on subsequent alcohol intake by male college students. The authors hypothesised that alcohol abusers would be more responsive to cues trigging alcohol craving—such as those associated with television programming and commercials—as compared to non-alcohol abusers. A popular prime-time television program was shown to students, and in the first experimental arm scenes in which television subjects drank alcohol were removed (unaccompanied by alcohol commercials), whereas in the second experimental arm those scenes remained (accompanied by alcohol commercials). Results indicated that there was no significant effect between the two arms.

Kohn and Smart (1984b) examined the effects of print advertising on *ad libitum* alcohol consumption in a public drink area. Two types of print advertising incorporating images and text were tested, one 'lifestyle' variant in which alcohol intake was observed in a variety of social settings, and a second 'product' variant in which a bottle of alcohol was depicted alongside favourable comments regarding its flavour. The authors recruited male passers-by at a large shopping mall, asking them to evaluate the appeal of both print advertisement variants or to submit a survey regarding their user experience of the mall. Subsequently, participants who elected to dine at a restaurant in the mall were secretly observed and their alcohol consumption recorded. Results indicated there was no effect across the two types of print advertisement on either immediate or long-term alcohol consumption.

Moreover, this review did not find a middle-range theory that alone was able to explain how CA interventions involving the manipulation of portion size, packaging, and containers for alcohol products. The contextual factor of drinking implements when combined with the relevant mechanism (psychological process of perception) generates an outcome of interest in 3 included studies (Pechey et al. 2016; Wansink & van Ittersum 2003; Wansink & van Ittersum 2005), which reported the effects of changing glass size on perceived alcohol consumption. In terms of review-level evidence, one included paper—Hollands et al. (2015)—conducted a meta-analysis of portion-size, packaging, and tableware on food and drink consumption. Despite searching for sizing criteria relevant to implements used in alcohol consumption, the authors found no eligible document that reported a main outcome of alcohol consumption.

What is known is that the amount of food and beverages that individuals consume depends in part on the size of containers and implements with which that food is presented (Hollands et al. 2015). In particular, some research indicates that a range of social norms influences what an individual understands to be an appropriate amount of food and beverage to consume in one sitting (Robinson et al. 2016). Moreover, how food and beverages is perceived by an individual may affect intake (Wansink & van Ittersum 2003; 2005). For example, how much alcohol an individual perceives to be contained within a bottle of alcohol influences that product's selection and consumption (Shah et al. 2011). It could also be that individuals may be subject to unit bias, in which one unit is perceived to be appropriate to consume in one sitting regardless how much that unit (such as a carafe of wine) actually contains (Steenhuis & Vermeer 2009). In addition, the physical dimensions of a glass or container of alcohol may affect overall intake because dimensions affect 1) the actual amount of alcohol available and 2) the perceived amount of alcohol consumed by an individual, who may be subject to a range of cognitive biases and thus believe a container physically contains more or less alcohol than it actually does (Wansink & van Ittersum 2003; 2005).

To the extent that a theory came close to explaining some aspect of drink implements on alcohol consumption, 3 included studies (Wansink & van Ittersum 2003; Wansink & van Ittersum 2005; Pechey et al. 2016) examined the effects of the Elongation Hypothesis (Raghubir & Krishna 1999) on perceived capacity of glasses thought to contain alcohol. The authors draw on research that suggests that elongated objects are perceived by most individuals to be larger than non-elongated objects (Holmberg & Holmber 1969; Verge & Vogartz 1978). Specifically, the Elongation Hypothesis suggests that individuals perceive elongated glasses to contain a greater

amount of liquid relative to that contained in less- or non-elongated glasses. In 2 observational studies (2003; 2005), Wansink & van Ittersum hypothesised that participants given an elongated glass would pour less alcohol or juice as compared to participants given a non-elongated glass. The mechanism for this differentiating factor is that elongated glasses would be perceived to be larger, prompting individuals to believe they need not pour as much juice or alcohol into the glass in order to achieve the desired volume. Results indicated that across all participant subgroups (including bartenders), the amount poured and elongation were positively associated. In other words, individuals who engage in self-pouring tend to pour more in short glasses as compared to tall glasses, and yet they perceive that they have poured more into tall glasses.

Similarly, Pechey et al. (2016) test the Elongation Hypothesis in examining the effects of wine glass size on sales of wine in a UK restaurant. The authors examined the effects of exchanging different-sized but similarly shaped wine glasses even as the specified volume ordered by the customer remained the same across all glasses. In other words, if two observed individuals ordered 125 ml of wine, they would both receive that amount although one randomised to one arm would receive a different-sized glass than the other individual randomised to a different arm. Results indicated that volume of wine, and therefore consumption, increased when sold in the larger wine glasses.

The reason the Elongation Hypothesis does not rise to the level of middle-range theory is because it does not offer an explanation for the observed results. Raghubir & Krishna (1999) merely took note of an interesting empirical phenomenon in which perceived differences in volume lead most individuals to assume they are consuming different amounts of liquid. The

model does not suggest an actual causal pathway through which this phenomenon is explained. Thus, in comparison to other candidate middle-range theories reported in this review, it seems incongruous to consider the Elongation Hypothesis a compelling candidate theory.

3.3.5 CMO configuration for social comparison

After the range of external environmental cues have been consciously and unconsciously processed, many individuals consider their relationship to a larger social group in deciding whether to drink or not. Contextual factors such as one's perceived social status and self-esteem interact with injunctive norms—which inform individuals if their behaviour will be condoned or sanctioned by others—to produce social comparison (see Figure 6.7). Alternatively, the interaction of self-esteem and gender may produce the comparison of self to others in determining social comparison. In addition, an individual's gender identity may, in combination with other contextual factors, produce gender prototyping, a psychological mechanism in which gender norms are ascribed to certain sets of behaviours in determining social comparison. Moreover, an individual's base knowledge of the effects of alcohol as well as their conscious understanding of their own history with alcohol may come into combination through anchoring bias, which informs an individual's evaluation of their drink behaviour in relation to that of others.

Table 6.7 *CMO configuration for social comparison*

Context	Mechanism	Outcome
Perceived social status Self-esteem Gender Health literacy Self-knowledge	Injunctive norms Self-comparison Gender prototyping Anchoring bias	Social comparison

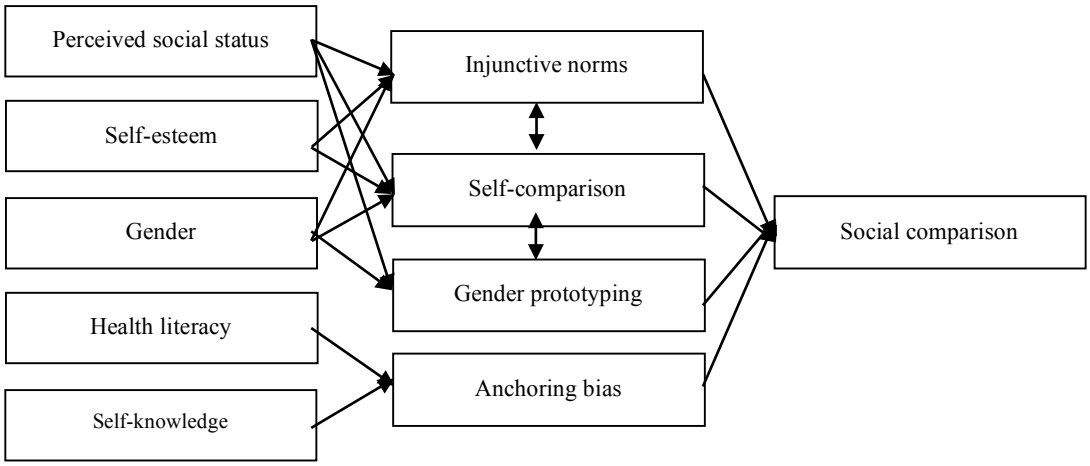


Figure 6.7 *CMO configuration for social comparison*

As a way to focus on the pathway leading up to social comparison, the Focus Theory of Normative Conduct (Cialdini et al. 1991) is arguably one of the most successful candidate middle-range theories reported in this review because it helps to explain and predict the interaction of relevant mechanisms (injunctive norms and self-comparison) with relevant contextual factors (perceived social status, self-esteem, and gender). This finding appears borne out in 5 included studies—Hustad et al. (2014), Taylor et al. (2015), and Teunissen et al. (2012), Lombardi (2010), and Neighbors et al. (2010)—which examine the effects of using social norms messaging on alcohol consumption. In the context of alcohol intake, descriptive norms simply model the perceptions of consumption by other individuals—denoting such things as frequency, overall consumption, and other behavioural patterns (Cialdini et al. 1991). Injunctive norms are

specific to individuals and denote if they believe others will view their consumption habits favourably or unfavourably (Cialdini et al. 1991).

In the context of CA interventions in alcohol consumption, the Focus Theory is typically embedded within a communication strategy that intends to educate an individual about their relative consumption level. Research indicates that heavy drinkers tend to overestimate alcohol consumption levels by other people (Schultz et al. 2007). In an attempt to correct and educate misconceptions, social norms can relay the relative consumption levels between an individual and the wider population (Moreira et al. 2009) and/or the percentile ranking of an individual in comparison to the population (Chan et al. 2007). This is the intervention strategy adopted by Taylor et al. (2015). The emphasis on 'ranking'—such as percentile ranking—in social norms is quite deliberate. Behavioural economic literature suggests that rank-framing is a powerful psychological tool that prompts individuals to change behaviour after considering their 'rank' along some metric—such as drinks consumed in one week—in relation to others (Vlaev et al. 2011).

A closely related CMO configuration may be teased out from the interaction of the mechanisms of self-comparison and gender prototyping with contextual cues gender, self-esteem, and perceived social status in 2 included studies (Teunissen et al. 2012; Neighbors et al. 2010). Here too, the Focus Theory may help to explain gender prototypes observed in the outcomes of some CA interventions. Research indicates that young people are strongly influenced by their perceptions of the type—'prototype'—of individuals who they know or imagine to drink alcohol (Spijkerman et al. 2007; Gerrard et al. 2002). Such drinker prototypes represent powerful factors

in university environments in which young people may still be developing their self-conception (Sussman et al. 2007). Partially to test the salience of these social norms, Teunissen and colleagues examined whether manipulating drinker prototypes presented in alcohol education surveys affected total alcohol consumption among students in a bar laboratory (2012). Results indicated that those exposed to positive prototypes consumed more alcohol relative to those exposed to negative prototypes. Male participants exposed to positive drinker prototypes consumed more alcohol as compared to those exposed to negative prototypes, whereas female participants appeared indifferent to positive or negative prototypes. Neighbors et al. (2010) similarly indicate that the perception of male drinker prototypes exerts a more powerful influence on college campuses as compared to that of female drinker prototypes. Thus, young men may be more susceptible to the manipulation of drinker prototypes than young women.

The mechanism of anchoring combines with the contextual factors of health literacy and knowledge of one's consumption history in 1 included study (Lombardi 2010). The author tested the effects of a social norm intervention that incorporated anchoring norms on self-report alcohol consumption and drinking patterns among college students. As discussed previously, educating students about actual alcohol amounts consumed by the average college student is thought to correct dangerous misperceptions that may prompt students to drink more than they otherwise would in an attempt to appear 'normal' (Haines & Spear 1996). Moreover, for college students and non-college students alike, histories of alcohol consumption are frequently solicited through self-report questionnaires. Yet there exists the possibility that the provision of a number of drinks, or a range of alcohol consumption, included in answer sections on multiple-choice self-report questionnaires may bias a respondent's reported consumption level.

Born of experimental psychology and behavioural economics, the Theory of Anchoring Bias supposes that an individual's quantitative estimates of some phenomenon are skewed towards known or reported values (Tversky & Kahneman 1974). As a candidate theory in the context of self-reported alcohol consumption, Anchoring Bias suggests that an individual may skew the actual number of drinks they report to have ordered in the previous week when given a perceived floor or ceiling in the number of drinks they are supposed to select on a multiple-choice questionnaire. Conversely, the more certain an individual is regarding some quantitative value, the less likely they rely on anchors. Lombardi (2010) hypothesised that college students did not mentally record the number of drinks, or their level of alcohol consumption, in a given week—perhaps biasing the self-report assessments of consumption.

Given this theoretical understanding of anchoring bias, Lombardi examined the effects of a social norm intervention designed to educate students about mean alcohol consumption among their peer group in 3 experiments. Such group means were conceived of as potential anchors for individuals' future consumption levels. In experiment I, randomly assigned students completed a 3-question questionnaire that asked 1) if they thought they consumed more, less, or about the same amount of alcohol as the average student at that university, 2) how many drinks they consume on average each week, and 3) their gender. Across 3 versions of this questionnaire, students received a 'high anchor' normative statement at the top of the questionnaire noting that the average student drank 19 drinks per week; a 'low anchor' normative statement noting that the average student drank 1 drink per week; and a control version that did not include a normative statement. In experiment II, Lombardi deployed the same questionnaire as used in experiment 1 with one change. For the second question asking students how many drinks they consume in an

average week, again the author tested 3 versions of the questionnaire. A 'high anchor' normative statement noted that the average student consumed 16 drinks per week; a 'low anchor' normative statement noted that it was 4 drinks per week; and the third version included no normative statement. In experiment III, the effects of a social norm poster were tested via its inclusion in the survey packet. Namely, Lombardi hypothesised that participants who received the social norm poster—which noted that "Most DePaul students have 4 or fewer drinks when they party" (Lombardi 2010, 8)— would result in fewer episodes of binge drinking at follow-up. Overall, results for experiments I and II indicate that most estimates skewed toward the low anchor rather than the high anchor, indicating perhaps that the high anchors were deemed implausible. Results for experiment III indicated that substantially fewer participants who received the poster treatment reported episodes of binge drinking.

3.3.6 CMO configuration for propositional reasoning

Upon considering their position relative to others in a group, an individual may then engage in conscious, reflective decision-making to determine if they will drink or not. Contextual factors such an individual's level of self-control and external incentives (such as financial payments) may interact through a mechanism of accountability in driving the individual's reasoning to drink or not to drink (see Figure 6.8).

Table 6.8 *CMO configuration for propositional reasoning*

Context	**Mechanism**	**Outcome**
Self-control External incentives	Accountability	Propositional reasoning

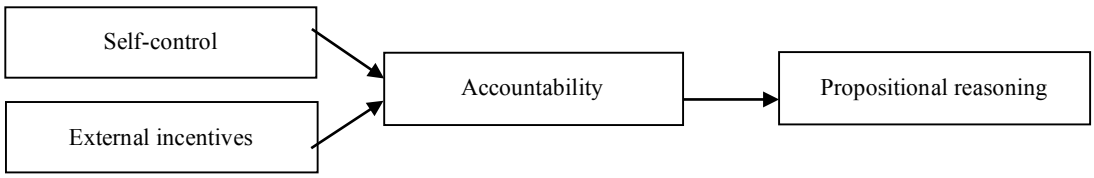


Figure 6.8 *CMO configuration for propositional reasoning*

To aid in propositional reasoning, the candidate theory of Self-Control (Carver & Scheier 1966) partially accounts for the effects of a range of CA interventions in alcohol consumption, although there is a large degree of heterogeneity in its actualisation in 3 included papers (Leeman et al. 2013; Otten et al. 2014; Vinson 2000). Self-control is a theoretical construct that denotes, among other things, the ability to change or overcome one's reaction to an affective or cognitive state that may or may not be induced by physical surroundings and stimuli (Muraven & Baumeister 2000; Baumeister et al. 1994). In extending the Theory of Self-Control put forward by Carver & Scheier (1966), Muraven & Baumeister (2000) develop a self-control strength model to describe self-control as a finite emotional and cognitive resource which may become depleted in a relatively short amount of time. In the context of alcohol consumption, one's self-control in limiting alcohol intake may fail or falter if their self-control has been depleted through exposure to emotionally and cognitively exhausting tasks (Muraven et al. 2002).

One of the difficulties in assessing the relevance of the Theory of Self-Control is determining what is and is not an adequate proxy for self-control. For example, Leeman et al. (2013) measure self-control in alcohol consumption by threatening participants who fail to perform a series of cognitive and behavioural tasks after consuming alcohol with a pay-reduction scheme. In short, individuals who perform worse at tasks at follow-up as compared to their baseline performance

made experimental participants eligible for a pay-reduction lottery. The addition of payment reductions to the paradigm was thought to imitate real-life negative consequences associated with over-consumption of alcohol above and beyond one's intentions. And it appears that participants exercised some degree of self-control: results indicated that treatment participants indeed consumed less alcohol and exhibited lower blood alcohol content levels. In contrast, Otten et al. (2014) measured self-control using the proxy of 'self-awareness' in which trial participants who were consuming alcohol as part of their prescribed protocol were asked to write down the number of drinks they consumed on a piece of paper. Results indicated that individuals who were asked to keep track of the number of alcoholic beverages they consumed drank less than those who did not.

The Theory of Self-Control is similarly at work in Vinson (2000), which tests the effects of a computerised behavioural contract on alcohol consumption in an aftercare treatment program among harmful drinkers. Problem drinkers who draft behavioural contracts in collaboration with healthcare professionals tend to report better maintenance of desired behaviour change (Fleming et al. 1997; Wallace et al. 1988). For ease of use and to streamline economic and time costs, a computer system was set up to offer a range of template behavioural contracts to patients, who could discuss desired personalised behavioural options with a healthcare provider before printing and signing such a document. For participants, one of the first steps in drawing up a contract was to complete a survey about their own perceptions of their history with alcohol and to report social and physical problems that may have resulted from it. Subsequently participants were offered a different range of goals to commit to, e.g. "I will seriously think about my drinking habits and patterns" and "I will keep track of how much alcohol I drink" (Vinson 2000, 16). The

contract was reviewed by both the participant and their healthcare provider, and printed and signed copies were retained by both individuals.

In this way, Self-Control is a convincing candidate theory whose effects are somewhat mitigated by the difficulty of determining a clear proxy for it. In this review's included trials, the Theory's operant logic could be discerned in 3 included trials—but even though all 3 trials reported statistically significant moderate effects, the proxy measures for self-control appear to be so disparate as to invite doubt about the Theory's coherency. It may be the case that just as some middle-range theories of behaviour operate 'close to the surface' with regard to observable effects, so too there are theories (like Self-Control [Carver & Scheier 1966] or Self-Efficacy [Bandura 1977]) whose focus is so concentrated on an individual's internal decision-making that their observable effects are difficult to precisely specify.

4. DISCUSSION

4.1 Summary of main findings

This realist review was intended to elicit aspects of the programme logic undergirding the causal process according to which CA interventions in alcohol consumption operate. It accomplished this by identifying relevant alcohol-related CA intervention trials; teasing out and testing candidate middle-range theories that help to explain the CMO interactions observed within those trials; and organising a narrative synthesis that help to identify 'hidden populations', specific micro-environments, and intervention-enhancement strategies. This review proceeded by

specifying *a priori* inclusion criteria according to the research question; conducting an extensive search strategy incorporating electronic searches, double-sided snowball searching, as well as consultations with end-users (namely, researchers and policymakers who help to design, implement, and analyse CA interventions); and employing analysis and synthesis techniques intended to test middle-range theories against identified demi-regularities. Notably, critical appraisal criteria were not posited, which is a source of well-founded criticism (discussed later in this section), but given that the research question was intentionally agnostic with regard to study design, this potential objection was outweighed by the competing priority of explaining the operant logic of as many alcohol-related CA interventions as possible.

Overall, 50 studies yielded evidence that was synthesised to generate a programme logic according to which the causal pathway for CA-influenced alcohol consumption operates. When it comes to problem drinkers, the first 3 stages of up to 6 stages in a causal pathway include self-recognition of a problem, an effort to find help, and alcohol craving management (such as avoiding situations in which alcohol cravings are predictably induced). When it comes to all drinkers, identified studies helped to generate 3 additional stages that may or may not lead directly to an outcome behaviour, such as no alcohol consumption, moderate consumption, or overconsumption. These stages include exposure to alcohol-related cues, social comparisons made by an individual to a group of people (such as a group of friends who are drinking), and propositional reasoning—a reflective decision-making process into which conscious and unconscious factors are channelled to produce an outcome behaviour.

For harmful drinkers, the initial step is self-recognition of problematic behaviour stemming from alcohol consumption. The Transtheoretical Model of Intentional Behaviour Change (Prochaska & DiClemente 1983) helps to explain the interaction of the contexts of educational background and health impacts with the mechanism of health literacy in 5 included studies (Cunningham et al. 2012; Freyer-Adam et al. 2014; Batel et al. 1995; Larimer et al. 2007; Neighbors et al. 2010). The mechanism of self-comparison interacted with the contexts of social environment and self-esteem. These interactions are modelled to varying degrees by three closely related candidate theories—Social Comparison (Festinger 1954), Social Identity (Tajfel 1982), and Self-Categorisation (Turner et al. 1987)—which were tested by Neighbors et al. (2010) in an Internet-based intervention that incorporated social norms surrounding college drinking among students.

After individuals realise they engage in harmful drinking, they may then seek help. The interaction of an individual's access to the Internet or a mobile phone and obstacles getting to regular treatment may—through the mediation of convenience—affect how they prepare. Namely, they may engage in online counselling and support fora in aid of their ongoing treatment. The contexts of Internet access and distance to clinic interact via the mechanism of convenience to help determine intervention uptake. As an intervention strategy to offer counselling—among other services—Internet-based interventions are frequently targeted to populations that may be considered to be 'hidden' yet suffer from mild alcohol-related problems (Blankers et al. 2008; Cunningham et al. 2009; Postel et al. 2005; Riper et al. 2008). In addition, 8 included studies investigated aspects of specific Internet-based CA interventions (Blankers et al. 2011; Blankers et al. 2013; Cunningham et al. 2014; Finfgeld-Connett et al. 2009; Neighbors et al. 2010; Riper et al. 2007; van Deursen et al. 2013; and Wallace et al. 2011). The interaction

of contextual factors such as SMS access and distance to clinic also help to drive participant engagement in maintaining behaviour change. SMS text-message-based interventions are thought to access a wide range of populations afflicted with mild alcohol-related difficulties in a low-cost manner in 3 included studies (Agyapong et al. 2015; Litvin et al. 2013; McTavish et al. 2012).

After individuals have sought help, over the course of counselling they may be told to prepare themselves for managing cravings and preventing relapse. The mechanism of agnostic attention (i.e. dispassionate focus on one's bodily experience) when combined with contextual factors such as craving for alcohol as well as training may generate an outcome of adherence to an alcohol-reduction plan. Six included studies reported CA interventions that incorporated the mindfulness (Murphy & MacKillip 2014; Ostafin et al. 2012; Witkiewitz & Bowen 2010; Witkiewitz et al. 2013; Vinci et al. 2014; Zgierska et al. 2009). The practice suggests that one's calm, dispassionate disposition and intense focus on one's present experience help to relieve stress and cravings (Kabat-Zinn 1994). In contrast, craving management may stem from the mechanism of expected benefit interacting with contextual factors such as resources and self-esteem, as appears to be the case in 2 included studies (Schoenmakers 2010; Schoenmakers 2007). Both interventions tested the effects of attentional bias modification training on alcohol consumption. In the context of alcohol, attentional bias modification may lead an individual to focus on their craving for alcohol to the neglect of other factors, such as a pre-conceived plan to avoid high-risk situations in which alcohol-related cues may prompt an individual to drink.

For all drinkers, serious consideration of the decision to imbibe alcohol usually may come in response to an external cue. Identified documents in this review indicated that a range of environmental stimuli—including lighting, sound level, music type, advertising, and drinking implements—impacts the spectrum of alcohol-related cues that prompt a decision to drink. These external contextual factors may interact via a relevant perceptual process (e.g. unconsciously noting the lighting level in a public drink space) in determining the palate of conscious and unconscious cues that prime drinking behaviour. The contextual cues of alcohol-related paraphernalia, music, lighting, advertisements, and drinking implements may all interact with perceptual processes to prompt drinking behaviour given an individual's perception of being in a dedicated drink environment. This appears to be the case for 2 included studies testing the effects of setting on consumption (Wigmore & Hinson 1991; Moss et al. 2015). A similar CMO configuration is at work in Nakamura et al. (2014), in which alcohol-related paraphernalia interacts with a psychological process of perception to cue purchase behaviour.

In contrast, the specific contextual factors of background music interact with the mechanisms of social engagement and perception in generating some consumption outcome in 4 included studies (Gueguen et al. 2004; Gueguen et al. 2008; Jacob 2006; Engels et al. 2011). The Arousal Hypothesis (Smith & Curnow 1966) is cited by 3 of these papers as a middle-range theory to explain why increased sound level, or variation in music type, appears to lead individuals to drink more (Gueguen et al. 2004; Gueguen et al. 2008; Jacob 2006). On the other hand, the Arousal Hypothesis does not help to explain the results of Engels et al. (2011), which investigated whether listening to music that contained references to alcohol prompted increased level of alcohol intake among consumers in public drink settings in the Netherlands.

The mechanisms of perception process and self-comparison interact with the contextual factor of advertisements in driving cue exposure as well in 4 included studies (Engels et al. 2009; Kohn & Smart 1984a; Kohn & Smart 1984b; and Sobell et al. 1986). Three closely related candidate theories—Situational Norms (Aarts & Dijksterhuis 2003; Everett et al. 1998), Modelling (Quigley & Collins 1999), and the Chameleon Effect (Bargh & Chartrand 1999)—help to explain this CMO configuration in 1 included study (Engels et al. 2009). On the other hand, these 3 candidate theories do not appear to explain the ambiguous effects observed in Kohn & Smart (1984a), Kohn & Smart (1984b), nor Sobell et al. (1986), which similarly report the effects of observational studies of advertising on subsequent consumption.

Moreover, this review did not find a middle-range theory that alone was able to explain CA interventions involving the manipulation of portion size, packaging, and containers for alcohol products. The contextual factor of drinking implements when combined with the relevant mechanism (psychological process of perception) generates an outcome of interest in 3 included studies (Pechey et al. 2016; Wansink & van Ittersum 2003; Wansink & van Ittersum 2005), which reported the effects of changing glass size on perceived alcohol consumption. In particular, those 3 studies examined the effects of the Elongation Hypothesis (Raghubir & Krishna 1999) on perceived capacity of glasses thought to contain alcohol. And yet the reason the Elongation Hypothesis does not rise to the level of middle-range theory is because it does not offer an explanation for the observed results. The model does not suggest an actual causal pathway through which this phenomenon is explained.

After the range of external environmental cues have been consciously and unconsciously processed, many individuals consider their relationship to a larger social group in deciding whether to drink or not. As a way to focus on the causal pathway leading up to social comparison, the Focus Theory of Normative Conduct (Cialdini et al. 1991) is arguably one of the most successful candidate middle-range theories reported in this review because it helps to explain and predict the interaction of relevant mechanisms (injunctive norms and self-comparison) with relevant contextual factors (perceived social status, self-esteem, and gender). This finding appears borne out in 5 included studies—Hustad et al. (2014), Taylor et al. (2015), and Teunissen et al. (2012), Lombardi (2010), and Neighbors et al. (2010)—which examine the effects of using social norms messaging on alcohol consumption.

A closely related CMO configuration may be teased out from the interaction of the mechanisms of self-comparison and gender prototyping with contextual cues gender, self-esteem, and perceived social status in 2 included studies (Teunissen et al. 2012; Neighbors et al. 2010). Here too, the Focus Theory may help to explain gender prototypes observed in the outcomes of some CA interventions. Neighbors et al. (2010) indicates that male drinker prototypes serve as powerful social perceptions on college campuses as compared to female drinker prototypes. Thus, young men may be more susceptible to the manipulation of drinker prototypes than young women.

Upon considering their position relative to others in a group, an individual may then engage in conscious, reflective decision-making to determine if they will drink or not. Contextual factors such an individual's level of self-control and external incentives (such as financial payments)

may interact through a mechanism of accountability in driving the individual's reasoning to drink or not to drink. To aid in propositional reasoning, the candidate theory of Self-Control (Carver & Scheier 1966) partially accounts for the effects of a range of CA interventions in alcohol consumption, although there is a large degree of heterogeneity in its actualisation in 3 included papers (Leeman et al. 2013; Otten et al. 2014; Vinson 2000). Self-control is a theoretical construct that denotes, among other things, the ability to change or overcome one's reaction to an affective or cognitive state that may or may not be induced by physical surroundings and stimuli (Muraven & Baumeister 2000; Baumeister et al. 1994). And yet, one of the difficulties in assessing the relevance of the Theory of Self-Control is determining what is and is not an adequate proxy for it. In this way, Self-Control is a convincing candidate theory whose effects are somewhat mitigated by the difficulty of determining a clear proxy for it. In this review's included trials, the Theory's operant logic could be discerned in 3 included trials—but even though all 3 trials reported statistically significant moderate effects, the proxy measures for self-control appear to be so disparate as to invite doubt about the Theory's coherency.

4.2 Limitations of the review

This review is subject to at least 5 major limitations. The first limitation is one of constrained generalisability. As mentioned in section 1, the reviewer chose to focus his question on a particular intervention set (CA interventions) and outcome (alcohol consumption). This review represents only one foray into the literature and thus there could be a wider set of additional candidate theories to test (Wong et al. 2010). Considering other middle-range theories would be important in further fleshing out the programme logic according to which CA interventions

operate, particularly in certain settings (e.g. private drink settings vs. social drink settings).

The second limitation relates to the constraints placed on data collected in this review. Few identified middle-range theories were developed and challenged in their every aspect. Among other things, it is therefore possible that unidentified mechanisms remained opaque to the reviewer. However, this is true for almost every realist review, gesturing in part to the impossibility of predicting with complete certainty a particular outcome with a high degree of specificity (Wong 2012, in Hannes & Lockwood 2012).

The third limitation is the result of human decision-making, part and parcel of the interpretive work that realist reviews undertake in complex interventions. As discussed in chapter 3, the realist philosophy proceeds in part from the premise that physical and social reality may be indirectly known to humans and therefore shape and constrain their choices, but the degree to which choices are constrained may vary widely. For this reason, programme theories may be imprecise in predicting how a given mechanism (i.e. a particular psychological decision-making process within an individual) will or will not be triggered by specific contextual-level factors in a given situation. Hence the certainty with which a programme theory, or at a more granular level a middle-range theory, is thought to predict a possible outcome should give due consideration to human agency.

The fourth limitation is one of critical appraisal. Developing, challenging, and refining candidate middle-range theories operates at two levels: first, at a removed level of abstraction in which a cogent explanation of a CMO configuration is posited, and second, in comparing that

configuration with empirical findings. At both stages, the reviewer interpreted for himself the extent to which a candidate theory did or did not 'measure up'—both in consistently and comprehensively explaining a logical chain of events and in explaining and predicting empirical findings (Wong 2012, in Hannes & Lockwood 2012). In this way, there existed a lens of interpretation between middle-range theory and empirical data, meaning there is not an *explicit* association between data quality and middle-range theory.

On that note, the fifth limitation is one of reproducibility. There was only one reviewer, and though he developed a protocol in consultation with stakeholders (including researchers and policymakers involved in CA intervention design), the fact remains that this review could benefit from the input of more perspectives. There are a variety of things to consider when interpretation is the primary yardstick of analysis (and when there is only one interpreter). Interpretation opens up the possibility of conflicting perspectives of, among other things, a given study's relevance to a research question; the success with which a candidate middle-range theory organises and explains observed demi-regular patterns; and the delineation of contextual factors, mechanisms, and outcomes within a given complex intervention. Moreover, papers included in this review represented a heterogeneous mix of study designs, sample populations, intervention modalities, and proxy outcome measures for alcohol consumption—constituting a maximum variety sample. Likely another review team could weigh candidate theories differently through the lenses of even the same demi-regularities identified here, much less within the wider empirical field.

Broadly speaking, however, these limitations should be given proper context. Three points in particular should be considered. First, the review meets the RAMESES publication standards for

realist review (Wong et al. 2013), and the initial research protocol was designed with it in mind. Second, the reliability of a realist review is measured in part by the extent to which the reviewer has been transparent in reporting revisions to the protocol and to the analysis and syntheses of middle-range theories. All revisions to this review's research protocol have been thoroughly documented (a brief summary is provided in Appendix 3.1). Third, as with all scientific theories, the success of a programme theory teased out in a realist synthesis depends in part on its ability to answer a research question in the most parsimonious, consistent, and comprehensive way until such a time that it is disproven or another programme theory is demonstrated to yield greater causal power according to those same standards (Wong 2012, in Hannes & Lockwood 2012). The main findings generated by this review helps to elicit important aspects of the programme theory of interest, including how and to what degree CA interventions in alcohol consumption work, and on whose behalf.

4.3 Strengths of the review

This review possesses 3 strengths. First, to the reviewer's knowledge, this is the first attempt to use realist review to examine CA intervention in public health, much less CA interventions in alcohol use. It joins a growing number of qualitative systematic reviews that attempts to deepen understandings about the causal mechanisms undergirding interventions instead of just focusing on the outcome effects that those interventions produce (Dixon et al. 2005). Greenhalgh and colleagues have noted how systematic reviews such as Cochrane-style meta-analyses and realist reviews may be used jointly, to complement each other's strengths (2007). This review does exactly that, since it was partially borne out of the need to explain significant heterogeneity in

outcome effects for a meta-analysis on CA interventions in alcohol consumption in public drink settings (chapter 5). Heterogeneity of this sort may be explained by focusing on an intervention strategy's causal logic—outlined in its theory of behaviour change—which is the locus of attention for realist reviews. An in-depth discussion as to how these two reviews speak to one another is reserved for chapter 7.

Second, this review extends the knowledge base by testing and refining some of the most compelling middle-range theories that explain the persistent 'how', 'why', and 'in what circumstances' questions about CA interventions in alcohol use. For example, the Theory of Self-Efficacy and Motivational Interviewing elicit important mechanisms of behaviour change with regard to moderating alcohol consumption through brief alcohol interventions. Yet the use of behavioural economic theories (such as the Theory of Anchoring) may enhance the efficacy of brief alcohol interventions by triggering an individual's unconscious mode of decision-making as well as their conscious mode of decision-making. Moreover, the Focus Theory of Normative Conduct indicates the extent to which alcohol consumption is mediated by, at a minimum, social considerations. For example, college students—who there is empirical reason to believe are keenly sensitive to perceptions surrounding drinking and stereotypes about drinkers—appear to be receptive to social norms that targets 1) the common overestimation of alcohol consumption by the average college student and 2) gender prototypes associated with drinking on campuses. Moreover, the Transthereotical Model can be exceptionally useful in generating personalised feedback that targets an individual's particular needs. And as with enhanced brief alcohol interventions, the use of technology such as automated feedback systems and online synchronous communication can improve the efficacy of such interventions.

Third, this review identifies 3 types of CMO configurations that appear to be beyond the scope of compelling middle-range theories so far identified in this review. CA interventions incorporating manipulation of drinking implements (such as glassware), CA interventions incorporating self-control measures, and CA interventions incorporating 'natural drink settings' are not readily explained by candidate theories identified in this review. Relevant CA interventions operating within these configurations appear to attain statistically significant results, however, and thus as an agenda-setting exercise for future research this review calls attention to demi-regularities observed in these settings for the purpose of searching for prospective candidate middle-range theories that might help to explain them.

4.4 Conclusions

This review gestures to a programme logic according to which the causal pathway for CA-influenced alcohol consumption operates. For problem drinkers, it appears that self-recognition of a problem, an effort to find help, and manage alcohol cravings represent 3 stages with attendant CMO configurations. For all harmful drinkers, stages related to exposure to alcohol-related cues, social comparisons made by an individual to a group of people, and propositional reasoning lead to a spectrum of outcomes, such as no alcohol consumption, moderate consumption, or overconsumption. Proceeding always from the perspective of theory, this review offers a way to look across and within causal theories of behaviour in considering both human and non-human components of an intervention. Armed with this, it may be possible to design additional alcohol-related CA intervention strategies, the subject of the next chapter.

Chapter 7.
A Taxonomy Linking Behavioural Change Theories and Theoretical Constructs for CA Interventions in Alcohol Use

1. INTRODUCTION

Results from the review of dual-process models of health-related behaviour (chapter 4) and the realist review of CA interventions in alcohol consumption (chapter 6) informs the development of this chapter's taxonomy intended to map the causal mechanisms for behaviour change in CA interventions. Qualitative taxonomic analysis is an approach to data analysis that identifies as its objective the generation of an organisation of related components constituting some phenomenon (Given 2008). Such components are situated into categories that may or may not be hierarchical in nature but—in all cases—trace the relationship between components. Examples of taxonomies may be found throughout the human sciences—organizing phenomena in every field from developmental biology to cultural anthropology. In intervention science in particular, Michie et al. (2011a) developed a qualitative taxonomy of behaviour change that attempts to classify behaviour change techniques using categories of theoretical mechanisms. Meanwhile, taxonomies of intervention components and theoretical constructs within specific content areas—such as weight management (Pope et al. 2000)—have also been generated. Regardless of the level of generalisability across behaviours, such taxonomies have been effective in identifying and mapping intervention components and gesturing to new interventions designs (Michie et al. 2013). A taxonomy is thus of interest to this thesis because it will organise the theories and theoretical constructs undergirding CA interventions in alcohol consumption.

1.1 Rationale

This chapter generates a taxonomy of CA intervention theoretical constructs using the theory-rich data generated by the review of theories of dual-process models of health-related behaviour (chapter 4) and the realist review of CA interventions in alcohol use (chapter 6). It does this in an effort to offer a conceptual mapping of extant knowledge pertaining to the theory of change embedded within alcohol-related CA interventions. However, it also seeks to inform and guide actors—such as the UK Behavioural Insights Team or the US Social & Behavioural Sciences Team—that may design future CA interventions in alcohol use and in other policy domains. Such a taxonomy may also reveal current gaps in research—either from the perspective of the theoretical literature or from the perspective of empirical intervention design.

1.2 Objectives

This chapter generates a taxonomy that:

a) Links behavioural change theoretical constructs with intervention components for CA interventions in alcohol use,
b) Creates a comprehensive classification of clearly labelled, well-defined CA intervention theoretical constructs organised in a way that is non-redundant, and
c) Reflects the main points of agreement and disagreement regarding theories identified in the review of theories of dual-process models of health-related behaviour (chapter 4) and the theoretical constructs identified in the CMO configurations reported in the realist review of CA interventions in alcohol use (chapter 6).

A taxonomy of theoretical components for CA interventions in alcohol use will make at least two original contributions to the first. First, it will clarify key features of such interventions to allow for improved intervention description and consistent reporting of relevant studies (Michie et al. 2013). Second, it will allow for improved design of theory-driven CA interventions by highlighting unused or under-used middle-range dual-process theories of behaviour. This feature could promote new intervention designs and enable replicability of existing CA intervention designs in the interest of effective and efficacious policies designed to moderate alcohol consumption (see Abraham & Michie 2008). Seven such strategies grow out of this taxonomy and are detailed in section 4.

2. METHODS

Unlike typologies, which tend to be produced deductively, many qualitative taxonomies are generated using an inductive approach, through which a range of relevant phenomena and characteristics are considered in service of developing a logical system into which all relevant cases may be grouped (Deatrick et al. 2006). Inductive taxonomies are intended to be bespoke, addressing a specified need in organising extant knowledge of some field (Michie et al. 2013). In this taxonomy, an empirical approach was used to search for relevant theoretical and empirical literature (chapters 4 and 6) that would feed into a taxonomy of theoretical constructs for CA interventions in alcohol use. As such, the taxonomy proceeded from constructs identified in included theories and primary trials. Though there are other approaches that may be taken to taxonomy generation, such as the approach driven by consensus among experts (Brown 1968), this approach represents an attempt to bring together granular evidence with dual-process

theories. As such, its rigor rests in part on the systematic review methods used in chapters 4 and 6 as well as the thematic analysis (see section 3.3).

2.1 Critical appraisal criteria

Reflecting in part the variety of methods used to generate qualitative taxonomies, criteria for critical appraisal are the subject of pronounced methodological contestation (Michie et al. 2013). Yet methodological guidance regarding taxonomies generated in the interest of theories have been produced (Lamb et al. 2011; Michie et al. 2013). Using these papers, the author has created a taxonomy that is: 1) parsimonious, 2) comprehensive, 3), unique, 4) testable, and 5) open to revision. The taxonomy should be parsimonious in that it ought to explain the relationships between taxa located on the same level of conceptualisation—and the relationships between taxa on different levels of conceptualisation—in as simple and clear a manner as possible. It ought to be comprehensive by incorporating all identified theoretical constructs. Elements within the taxonomy should be both unique (in other words, there should be no duplication of taxa components) and testable, in that they may be framed in experimental conditions that may disprove the theory or theoretical constructs. Finally, the taxonomy should be flexible enough to contain any current or future unidentified dual-process models of health-related behaviour and theoretical constructs used in CA interventions in alcohol consumption.

Even in higher realms of abstraction such as those in which this taxonomy belongs, critical appraisal criteria of this kind offer meaningful qualitative differences among theories and theoretical constructs. They identify the standards according to which a taxonomy may be

challenged and make it possible to compare taxonomies organising data for the same phenomenon. More importantly, comprehensiveness, parsimony, testability, uniqueness, and openness to refinement grow out of the epistemic tradition within which conceptualisations of 'theory' operate (Merton 1968).

2.2 Data synthesis processes

In this taxonomy, conceptual elements were first posited and defined with the understanding that they would be later iteratively revised and characterised. Through a process called thematic coding, the author generated a list of concepts that were found within the data set. These included dual-process models of health-related behaviour (identified in chapter 4) and theoretical constructs pertaining to CA interventions in alcohol use (generated in chapter 6). In developing coding categories, conceptual data were removed from their original context and systematically organised with some common identifying marker—denoting a category label—such that all data sharing the same identifier were picked out and grouped together (Tesch 1990). Categories of coded concepts then allowed for within- and across-category comparisons. As induction progressed, both theories and theoretical constructs were dis-aggregated, reconceived, re-labelled, and re-organised as necessary in light of emergent understanding (Given 2008).

3. RESULTS

3.1 Taxonomy generation

Fifty-one dual-process theories were included in taxonomy construction (Figure 7.1). Twenty-one dual-process theories had been previously identified in the review of theories of health-related dual-process models of behaviour (chapter 4), and 44 dual-process theories were identified in the realist review of CA interventions in alcohol use (chapter 6). Notably, 14 of the theories from the review of theories were also included in the realist review. In the interest of categorising unique elements, the author eliminated such duplicates. Among theories, publication years ranged from 1951 to 2016. Notably, papers reporting 'experimental' data as cited in the 50 records included in the realist review were excluded from the taxonomy on the basis that they did not share relevant theoretical constructs.

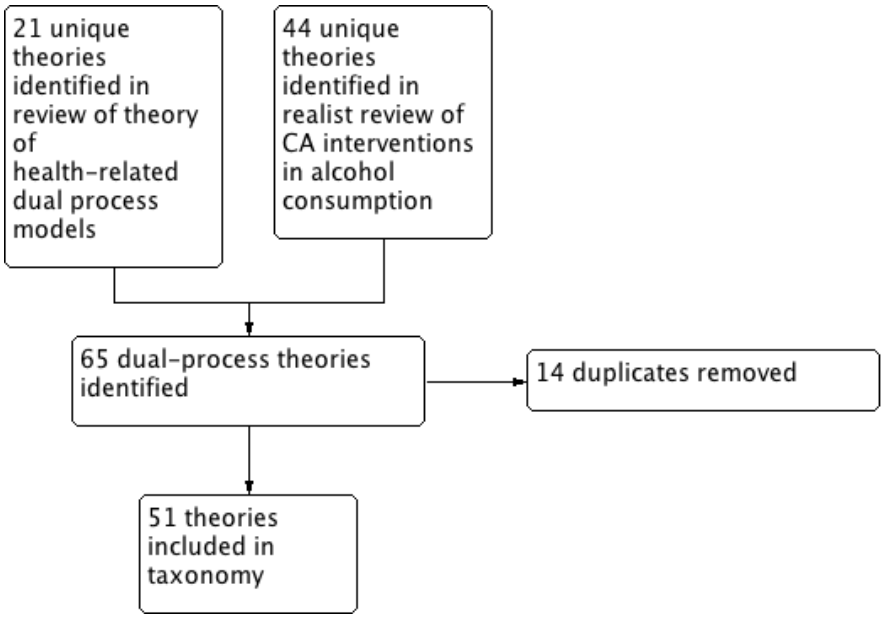


Figure 7.1 *Identifying records for taxonomy construction*

This taxonomy also incorporated 42 theoretical constructs: 16 unique mechanisms and 26 contextual factors identified in the realist review (see Table 7.1). These theoretical constructs helped guide intervention design (section 4) and are thus organised into the taxonomy as well.

3.2 Development of the taxonomy

A matrix taxonomy was developed to organise the dual-process models identified in both the review of theory (chapter 4) and the realist review (chapter 6) as well as the theoretical constructs identified in the realist review. Unlike other taxonomic models, a matrix taxonomy makes it possible to examine empirical or conceptual data across multiple dimensions: first, in relation to other data within the same level of granularity (columns), and second, in relation to other data across levels of granularity (rows). The resulting taxonomy is represented in Table 7.1.

3.3 Applying thematic analysis to theories and theoretical components

Theories identified through the review of theories of health-related dual-process models of behaviour (chapter 4) were coded by year, from earliest to latest. During this process theories drawn from the realist review were added and refined (see column 5 of Table 7.1). Theories relating to the same programme logic were grouped. For example, 4 models (Moreiera et al. 2009; Walters & Neighbors 2005; Chan et al. 2007; Dimeff et al. 1999; Neighbors et al. 2004) may all be seen as iterations of the Social-Norm Message dual-process model, and thus all such iterations are grouped together in column 4.

New codes were generated to identify mechanisms and contextual factors in columns 2 and 3, respectively, and they were organised on the basis of studies included in the realist review. For example, the CMO configuration pertaining to the interaction of the mechanism of self-comparison with the contextual factors of social environment and self-esteem were observed in Neighbors et al. (2010), which was explicitly grounded in 3 dual-process models: Social Comparison (Festinger 1954); Social Identity (Tajfel 1982); and Self-Categorisation (Turner et al. (1987). On the basis of observing these theories tested in empirical investigation, those 3 dual-process models were grouped into the CMO configurations associated with the outcome (column 1) of self-recognition. Eventually, saturation was obtained after all identified theories and theoretical constructs were integrated into the taxonomy, indicating no other theories or theoretical constructs emerging from the included papers could be organised into the taxonomy (Bowen 2008).

Table 7.1 *Taxonomy of causal factors for CA interventions in alcohol use*

Outcome	Mechanism	Contextual factor	Example (study ID)	Relevant Dual-Process Theory	Intervention strategy
Self-recognition	Self-comparison Denial Health literacy Judgment of ongoing experiences	Social environment Self-esteem Educational background Health impacts Troubling experience(s)	Cunningham et al. (2012)	--	Personalised feedback
			Freyer-Adam et al. (2014)	--	Personalized feedback
			Batel et al. (1995)	--	Personalized feedback
			Larimer et al. (2007)	--	Personalised feedback
			Neighbors et al. (2010)	Social Comparison (Festinger 1954) Social Identity (Tajfel 1982) Self-Categorisation (Turner et al. 1987)	Internet-based intervention
			--	*Risk-as-Feelings Model (Loewenstein et al. 2001)	--
Finding aid	Convenience Participant empowerment Expected benefit Accountability	Internet access SMS access Distance to clinic Lifestyle habits Messenger	Cunningham et al. (2014)*	--	Internet-based intervention
			Blankers et al. (2013, 2011)*	--	Internet-based intervention
			Finfgeld-Connett et al. (2009)	--	Internet-based intervention
			Riper et al. (2007)*	--	Internet-based intervention
			Van Deursen et al. (2013)* Wallace et al. (2001)*	Incentive Sensitisation Theory (Robinson & Berridge 2008) Attentional Bias Theory (MacLeod et al. 1986) Cognitive Behavioural Relapse	Internet-based intervention Internet-based

				Prevention Model (Marlatt & George 1984)	intervention
			Agyapong et al. 2015	--	SMS-text-based intervention
			Litvin et al. 2013	--	SMS-text-based intervention
			McTavish et al. (2012)	Social Learning (Rhodes et al. 1997) Persuasive Communication (Hovland et al. 1964) Transtheoretical Model (Prochaska & DiClemente 1983)	SMS-text-based intervention
			Murphy et al. 2012	Substance-free Reinforcement (Carroll et al. 2009; Higgins et al. 2004 Delayed Reward Discounting (Madden & Bickel, 2010; Vuchinich & Simpson, 1998; Murphy et al. 2006)	Personalised feedback
			Varvil-Weld et al. 2014	Parent Typing (Abar 2012; Varvil-Weld)	Psycho-educational
			Bickel et al. 2014	Reinforcer Pathology (Bickel et al. 2011) Discounting (Mazur 1987; Rachlin et al. 1991; Jones & Rachlin 2006) Delay discounting (Chung & Herrnstein 1967; Herrnstein 1961; Baum & Rachlin 1969)	--
			--	*Change Theory (Lewin 1951)	--
Craving management	Expected benefit Agnostic attention	Self-esteem Resources Craving Training	Murphy & MacKillip (2014)	Mindfulness Therapy (Marlatt 2002; Bishop et al. 2004) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Witkiewitz et al. 2005)	Mindfulness
			Ostafin et al. (2012)	Dyscontrolled Use (Widiger & Smith 1994; Tiffany 1990; Wiers & Stacy 2006; Fazio 1990) Reflective & Impulsive Determinants of Addictive Behaviour (Deutsch & Strack 2006) Mindfulness Therapy (Bishop et al. 2004)	Mindfulness
			Witkiewitz & Bowen (2010, 2013)	Negative-reinforcement Withdrawal Model (Wikler 1948) Mindfulness Therapy (Marlatt 2002;	Mindfulness

				Bishop et al. 2004; Teasdale et al. 2000) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Witkiewitz et al. 2005; Marlatt & Gordon 1985)	
			Vinci et al. (2014)	Negative Affect (Watson et al. 1988) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Brewer et a. 2009; Witkiewitz & Bowen 2010) Mindfulness Therapy (Marlatt 2002; Kabat-Zinn 1994; Baer 2003; Shapior 1982)	Mindfulness
			Schoenmakers et al. (2010)	Attentional Bias (Field 2005; Franken 2003; Robinson & Berridge 1993; Weinstein & Cox 2006) Incentive Sensitisation Theory (Robinson & Berridge 1993, 2001)	Attentional bias retraining
			Schoenmakers et al. (2007)	Attentional Bias (Franken 2003; Robinson & Berridge 1993; Weinstein & Cox 2006; Cox et al. 2006) Incentive Sensitisation Theory (Robinson & Berridge 1993, 2001)	Attentional bias retraining
			--	*Social Cognitive Theory of Self-Regulation (Bandura 1991)	--
Cue exposure	Self-comparison Social engagement Engagement with relevant perceptual process	Alcohol-related paraphernalia Background music Lighting level Advertisements Drinking implements	Wigmore & Hinson (1991)	Social Learning Theory (Bandura 1977; Collins et al. 1985; Garlington & Dericco 1977; Hendricks et al. 1978)	Drink setting
			Moss et al. (2015)	Attentional Preferences (Schoenmakers & Wiers 2009)	Drink setting
			Gueguen et al. (2008)	Arousal Hypothesis (Smith & Curnow 1966)	Auditory (sound level)
			Gueguen et al. (2004)	Arousal Hypothesis (Smith & Curnow 1966)	Auditory (sound level)

			Jacob (2006)	Arousal Hypothesis (Smith & Curnow 1966)	Auditory (music type)
			Engels et al. (2011)	Arousal Hypothesis (Smith & Curnow 1966) Stereotype Activation (Bargh et al. 1996; Dijksterhuis et al. 2005)	Auditory (music type)
			Engels et al. (2009)	Situational Norms (Aarts and Dijksterhuis 2003) Modelling (Quigley and Collins 1999) Chameleon Effect (Bargh & Chartrand 1999)	Digital advertising
			Pechey et al. (2016)	Portion size (Benton 2015; English et al. 2015; Herman et al. 2015; Kerr et al. 2009) Volume perception (Walker et al. 2014; Raghubir & Krishna 1999) Choice architecture (Hollands et al. 2016) Unit Bias (Geier 2006)	Drink implements
			Wansink & van Ittersum (2005) Wansink & van Ittersum (2003)	Perceptual Stimuli (Piaget 1969; Raghubir & Krishna 1999; Sheeran et al. 2005; Walker et al. 2014; Osberg et al. 2010) Perceptual Stimuli (Piaget 1969; Raghubir & Krishna 1999; Sheeran et al. 2005; Walker et al. 2014; Osberg et al. 2010)	Drink implements Drink implements
			Nakamura et al. 2015	Product placement (Chevalier 1975; Curhan 1974; Frank & Massy 1970; Klein & Wright 2007; Park et al. 1989; Sorenson 2008; Wilkie et al. 2002; Wilkinson et al. 1982)	Product placement
			Kohn & Smart 1984	--	Print advertising
			--	*Affect Heuristic (Slovic et al. 2002)	--
			--	*Implementation Intentions (Gollwitzer 1993)	--
Social comparison	Injunctive norms Self-comparison Gender	Perceived social status Self-esteem	Hustad et al. (2014)	Descriptive and injunctive norms (Cialdini et al. 1991; Borsari & Carey, 2003; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007) Perceptions (Osberg et al., 2010; Osberg	Social norms

	prototyping Anchoring bias	Health literacy Gender Self-knowledge		et al. 2011; Osberg et al., 2012) Subjective norms (Fishbein & Ajzen 2010)	
			Lombardi 2010	Social Norms (Perkins & Berkowitz 1986; Perkins 1997) Anchoring (Tversky & Kahneman 1974; Jacowitz & Kahneman 1995)	Social norms
			Taylor et al. 2015	Choice architecture (Thaler & Sunstein 2008) Rank-framing (Stewart et al. 2006; Vlaev et al. 2011) Social Norm Message (Moreiera et al. 2009; Walters & Neighbors 2005; Chan et al. 2007; Dimeff et al. 1999; Neighbors et al. 2004)	Social norms
			--	*Norm Activation Theory (Schwartz 1977)	--
			-- --	*Social Identity Theory (Tajfel & Turner 1979) *Uncertainty-Certainty Theory (Hogg 2007)	-- --
Propositional reasoning	Accountability	Self-control External incentives	Leeman et al. 2013	Impaired Control (Heather et al. 1993; Kahler et al. 1995)	Self-control
			Otten et al. 2014	Ego Depletion (Muraven et al. 1998; Baumeister et al. 1998) Self-Regulation (Muraven & Baumeister 2000; Bagozzi & Edwards 1982; Carver & Scheier 1981; Baumeister et al. 2007)	Self-control
			Vinson et al. 2000	Adherence (Putnam et al. 1994; Ossip-Klein et al. 1984; Swain & Steckel 1981)	Self-control
			--	*Theory of Alcohol Pre- and Post-Consumption (Moss & Albery 2009)	--

*Denotes unused theory identified in the review of theory (chapter 4)

3.4 Iterative development of the taxonomy

All generated theoretical constructs (listed in columns 2-3 of Table 7.1) were re-checked against the definition for a CA intervention provided in chapter 1. Notably, 9 dual-process models identified in the review of theory were not identified in the realist review. They include the Risk as Feelings Model (Loewenstein et al. 2001); Change Theory (Lewin 1951); Social Cognitive Theory of Self-Regulation (Bandura 1991); Affect Heuristic (Slovic et al. 2002); Implementation Intentions (Gollwitzer 1993); Norm Activation Theory (Schwartz 1977); Social Identity Theory (Tajfel & Turner 1979); Uncertainty-Certainty Theory (Hogg 2007); and the Theory of Alcohol Pre- and Post-Consumption (Moss & Albery 2009).

After careful consideration of their constituent theoretical constructs, those theories were grouped with one of the 6 seemingly relevant CMO configurations identified in the realist review. Here, one synthesis principle emerging from the review of theory aided in the grouping exercise. Given that all 21 dual-process models identified in the review of theory were synthesised into a general dual-process model of health-related behaviour, it was possible to consider the range of psychological inputs (external cues, internal cues, and regulating factors) that are processed both consciously and unconsciously in producing behaviour. Hence, it was possible to group similar dual-process models in the taxonomy on the basis of their treatment of an individual as 1) an irrational actor, 2) a social actor, 3) an actor situated in a physical environment, and 4) a self-regulated actor. For example, Social Identity Theory (Tajfel & Turner 1979) clearly belonged to the 'individual as a social actor' family of theories in the review of theory but was not identified in the realist review. However, in relation to the 6-stage causal

pathway identified in the realist review, it seemed appropriate to group Social Identity Theory with other relevant theories sharing the same epistemic assumptions—as discussed in the review of theory—that emerged as candidate theories to potentially explain the demi-regularities associated with the 'social comparison' CMO configuration. Hence, Social Identity Theory appears in the taxonomy with other dual-process theories that seem particularly relevant to 'social comparison'. In this way, using the results of the realist review, the author identified granular demi-regularities on the basis of empirical data and organised prescriptive theoretical constructs belonging to dual-process models identified in the review of theory. This represents an important guiding principle for prospective intervention design as it grounds theories of change into constituent theoretical constructs (e.g. the mechanisms of descriptive and injunctive norms) that have been manifested in a narrow ranges of outcomes.

4. RECOMMENDATIONS FOR ALCOHOL-RELATED CA INTERVENTION DESIGN

This taxonomy was generated for the purpose of informing end-users (i.e. intervention designers) about both extant and prospective causal mechanisms in CA interventions in alcohol use. Given that the realist review identified 6 CMO configurations linked to a pathway to alcohol consumption, it was possible to recommend intervention strategies that target specific outcomes along that pathway. Moreover, the taxonomy indicated that there are 9 dual-process models identified by the review of theory that do not appear to form the basis of any current alcohol interventions. Hence, upon considering this taxonomy it was possible to identify potential opportunities for designing intervention strategies along two axes: strategies that 1) attend to at least one CMO configuration embedded within the 6-stage consumption pathway identified in

the realist review and 2) are driven by dual-process models identified in the review of theory that appear not to have been tested in any alcohol-related CA intervention trial identified in the realist review. The result is the following 7 intervention strategies, although it is possible to conceive of many more using the taxonomy results.

4.1 Designing intervention strategies that target self-recognition of problem

Interventions should target individuals who may engage in harmful drinking but who—for a variety of reasons—do not acknowledge their behaviour. Many of the included studies in the realist review (chapter 6) that targeted this outcome did so through the incorporation of personalised feedback, in which potential harmful drinkers were lead to compare their consumption levels with that of a larger population, e.g. on a college campus. Additional strategies could focus on the pathway between learning that one's consumption is higher than recommended intake levels and admitting that it poses an explicit health risk.

Strategy 1

Theoretical basis. The Risk as Feelings Model argues that emotional reactions to risky situations diverge from cognitive assessments (Loewenstein et al. 2001). Though it is explicitly a dual-process model, the Risk as Feelings Model suggests that unconscious, automatic cognitive processing occurs before and alongside deliberative processing. An individual's affect may therefore drive their assignation of probabilities to the range of possible behavioural consequences even as their sensory perceptions filter environmental cues.

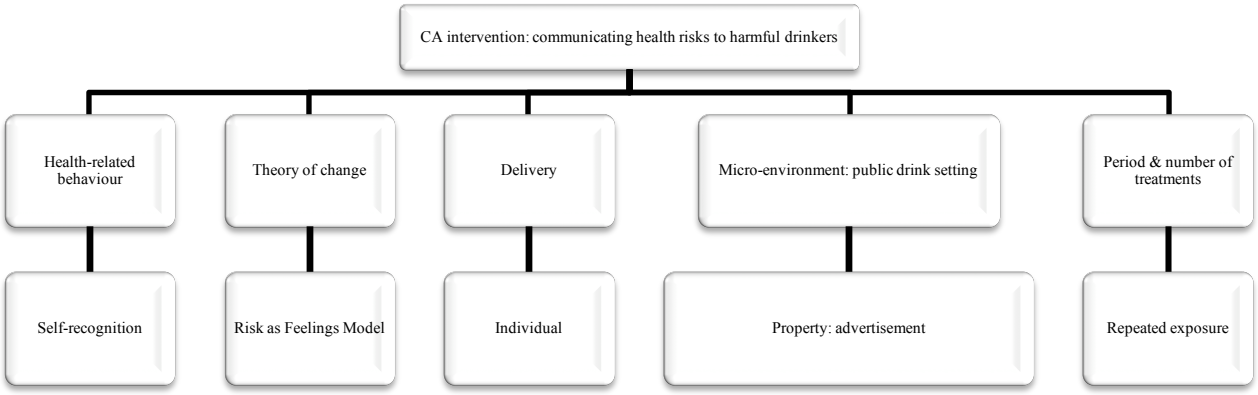


Figure 7.2 Example of CA intervention to enable self-recognition of alcohol problem

Intervention content. The model suggests that if the perception of risk—as influenced by emotions—overwhelms other reasoning processes, the individual may choose a risk-averse behaviour. An alcohol-related CA intervention strategy incorporating the heuristic might target the risks associated with long-term alcohol use, such as posting aversive images of liver damage. Research about risk communication—primarily from the perspective of risk-aversion—indicates that effective messages tend to be easily understandable, unforgettable, and situated in relevant environments. For example, it is possible to imagine placing Responsible Drink Message posters presented in the restrooms of pubs (see, for example, Moss et al. 2015).

4.2 Designing intervention strategies that target finding aid

Interventions should focus on treatment plans that incorporate appropriate components, such as counselling and motivational interviewing, that facilitate learning about alcohol cravings and strategies to avoid high-risk situations. Many of the included trials in the realist review (chapter 6) delivered a brief intervention through some digital means, such as the Internet or SMS-text-based messages.

Strategy 2

Theoretical basis. Change Theory holds that behavioural change is driven by the development of habits through comparison with group standards (Lewin 1951). The Change Theory views habit less as an unconscious, repeat, regular behaviour and more as a psychological construct that denotes cognitive resistance to change. Lewin did not equate habit with volitional stubbornness but rather with the resilience of an individual's unconscious self-concept as a member of a social group. Hence, externally driven social changes may cause habits to 'unstick' and alter to conform to a new socially driven track. For this reason, in many cases an individual desires to meet a behavioural standard that they perceive to be set by their social grouping. Changes in habit are thus attenuated by the individual's desire to conform to a new or evolving group standard. Behavioural maintenance is mediated in part through the environmental cues that make it easier or harder for them to perform the changed behaviour.

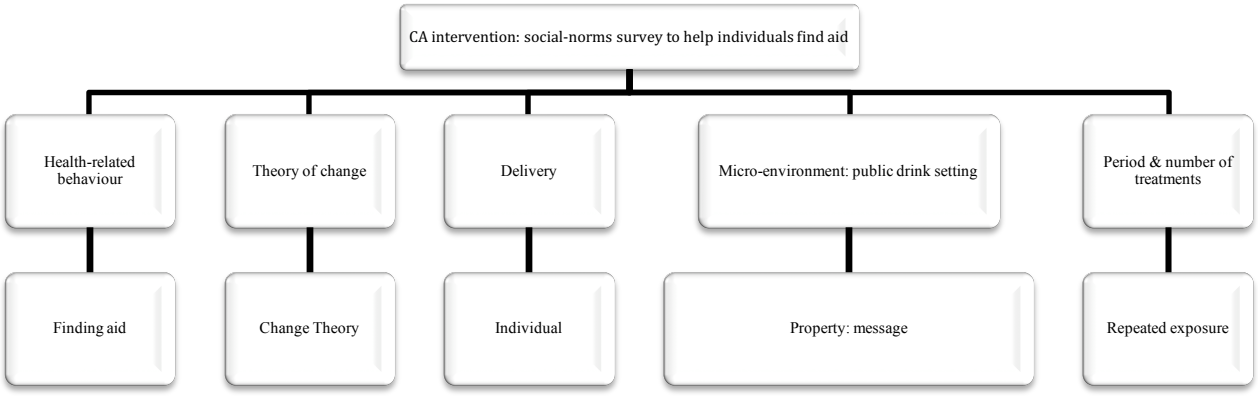


Figure 7.3 Example of CA intervention to enable finding aid for reducing alcohol consumption

Intervention content. Above and beyond facilitating delivery of propositional intervention strategies such as brief interventions, future interventions could incorporate other principles of

behavioural economics, such as what Lombardi (2010) did via the use of anchoring. For example, the representativeness bias (Tversky & Kahneman 1974) would indicate that most individuals associate public drinks settings such as bars with alcohol consumption, even though naturally alcohol is not the only beverage consumed in bars. Therefore, a potential intervention strategy could incorporate a quiz that not only informs individuals who report drinking above recommended guidelines—or who have regular problem drinking episodes—about their ranking relative to their peers but also provides contact information for proximal treatment centres.

4.3 Designing intervention strategies that target craving management

As indicated in chapter 6, mindfulness and attentional bias retraining offer two strategies to manage alcohol cravings. Future CA intervention strategies in alcohol may incorporate other strategies, such as meditation, that train individuals to first identify cravings and second exercise greater restraint before automatically responding to them.

Strategy 3

Theoretical basis. The Social Cognitive Theory of Self Regulation (Bandura 1991) holds that one's self-observation after behaviour, combined with judgemental processes (including personal standards, referential performances, valuation of activity, and performance determinants) result in a self-reaction (positive or negative). Included within self-judgement are personal and group norms, similar to those of the Norm Activation Theory (Schwartz 1977). Finally, self-monitoring and -judging drive the individual's reaction to their behavioural outcome, including the

assignation of value to that performance as well as what, if any, benefits should accrue to it.

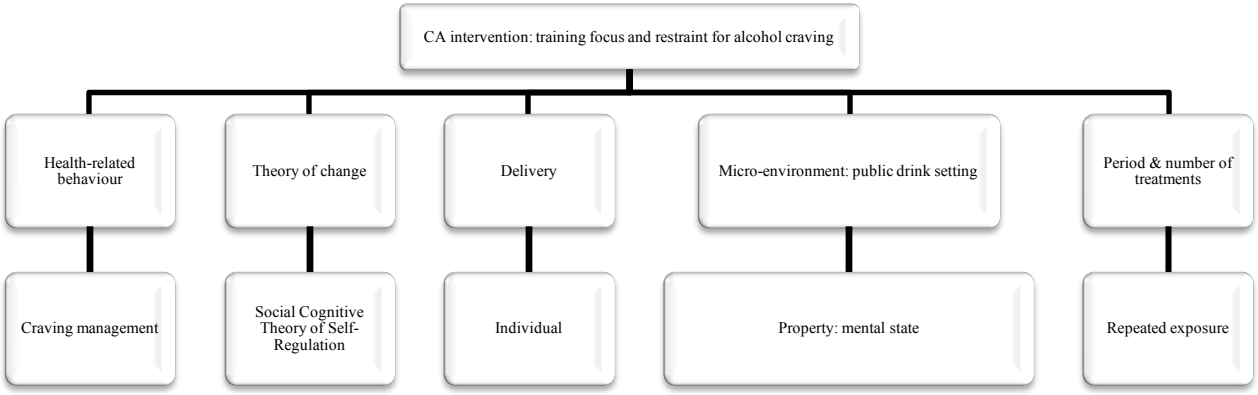


Figure 7.4 Example of CA intervention to enable alcohol craving management

Intervention content. The ability of individuals engaged in mindfulness exercises to manage their alcohol cravings to focus their attention on their immediate surroundings and bodily experience indicates that other strategies that incorporate similar focus-enhancing techniques can be brought to bear on alcohol cravings. Incorporating such a strategy into a treatment program may help harmful drinkers with craving management. A range of meditation techniques that already draw one's attention to their bodily awareness may focus in particular on alcohol craving and anticipate the conscious renunciation of such craving. As observed in MBRP trials (Witkiewitz et al. 2010; 2013) identified in the realist review, habituated meditation of this sort is likely to improve an individual's ability to resist satisfying alcohol cravings.

4.4 Designing intervention strategies that target alcohol cue exposure

Interventions which rely solely on manipulating physical objects within a drink environment offer promising potential in reducing alcohol consumption. However, it should be obvious that

scaling lessons gleaned from trials to the level of policy, even at an extremely localised level, present several difficulties. First, in the vast majority of public drink establishments, there is a conflict between the interest of private businesses—in maximising profits—and public efforts to reduce alcohol consumption via manipulation of, for example, lighting, sound level, music type, seating setup, and alcohol-related paraphernalia (e.g. marketing advertisements in bars). Second, interventions that reduce the alcohol available for drinking in one sitting (e.g. using glasses containing less liquid volume than standard pint-size glasses) should be communicated to customers. In other words, an individual ordering a pint of beer should not be served something that is known to be less than a pint of beer. Third, such interventions would likely need to incorporate a differential price scale: it would be unreasonable to charge customers the same price for a pint of beer as for something that is less than a pint of beer.

Strategy 4

Theoretical basis. The Affect Heuristic holds that for individuals who need to make decisions quickly, emotions may influence decisions (Slovic et al. 2002). The authors put forward the Affect Heuristic to explain how individuals calculate risk from the perspective of their emotional responses to situations entailing risk and not necessarily on the probability of those situations obtaining. Similarly, the Elaboration Likelihood Model of Persuasion holds that the central route of information processing involves message elaboration; the peripheral route considers positive and negative environmental cues (Petty & Cacioppo 1986).

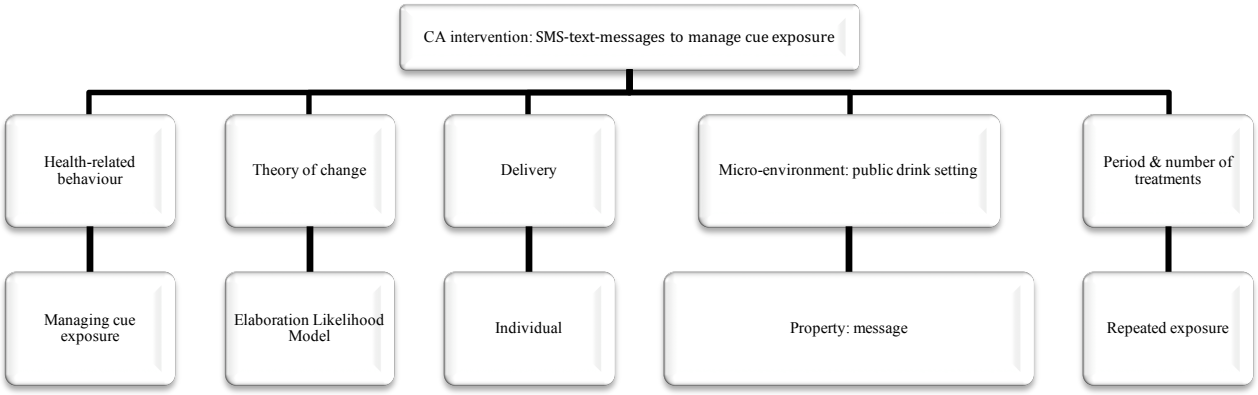


Figure 7.5 Example of CA intervention to enable management of alcohol cue exposure

Intervention content. Regulating alcohol paraphernalia and limits in public drinking establishments beyond extant policies would perhaps be misguided (especially for the vast majority of drinkers who are not problem drinkers). It is instead helpful to encourage a competing agenda that ameliorates the effects of paraphernalia that favour consumption on heavy drinkers. Hence, some alcohol treatment programs should incorporate automated SMS-text-messages sent by a heavy drinker's close friends and families just before periods in which the individual would otherwise be drinking. Subjects who receive periodic reminders that they are externally accountable to other people they know and respect may respond positively, even amid cues that prompt alcohol cravings.

Strategy 5

Theoretical basis. The theory of Implementation Intentions (Gollwitzer 1993) uses holds that implementation of behavioural intentions is driven by 'if-then' logical cues. In this way, it harnesses a conditioned rehearsal system in order to lighten the cognitive load introduced by a particular behavioural scenario such that the desired behaviour becomes automatic. The objective

is thus to make individuals cognitively equipped to behave in response to their prepared intentions (Maio et al. 2007)

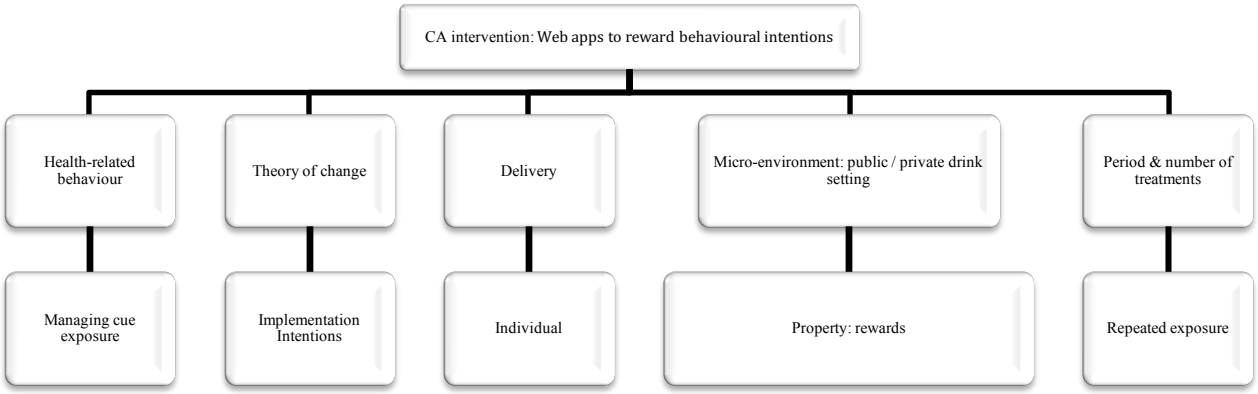


Figure 7.6 Example of CA intervention to enable management alcohol cue exposure

Intervention content. Positive reinforcement strategies may be integrated into 'if-then' interventions that are tailored to a problem drinker's alcohol treatment program. For example, web-based applications ('apps') may be used to track and reward heavy drinkers enrolled in an alcohol CA intervention who successfully execute their intentions to reduce consumption. Meeting weekly and monthly targets could automatically cue some external incentive system, such as receiving a written affirmation from a family member or friend.

4.5 Designing intervention strategies that target social comparison

Intervention strategies may rely on communicating group norms to curb alcohol intake by excessive drinkers. Included studies in the realist review (e.g. Lombardi 2010) demonstrated that, for example, correcting the misconceptions of college students as to the amount of alcohol regularly consumed by most students on campuses appeared to reduce self-reported consumption levels. It is possible to think of other social contexts and communities in which a similar strategy

may be adopted, e.g. military bases, correctional facilities, hospital emergency rooms, and so on.

Strategy 6

Theoretical basis. Norm Activation Theory argues that behaviour is driven by executing behaviour that one believes accords with some group standard—the result of being aware of consequences, ascribing responsibility to consequences, and engaging subjective norms (Schwartz 1977). The Theory further defines norms to be personal and centred on an individual's intrinsic values regarding a duty to behave in a certain fashion. In this way, personal norms are thought to arise from the application of social norms to an individual's conduct as mediated by their environment and their sense of self.

Similarly, Social Identity Theory (Turner and Tajfel 1979) and the Uncertainty-Certainty Theory (Hogg 2007) together assume that an individual's identity is driven by their self-perceived membership of a group, which prompts certain behaviours and discourages others. The extent to which an individual believes that they already share or could potentially share some common characteristic with the group determines in part the extent to which an individual may seek to become a member of that group. Therefore, the possibility of influencing individual behaviour may depend in part on identifying and emphasising particular social norms of the group with which an individual believes they are a member (or would like to become a member).

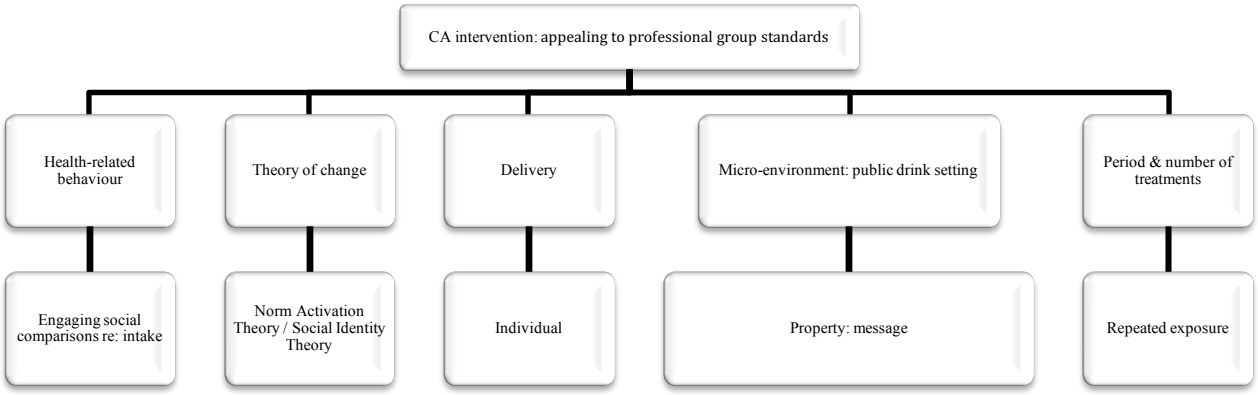


Figure 7.7 Example of CA intervention to enable social comparisons to reduce consumption

Intervention content. In most settings, communicating a group's healthy attitude toward alcohol consumption (i.e. moderate consumption) could help persuade problem drinkers to drink less over time. For example, appealing to the ethos of different professional associations (such as lawyers and engineers) may moderate consumption by harmful drinkers within those groups—especially on behalf of groups known to contain a greater concentration of heavy drinkers than average. Of course, such strategies should be sensitively communicated and evidence-based (e.g. pursued only where there appears to be a significant concentration of harmful drinkers).

4.6 Designing intervention strategies that target propositional reasoning

There is wide scope for creativity in designing future alcohol-related CA interventions that target propositional reasoning by employing behavioural economic and health psychological principles. For example, the manipulation of explicit incentives (e.g. financial incentives; Leeman et al. 2013) demonstrates that consumption reduction may be achieved when drink situations are framed in such a way that an individual understands she has something to lose.

Strategy 7

Theoretical basis. The Theory of Alcohol Pre- and Post-Consumption (Moss & Albery 2009) holds that before drinking, an individual engages in propositional reasoning about consumption, a process that is mediated by cue exposure and association activation. After consumption, the influence of propositional reasoning is weakened. During the pre-consumption phase, then, priming activates various cognitive patterns—including expectations for alcohol consumption based in part on short- and long-term memories associated with alcohol intake—and may access a range of behavioural patterns. In the consumption stage, while individuals may be motivated to process information propositionally, they may find that their capacity is at least marginally impaired as a result of intake. The effect of 'alcohol myopia' then sets in, in which individuals seemingly process and attend to only the most salient environmental and behavioural stimuli.

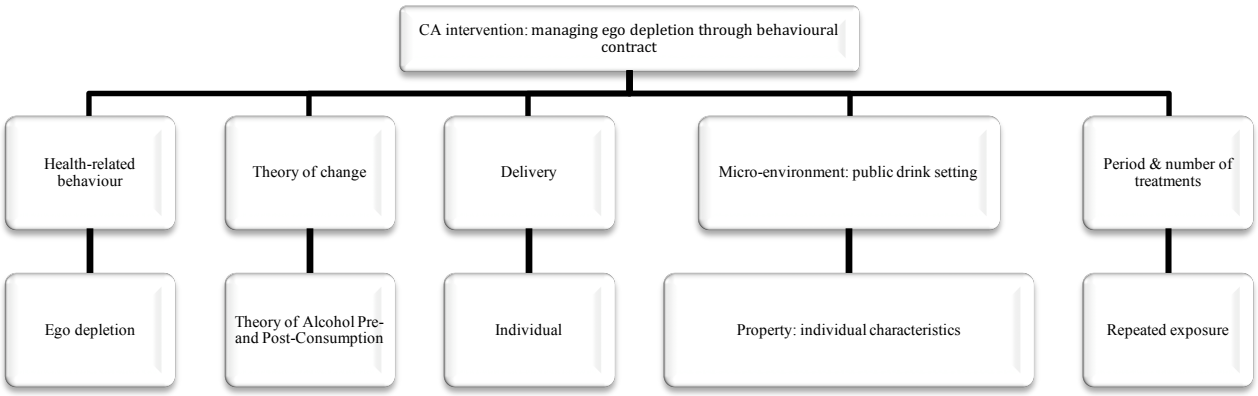


Figure 7.8 Example of CA intervention to enhance propositional reasoning

Intervention content. Given the positive correlation between alcohol consumption and stress (such as ego depletion; Otten et al. 2014) it is likely the case for some problem drinkers that targeting stress-related psychosocial issues can improve a host of outcomes, including

consumption reduction. Moreover, interventions that aid in efforts to maintain a behaviour change (e.g. adherence) are promising because they enable individuals to unconsciously execute a strategy that has been previously reasoned out. For example, it may be possible for harmful drinkers in treatment programs to draw up a behavioural contract that pre-commits them to drinking only in a limited number of specified settings, or on certain occasions, or with certain friends and family members.

5. DISCUSSION

5.1 Summary of main findings

A taxonomy was populated by 51 discrete dual-process theories from a review of theory of dual-process models of health-related behaviour (chapter 4) and a realist review of CA interventions in alcohol consumption (chapter 6). In this way, dual-process theories taken from primary trials and review-level evidence were extracted and coded. Thematic coding was used to characterise and organise all CA intervention theoretical constructs (mechanisms and contextual factors) identified in the realist review. The dual-process theory codes and theoretical construct codes were then combined on the basis of empirical trials and verified against a definition of CA intervention detailed in the research proposal. A final list of theories and theory constructs produced (Table 7.1). Given the end-use of the taxonomy for the purposes of alcohol CA intervention design, using the taxonomy it was possible to identify 7 potential theory-driven intervention strategies generated along two axes within the 6-stage consumption pathway identified in the realist review and within the 9 unused dual-process models identified in the

review of theory.

This taxonomy met several critical appraisal criteria (Michie et al. 2013). First, the taxonomy is parsimonious: theories were grouped on the basis of shared mechanisms and outcomes. Second, in order to ensure the taxonomy was comprehensive, all relevant theories reported in the review of theory and realist review that would indicate a CA intervention programme logic were included in the taxonomy. This enabled the taxonomy to capture a vast array of possible CMO configurations. Third, theories were included as long as they were testable, regardless if there existed an empirical evidence base. Fourth, in order to ensure conceptual uniqueness, several iterations of dual-process theories were combined over the course of thematic analysis. Theories were then grouped on the basis of shared 'actualising elements'—namely, those constructs (mechanisms and contextual factors) that were observed in CA interventions in alcohol consumption. Fifth, the taxonomy represented the integration of empirical and theoretical literature and elicited a range of CA interventions in alcohol use, both extant and potential. This means the taxonomy may organise future CMO configurations that pertain to alcohol-related CA interventions.

5.2 Limitations of the taxonomy

This taxonomy has at least two limitations. First is a problem of reliability. Other researchers may organise the theories and theory constructs differently. Although the author outlined a clear definition for CA intervention and clear critical appraisal criteria in judging the taxonomy and its constituent elements, it is possible that other research teams would denote different categories

and sub-categories in the taxonomy. Secondly, and more importantly, the author was the only person to engage thematic analysis in coding potentially relevant elements and taxa. Two or more coders independently examining the included theories and theoretical constructs would have improved the validity of the generation.

Additional research will depend and complicate this taxonomy. For example, a formal independent consensus process would help to refine this taxonomy. Consensus-generation would also likely increase its use among intervention designers most likely to benefit from it, including the Behavioural Economics Team of Australia, the US Social & Behavioural Sciences Team, the UK Behavioural Insights Team, and other public-sector agencies.

5.3 Strengths of the taxonomy

This taxonomy has several strengths. First, it makes an important gesture toward identifying and organising the conceptual frameworks on which CA interventions in alcohol use rely. Given the potential range of manipulating vastly different behavioural insights, biases, and heuristics that are relevant to reducing alcohol consumption, it is helpful to map out extant theories and constructs—both in relation to concrete CMO configurations, but also in relation to other theories and constructs. It also attempts to present the taxonomy in a relatively simple mapping that intervention designers can harness in developing new CA trials in alcohol consumption.

Second, the taxonomy sheds light on the relationship between theories, theoretical constructs, and CMO configurations relevant to alcohol-related CA interventions. Several studies included

in the realist review of CA interventions in alcohol use (chapter 6) identified various 'norms', but the taxonomy distinguishes 'social norms', 'social norm messaging', 'situational norms', 'subjunctive norms', and 'injunctive norms' (Lombardi 2010; Hollands et al. 2015; Taylor et al. 2015; Hustad et al. 2014). Notably, the taxonomy delineates the relationship of each 'norm' construct to each other and to empirical CMO configurations. Delineations of this sort should help intervention designers specify those mechanisms and contextual factors that they believe will lead to a narrow range of outcomes.

Third, this taxonomy identifies areas of opportunity for designing future CA interventions in alcohol consumption. On the basis of 9 unused dual-process models (from the review of theory) and the 6-stage consumption pathway (from the realist review), it was possible to develop at least 7 theory-driven intervention strategies. Of course, it should be said that these 7 strategies only represent a starting point in capitalising on the potential of this organisational mapping to generate new ideas and understandings about, among other things, intervention design.

5.4 Conclusions

As a conceptual tool, this taxonomy may be employed by researchers and policymakers in a variety of ways. First, it should be used to motivate and organise exhaustive CA intervention protocols that report the theoretical underpinnings and experimental conditions according to which an intervention proceeds. Second, it should be used to focus attention on the array of theoretical constructs, both those which have been extensively empirically validated, such as 'social norms', as well as those that have not, such as 'rank framing' of choices. This will set the

agenda for future research into CA interventions in alcohol consumption. Third, and relatedly, this taxonomy identifies areas of opportunity for designing CA intervention in alcohol consumption by innovating upon the results of a review of theory and realist review. Fourth—and perhaps most important to the aims of this thesis—it should be used to identify causal mechanisms associated with CA interventions in alcohol consumption. Elaboration upon these mechanisms—and the causal pathways into which they are embedded—should implicate the design and implementation of increasingly sophisticated CA interventions into alcohol consumption that draw directly upon their engagement.

This taxonomy serves as an answer to several calls for a conceptual mapping of extant theoretical and empirical evidence regarding CA interventions in a specified public health domain (Hollands et al. 2013; Shemilt et al.). It attempts to completely report all identified theories and theoretical constructs relevant to CA interventions that have thus far been identified in an effort to guide and inform future intervention design in this field. Moreover, it provides conceptual and organisational clarity in synthesising constructs (identified over multiple CA intervention trials) with dual-process theories of health-related behaviour. Most importantly, the clear delineation of relevant CA intervention theoretical constructs enables researchers to consider where and in what ways additional research may further bear out the CA approach to behaviour change in alcohol consumption.

Chapter 8.
Final Thoughts and Conclusions

1. INTRODUCTION

This thesis attempted to answer the research question, what are the causal mechanisms undergirding 'choice architecture' interventions in alcohol use? CA interventions were broadly conceived of as a public policy approach that involve altering features of physical or social environments to influence individual behaviour (Thaler & Sunstein 2008). The 'libertarian paternalism' philosophy underpinning CA interventions remains open to debate both inside and outside of public health, even as teams of psychologists and economists are attempting to implement these interventions at every level of government (e.g. the Behavioural Economics Team of Australia, the French Nudge Unit, and many others). In recognition of this salience, as well as the unanswered questions surrounding the theoretical constructs according to which CA interventions work, this thesis grew out of two needs. First, attempts to conceptualise the inner workings of CA interventions are vital to improving trial efficacy and effectiveness. In the same vein, it is difficult to specify precisely the causal mechanisms that these interventions are intended to affect without focusing on at least one area of public health (such as alcohol consumption). Second, only recently is an evidence base of CA interventions in alcohol use emerging. The Hollands et al. (2013) scoping review of CA interventions in public health identified several unexamined studies in alcohol consumption, which inspired the above research question.

Together, these needs motivated the focus and sequencing of this thesis. In order to address the research question, the project drew on systematic review methodology, including that used by reviews of theory, Cochrane-style meta-analyses, and realist reviews, in order to elicit relevant theories, effects of CA interventions in alcohol consumption, and CMO configurations (respectively). Second, this project attempted to develop a guide to alcohol-related CA intervention strategy design by developing a qualitative taxonomy of theoretical constructs and theories used in CA interventions in alcohol consumption in order to highlight potential research gaps and unrealised opportunities for future intervention design. Together, these aims should expand common understanding of the feasibility and desirability of allocating resources to CA interventions in view of improving health-related behaviour.

Ultimately, CA interventions in alcohol consumption were defined and identified using a refined definition of CA intervention posited by Hollands et al. (2013). The authors' definitional criterion that CA interventions take place within the same micro-environment as that of the target behaviour was relaxed in recognition of two facts. First, the original definition of choice architecture by Thaler and Sunstein (2008) entailed no such requirement. Second, instrumental concerns about tracing causality between CA intervention components and an intended behavioural effect were ultimately set aside in light of this thesis' attempts to characterise the full range of interventions in alcohol consumption motivated by the CA approach (i.e. those strategies that relied on both conscious and unconscious pathways to reduce alcohol intake). However, in reviewing evidence of the effects of CA interventions in alcohol use in public drink settings (chapter 5), the author adopted the Hollands et al. (2013) definition to address anticipated heterogeneity. And indeed, heterogeneity among intervention characteristics led in

part to a non-statistically significant effect, which cannot help but give pause to intervention designers considering future attempts to employ CA interventions in alcohol use.

However, despite the lack of demonstrated effectiveness among that subset of alcohol-related CA intervention strategies, this thesis ultimately attempted to answer the research question by identifying CMO configurations leading to 6 outcomes of interest along the causal pathway to alcohol consumption. If the 'causal mechanisms' mentioned in the research question may be broadened to include both 'contextual factors' and 'mechanisms' (as defined by realist review), then those data present in the CMO configurations identified in the realist review (chapter 6) present at least one attempt to answer the research question.

2. Summary of Findings by Research Aims

2.1 Conceptualisation of CA interventions

One aim of this project was to develop a conceptual framework of CA interventions in alcohol use. This thesis refines the operational definition of CA interventions put forward by Hollands et al. (2013) to characterise CA interventions as:

> Interventions that alter the intrinsic physical qualities or positioning of micro-environmental cues in an effort to alter health-related behaviour. This class of interventions may call on both automatic and volitional cognitive responses and respects classical economic rational preferences by not excluding any behavioural options that might otherwise be available if the intervention did not take place.

This definition is distinct from that of Hollands et al. (2013) in that the latter specified that CA interventions must take place within the same micro-environment as that of the observed behaviour. The author felt that this was an instrumental requirement—which, while perhaps helpful in strengthening a causal connection between a 'nudge' and an effect—unnecessarily precludes too many interventions that otherwise fit the description of choice architecture as first posited by Thaler and Sunstein (2006).

This thesis then moves on to asserting a conceptual typology for CA interventions for alcohol use which might categorise relevant intervention components as well as locate this subset of strategies within health-related behavioural interventions. Such a framework draws from theoretical material related to behavioural interventions, CA, alcohol use, sustained behavioural change, as well as empirical studies of alcohol use. One hope of this project was to develop a model that would not only nest all pertinent terminology related to CA as applied within a health-related behavioural context but would also be able to predict how future studies may be categorised in a taxonomy (chapter 7).

Although Hollands et al. (2013) curate an evidence base in service of developing a typology of CA interventions in public health, the author develops a narrower typology of CA interventions in alcohol use. The typology is constituted of five categories of intervention components, including targeted health-related behaviour; theory of change; micro-environment; period and number of treatments; and intended recipients; and physical palette. Within these categories are a range of component sub-classes, including public or personal sphere (the micro-environment setting in which the behaviour takes place); a single treatment, regular treatments, or as-needed

irregular treatments of the intervention (period and number of interventions); and intrinsic qualities or positioning (constituting the physical palette). The author later uses such a typology schema to categorise components used in 7 prospective intervention strategies into alcohol consumption that were developed under the guidance of a qualitative taxonomy of CA intervention theoretical components (chapter 7).

2.2 Review of dual-process models of health-related behaviour and cognition

The aim of the review of theory was to identify dual-process models of health-related behaviour and synthesise a general model. Because analysis and synthesis focused on conceptual rather than empirical evidence, it makes a substantive contribution to this thesis by specifying the theoretical landscape within which exists a programme theory of CA interventions into alcohol consumption. The review proceeds in part from theories identified using an iterative search strategy and which assume that human behaviour and cognition is the result of both conscious and unconscious reasoning. The reviewer specified inclusion criteria in order to identify all relevant dual-process models that account for health-related decision-making. Iterative template analysis was conducted in part to aid the synthesis of shared theoretical constructs and causal pathways.

The synthesised general dual-process model of health-related behaviour indicated that an individual's propositional and unconscious reasoning processes are motivated by their response to internal cues (such as heuristics, attitude, and affect), physical cues (social and physical environmental stimuli) as well as regulating factors (such as habit) that mediate between internal

cues and regulating factors. This model was developed in part through the consideration of foundational assumptions made by each theory, including the extent to which a theory views an individual as: 1) an irrational actor, 2) a social actor, 3) an actor situated in a physical environment and amenable to external cognitive cues, or 4) a self-regulated actor.

2.3 Cochrane-style systematic review of CA interventions in alcohol use in public drink settings

The aim of the Cochrane-style meta-analysis was to determine the composite effect of CA interventions in alcohol consumption in public drink settings. Review-level evidence of the primary outcome—alcohol intake—in the 6 meta-analysed studies, or 13 included trials, demonstrated a non-significant, moderate effect size of CA interventions on the primary outcome (SMD = 0.63) given the variance of results (95% CI: -0.06 and 1.31, with a p value = 0.07). The high level of heterogeneity (I squared = 93%) across trials is partially explained by the range of different operant logics pursued by different CA intervention strategies. In other words, different CA interventions manipulated a host of different contextual factors, which in turn affected subjects' sensory faculties. Although the reviewer would have naturally preferred to conduct subgroup analysis, search results turned up too few trials to analyse. Moreover, because some potential subgroups, such as 'setting', incorporate the same or similar components as other potential subgroups (e.g. 'television commercials'), results of a subgroup analysis would be extremely difficult to interpret at best and misleading at worst. While this review stratified CA intervention types on the basis of manipulated environmental stimuli (e.g. music type or lighting level), as discussed in Caldwell & Welton (2016) alternatively it is also possible to use candidate

middle-range theories identified and tested in a realist review to partition intervention components.

Moreover, the extent to which reporting of the primary outcome differed substantially in several studies emphasises how researchers chose to focus attention on different aspects of drinking-related behaviour. The reviewer excluded 5 studies from the meta-analysis because each study's reporting of alcohol consumption proved incommensurable with each other and with the 13 included trials. That is to say, non-meta-analysed studies did not measure alcohol consumption by volume but rather by some other scale (such as money spent in a bar).

2.4 Realist review of CA interventions in alcohol use

The aim of the realist review was to develop a programme theory for CA interventions in alcohol use and, in so doing, identify causal mechanisms that lead to behaviour change. Fifty included studies yielded were analysed and synthesised to generate the programme logic according to which at least one causal pathway for CA-influenced alcohol consumption operates. For alcohol abusers and individuals who are aware they exhibit signs of alcohol abuse, the first 3 stages of up to 6 stages of that causal pathway (leading to some consumption outcome) include 1) self-recognition of a problem, 2) an effort to find help, and 3) alcohol craving management and avoidance of situations that might induce alcohol cravings. Identified studies then implicated 3 additional stages—that may be used to explain the behaviour of all drinkers—leading to some outcome, including no alcohol consumption, moderate consumption, or overconsumption. These stages include 4) exposure to alcohol-related cues, 5) social comparisons made by an individual

to a group of people (e.g. a friend group), and 6) propositional reasoning. The last of these stages refers to the ultimate decision-making process into which both conscious and unconscious factors are channelled to produce an outcome behaviour.

Although the pathway is shown in this thesis to be linear, it is reasonable to assume that decision-making that determines alcohol consumption is dynamic and incorporates feedback mechanisms. For example, even after consumption begins an individual may be persuaded to drink more or less than they originally anticipated—reflecting changes in the presentation of alcohol-related cues or social comparisons. Moreover, there is also the influence of alcohol itself on an individual's physiological and mental conditions. To flesh out each of these 6 stages leading to an outcome behaviour of interest, the reviewer generated a relevant CMO configuration for each stage ultimately leading to some consumption outcome.

2.5 Taxonomy of theories and theoretical components related to CA interventions in alcohol use

The aim of the taxonomy was to organise relevant dual-process models of health-related behaviour and theoretical constructs involved in CA interventions in alcohol use, for the purpose of guiding future interventions. Fifty-one dual-process theories and 42 theoretical constructs were included in taxonomy construction. Twenty-one dual-process theories had been previously identified in the review of theories of health-related dual-process models of behaviour (chapter 4), and 46 dual-process theories were identified in the realist review of CA interventions in alcohol use (chapter 6). After de-duplication, the author conducted inductive thematic analysis to

identify, categorise, and where possible group the full range of CA intervention theoretical constructs specified in the included theories. As an initial step, included theories were coded for CA intervention theoretical constructs. Codes were subsequently refined throughout this process, checked for redundancy, and ordered in higher-abstraction categories on the basis of sharing some middle-range theory characteristics. The author confirmed saturation after all included theories were integrated into the taxonomy and generated a final list of theories and theory constructs. Upon considering the completed taxonomy, the author considered underused dual-process models identified in the review of theory, oriented each of them around at least one of the 6 stages identified in the causal pathway of alcohol consumption generated by the realist review, and—armed with this information—finally posited possible theoretical and empirical content for 7 CA intervention strategies into alcohol consumption.

3. Strengths and Limitations

3.1 Limitations of this thesis

Reproducibility. In the review of theory and realist review, coding and analysis of included documents would likely have been improved through the judgement of multiple independent coders. Given the rigorous systematic methods employed in this thesis' construction, it joins several recent qualitative reviews that have been constructed solely on the basis of existing literature (Tugwell et al. 2010; Anderson et al. 2011). However, subjecting these reviews to revision through a double-coding process would 1) potentially identify other relevant data in each of them, 2) refine their analyses, and 3) possibly identify relevant gaps in the literature and

the ‘conceptual genealogy’ that theories are born of (Bonell et al. 2013).

Potential for incommensurability. In the review of theory and realist review, at times the reviewer found it difficult to reconcile areas of disagreement among theories positing explanations for the same phenomena. Most theories drew from their own theoretical lexicons and yet ultimately proved commensurable in their underlying assumptions—but that was not always the case. Although thematic synthesis (for the review of theory) and iterative designing of CMO configurations (for the realist review) enabled the author to navigate among competing disagreements, there exist several opportunities for thoughtful critics to question the narrative synthesis and programme logic offered by the two reviews, respectively.

Search strategy. In all 3 reviews, difficulty in assigning labels related to ‘CA’ and ‘nudge’ could mean that this thesis unnecessarily excluded trials that would otherwise be of interest to it. In comparison, another reviewer examining a narrower range of CA intervention types—such as textual warnings on alcohol containers—could perhaps feel slightly more confident in her search strategy given the large number of terms associated with micro-environmental stimuli affecting a range of conscious and unconscious senses. Perhaps a more extensive search strategy would include even more terms related to specific sensory faculties, extending beyond the visual, auditory, gustatory, tactile, and olfactory senses.

Critical appraisal of empirical trials. In the Cochrane-style review and realist review, included trials demonstrated some degree of risk of bias given the nature of interventions involved. In 3 trials (Gueguen et al. 2004; Gueguen et al. 2008; Sobell 1986), for example, researchers did not

randomly allocate their selection of participants. Engels et al. (2009) posited a research protocol in which personnel were not blinded to the treatment groups, which may have affected their observation of research participants. Finally, the outcome assessment was not fully blinded to research participants in Sobell (1986). In the realist review, the reviewer interpreted for himself the extent to which a candidate theory 'measured up'—both in consistently and comprehensively explaining a logical chain of events and in explaining and predicting empirical findings. In this way, there existed a lens of interpretation between middle-range theory and empirical data, meaning there was not an explicit association between data quality and middle-range theory—thus limiting the opportunity for critical appraisal.

Heterogeneity among intervention strategies. Heterogeneity became most apparent in the Cochrane-style review, necessitating in part the incorporation of a realist review. Absent the realist review's substantiation of CA intervention mechanisms, it would be hard to justify the definition of CA intervention detailed in chapter 1. Results of the Cochrane-style review indicated that the statistically non-significant, moderate effect size of 0.63 was accompanied by a relatively large degree of heterogeneity in outcomes (I squared = 93% and p value = 0.07). Substantial heterogeneity usually indicates that the high degree of variability in review-level evidence may be attributed to large systematic differences in intervention types (e.g. CA interventions targeting sound level as distinct from CA interventions targeting drinking implements) instead of random chance. This matters because a high level of heterogeneity can provide compelling evidence for *not* trying to meta-analyse the results of several trials.

Generalisability. Across trials included in the Cochrane-style review and realist review, a disproportionate number of subjects were male, and the majority of studies were conducted in Western Europe and North America. In the Cochrane-style review, for example, among meta-analysed trials there was a greater number of male subjects (369 out of 600 total subjects, or 61.5 percent). And of the 11 studies included in the narrative synthesis, 3 conducted on samples recruited in The Netherlands, 3 in France, 3 in Canada, and 1 each in the UK and US. It is possible that trials conducted on a sample of individuals that better represented gender and geographic diversity would yield at least slightly different effects. Moreover, in the realist review, the reviewer chose to set his aperture to a narrow focus on CA interventions in alcohol consumption, a relatively small foray into literature surrounding both the relevant intervention types and outcomes. Consequently, this review offers a single perspective on the phenomenon in question, indicating in part there is a larger set of potentially relevant candidate theories to identify and test. Further research into this phenomenon should continue investigating the programme logic according to which CA interventions operate, focusing in particular on particular intervention strategies (e.g. manipulating auditory stimuli).

Subjective interpretation. As seen in the review of theory and realist review, the respective methodologies proceed in part from the premise that physical and social reality may only be indirectly known to humans and therefore constrain their choices, but the degree to which choices are constrained may vary widely. Given this understanding, any single interpretation of a theory or set of theories likely has limited ability to predict how a particular mechanism will be actualised in a wide range of contexts pertaining to a common phenomenon. Differing interpretations may therefore invite competing answers to, for example, whether an included

study is relevant to a research question; whether a candidate middle-range theory sufficiently accounts for demi-regularities observed across a set of relevant trials; and whether an element should be considered a mechanism or contextual factor in a given trial.

However, these limitations should be placed in context given at least 3 points. First, in this thesis 2 of the 3 reviews were conducted in line with publication standards (PRISMA for the Cochrane-style review; Wong et al. 2013 for the realist review) and thus met the widely accepted peer-review benchmarks of each review type. Second, transparency was demonstrated in the review of theory and realist review through the inclusion of every change made to their associated research protocols developed *a priori* (see Appendices 1.1 and 3.1) in view of the importance of ensuring that findings are replicable. Third, this thesis understands that the extent to which a particular theory and its associated constructs (including causal mechanisms) is successful depends in part on the theory's ability to answer a research question in the most parsimonious, consistent, and comprehensive fashion possible until such a time that the theory is disproven or another theory is demonstrated to yield greater causal power according to those same standards. The narrative synthesis and general model identified in the review of theory, as well as the programme logic mapped out in the realist review, are reported in such a fashion that they may continue to be iteratively revised as new included studies are added and deeper insights are plumbed.

3.2 Strengths of this thesis

Originality. This thesis contains the first review of theory to be conducted on dual-process models in health; the first Cochrane-style meta-analysis of CA interventions in alcohol use; the

first realist review to examine CA interventions in public health, much less CA interventions in alcohol use; and the first taxonomy generated by a review of theory and realist review. Together, these papers join a growing number of systematic reviews that attempt to deepen understanding of the causal mechanisms undergirding interventions instead of just focusing on the outcome effects that those interventions produce (Dixon et al. 2005). Greenhalgh and colleagues have noted how systematic reviews such as Cochrane-style meta-analyses and realist reviews may be used jointly to complement each other's strengths (2007). So too was this thesis partially born out of the need to improve outcomes as well as explain weak effects and significant heterogeneity in outcome effects for a meta-analysis on CA interventions in alcohol consumption in public drink settings (chapter 5).

Critical appraisal of theory. Both the review of theory and taxonomy draw deeply on recently developed critical appraisal criteria. The review of theory usefully considers the methods used in the Bonell et al. (2013) review of theory. The reviewer drew on 5 criteria of critical appraisal in judging each theory's internal logic, parsimony, and generalisability. In addition, the taxonomy represents an original contribution to the literature surrounding CA interventions in alcohol use in part because it stands up to critical appraisal criteria (see Michie et al. 2013). Namely, this taxonomy was made to be parsimonious and comprehensive in terms of all identified theoretical constructs, and to incorporate constructs that are non-redundant, well-defined, and organised in a logical manner.

Synthesis. The synthesis of the review of theory demonstrates how theory may be organised on the basis of shared epistemological assumptions in generating a general dual-process model of

health-related behaviour. Indeed, the ability of a synthesis to return again and again to a single unit of analysis—in this review's case, the unit was a hypothetical individual—represents an important organising principle in highlighting areas of agreement and disagreement for a group of included theories. Most notably, all identified theories could be nested within the general model as it is ordered on a higher plane of abstraction so as to incorporate all identified theoretical constructs touching on, for example, external cues, internal cues, regulating factors, and both unconscious and conscious decision-making processes.

Guidance for future CA interventions in alcohol consumption. This taxonomy generated by findings from the review of theory and realist review was intended in part to guide end-users (i.e. intervention designers) in thinking about extant and prospective causal mechanisms in CA interventions in alcohol use. To wit, because the review of theory identified 9 dual-process models that do not appear to form the theoretical grounding for any included alcohol interventions, and the realist review identified 6 CMO configurations undergirding a causal pathway to some alcohol consumption outcome, the author was able to articulate 7 novel theory-driven intervention strategies that may help to reduce alcohol intake. Moreover, such strategies are not exhaustive. It is possible to conceive of several more strategies using the taxonomy through, for example, the integration of different constructs of commensurate dual-process models that may generate new ideas for targeting the reduction of alcohol consumption.

Applicability to other CA interventions. As the thesis grounds a body of observed data in theories of behaviour underwritten by modified assumptions of rationality, it demonstrates how dual-process models draw on both conscious and unconscious reasoning (Systems 1 and 2) to explain

human action. As such, though it focuses on health-related behaviours in particular, most of the theories are generalisable and can be used to explain other behaviours as well. Indeed, some theories were developed to explain a wider class of behaviour—such as Prospect Theory (Tversky & Kahneman 1979), one of the foundational conceptualisations in behavioural economics. It is easy to imagine that some set of theories (e.g. 'situational norms') and theoretical constructs (e.g. the mechanism of 'social comparison') are actualised in other CA intervention strategies. In this way, identified mechanisms and contextual factors may generalise across multiple areas of public health, and even across policy domains (e.g. household energy policy, retirement savings, and more).

4. Implications for Future Research

4.1 Implications for systematic review methodology

There appears to be great scope and applicability for reviews of theory to sketch out the theoretical landscape within which operate multiple theories of behaviour change for some set of intervention strategies, such as CA interventions in alcohol consumption. Reviews of theory help interpret and map theories in such a fashion that conceptual evidence is understood in novel ways (Gough et al. 2012). Comparing theories on the basis of key concept definitions, hypothesised causal pathways, temporal sequencing, outcomes, and a range of contextual factors helps to distinguish significant areas of conceptual overlap and difference (Hardin 2008). It is likely that such reviews will grow in salience as qualitative reviews interested in theory as a unit of analysis investigate how multiple theories explain the same phenomenon.

This thesis also underlines the potential for bringing together Cochrane-style and realist reviews, given their respective complementary strengths (Greenhalgh et al. 2007). Heterogeneity among intervention strategies identified in the Cochrane-style review is partially explained through the identification of CMO configurations identified in the realist review. Namely, the realist synthesis helps to buttress the causal logic by which all alcohol-related CA intervention types are grouped together—bringing together such diverse intervention strategies as those affecting lighting level to drinking implement size and shape. Most importantly, some subset of candidate middle-range theories help to explain when, for whom, and under what circumstances mechanisms are or are not actualised in alcohol-related CA interventions, contingent on contextual factors. As such these complementary reviews join others in eliciting the potential for qualitative reviews considering different units of analysis (intervention effect sizes and theory, respectively) to 'speak to one another'.

To the author's knowledge, this thesis represents the first attempt to synthesise results from a review of theory and a realist review into a qualitative taxonomy. Thus, the taxonomy provides a foundational step toward reporting and organising the conceptual frameworks on which CA interventions in alcohol use rely. A large set of biases and heuristics are relevant to alcohol consumption, and their manipulation by choice architects in CA intervention strategies is qualitatively enhanced through the careful identification and organisation theories and theoretical constructs that appear to govern consumption. This taxonomy represents one such attempt at identification and organisation and is reported in an easy-to-understand matrix framework that may aid intervention designers in integrating both extant relevant intervention strategies not identified in this thesis as well as future strategies.

4.2 Implications for empirical study

This thesis joins other research programmes that are, at one time, 1) enhancing the database of evidence for the efficacy and effectiveness of CA intervention trials in public health and 2) investigating what role different psychological factors play in generating individual results.
It grew out of a need to more closely attend to the evidence generated by CA intervention trials in alcohol use. Evidence drawn from the effect sizes of individual trials of CA interventions in alcohol use in public drink settings may appear to qualify the extent to which intervention designers should rely on such interventions to reduce alcohol consumption. Surely there are other CA intervention strategies in public health that may benefit from such attention (Hollands et al. 2013).

The realist review was generated through the identification of individual CMO configurations and testing of candidate middle-range theories, the net result of which was a glimpse into a programme logic undergirding CA interventions in alcohol use. Such a programme logic appears to proceed through 6 stages of pre-consumption processing of internal, external, and regulating factors. Identified CMO configurations at each stage invite further investigation through 1) primary trials directly testing contextual factors and mechanisms and 2) additional secondary analysis that might reveal new demi-regularities that may be used to test both the candidate middle-range theories identified in this review as well as new candidate theories thus far unidentified.

4.3 Implications for theoretical study

Although this thesis is premised on a precise definition of CA interventions in alcohol use, future research may well test the extent to which definitional criteria shape the body of strategies called CA interventions. As demonstrated in this thesis—through the refinement of the Hollands et al. (2013) definition—considering and reconsidering basic conceptual frameworks (like definitions) offers a rich variety of forays into the theoretical landscape surrounding both alcohol consumption and CA interventions intended to reduce it. This matters because, as seen in the Cochrane-style review and realist review, specifying the basic conceptualisation of an intervention strategy naturally shapes search strategies as well as the body of identified studies they collect—which has important implications for generating effect sizes and positing causal pathways between interventions and effects.

Moreover, many of the identified causal mechanisms are also likely to drive behaviour in at least a few other CA intervention strategies across public health and other policy domains. The taxonomy offers one of the first organising frameworks of extant theoretical and empirical evidence regarding CA interventions in a specified public health domain. It thus gestures to significant dual-process theories and theoretical constructs that may be relevant to other health-related behaviour change interventions. And it provides some measure of guidance for researchers to continue investigating how alcohol consumption may be reduced through consideration of a whole host of contextual factors and causal mechanisms driven by an individual's physical and social environment, internal cues, as well as regulating factors that mediate between the two.

5. CONCLUSIONS

Even though it is expressly intended to manipulate individual behaviour by targeting micro-environmental cues and incentives, the CA approach is subject to all the 'usual' criticisms of paternalism as well as criticisms from an efficacy standpoint. First, critics may object to the strong assumptions undergirding the CA approach from the point of view of an individual's own welfare, e.g. individuals do not behave uniformly in the same micro-environment. Second, public health critics in particular question if CA interventions actually represent the most effective intervention strategy available to policymakers intent on affecting individual health-related behaviour. While these critiques are reasonable, this thesis chooses to bracket them and instead focus on precisely specifying what alcohol-related CA intervention strategies entail (both theoretically and empirically) for the twin objectives of studying and improving them.

Refining the simplistic assumption that individuals act as 'rational agents' with consistent preferences across time and environments, dual-process models indicate that a wide range of physical, internal, and self-regulating factors help shape an individual's conscious and unconscious beliefs and attitudes. As revealed in this thesis, such models may be harnessed in discrete CA intervention strategies to alter observed patterns of behaviour in a variety of contexts and result in both intended and unintended consequences vis-à-vis the outcome of alcohol intake reduction. However, if such strategies are to increase in salience, it is important first to acknowledge the limited extent to which they have been proven effective thus far—as this thesis demonstrates—and second to consider how relevant causal mechanisms for behaviour change in reducing alcohol intake should be actualised in theory-driven CA intervention strategies.

References

Aarts, H., & Dijksterhuis, A. (2003). The silence of the library: environment, situational norm, and social behavior. Journal of personality and social psychology, 84(1), 18.

Abar, C. C. (2012). Examining the relationship between parenting types and patterns of student alcohol-related behavior during the transition to college. Psychology of Addictive Behaviors, 26, 20–29.

Adams, C. E., Benitez, L., Kinsaul, J., McVay, M., Barbry, A., Thibodeaux, A., et al. (2013). Effects of brief mindfulness instructions on reactions to body image stimuli among female smokers: an experimental study. Nicotine & Tobacco Research, 15(2), 376e384.

Agyapong, V. I. O., Mrklas, K., Suen, V. Y. M., Rose, M. S., Jahn, M., Gladue, I., ... & Greenshaw, A. (2015). Supportive text messages to reduce mood symptoms and problem drinking in patients with primary depression or alcohol use disorder: protocol for an implementation research study. *JMIR research protocols*, *4*(2).

Ajzen I. *Behavioral interventions based on the Theory of Planned Behavior*. 2006. Available at: www.people.umass .edu/aizen/pdf/tpb.intervention.pdf

Ajzen, I. (1991). The theory of planned behaviour. Organisational Behavior and Human Decision Processes, 50, 179-211.

Ajzen, I., & Fishbein, M. (1975). Belief, attitude, intention and behavior: An introduction to theory and research.

Albarracin, D., Gillette, J. C., Earl, A. N., Glasman, L. R., Durantini, M. R., & Ho, M.-H. (2005). A test of major assumptions about behaviour change: A comprehensive look at the effects of passive and active HIV-prevention interventions since the beginning of the epidemic. Psychological Bulletin, 131, 856 – 897.

American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. Washington, DC: American Psychiatric Association, 2013.

Anderson LM, Petticrew M, Rehfuess E, Armstrong R, Ueffing E, Baker P, Francis D, Tugwell P: Using logic models to capture complexity in systematic reviews. Res Synth Methods 2011, 2:33–42.

Anderson, P. (2009). Is it time to ban alcohol advertising? Clinical Medicine, 9(2), 121_124.

Andrews G., Issikadis C., Sanderson K., Corry J., Lapsley H. Utilising survey data to inform public policy: comparison of the cost-effectiveness of treatment of ten mental disorders. *Br J Psychiatry* 2004; 184: 526–33.

Antoni, M. H. (2003). Stress management intervention for women with breast cancer. Washington, D.C.: American Psychological Association.

Areni CS, Kim D. The influence of background music on shopping behavior: Classical versus top-forty music in a wine store. *Int J Res Marketing.* 1993;11:117–125.

Astbury, B., & Leeuw, F. L. (2010). Unpacking black boxes: mechanisms and theory building in evaluation. *American journal of evaluation*, *31*(3), 363-381.

Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., ... & Rossow, I. (2010). Alcohol: no ordinary commodity–research and public policy (2nd Edition). Oxford: Oxford University Press.

Babor T., Grant M. Project on Identification and Management of Alcohol-Related Problems Report on Phase II: A Randomized Clinical Trial of Brief Interventions in Primary Care. Geneva: World Health Organization; 1992.

Babor T. F., Higgins-Biddle J. C. Brief Intervention for Hazardous and Harmful Drinking: A Manual for Use in Primary Care. Geneva: World Health Organization; 2001.

Babor T. F., Higgins-Biddle J. C., Saunders J. B., Montiero M. G. The Alcohol Use Identification Test: Guidelines for Use in Primary Care, 2nd edn. Geneva, Switzerland: World Health Organization; 2001.

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. Clinical psychology: Science and practice, 10(2), 125-143.

Baker, T. B., Piper, M. E., Fiore, M. C., McCarthy, D. E., & Majeskie, M. R. (2004). Addiction motivation reformulated: An affective processing model of negative reinforce- ment. Psychological Review, 111, 33–51.

Bambra C: Real world reviews: a beginner's guide to undertaking systematic reviews of public health policy interventions. J Epidemiol Community Health 2011, 65:14–19.

Banaji, M. R., & Hardin, C. D. (1996). Automatic stereotyping. Psychological Science, 7, 136 – 141.

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational behavior and human decision processes*, *50*(2), 248-287.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191.

Bargh, J. A., & Barndollar, K. (1996). Automaticity in action: The unconscious as a repository of chronic goals and motives. In P. M. Gollwitzer & J. A. Bargh (Eds.), The psychology of action: Linking cognition and motivation to behavior (pp. 457– 481) New York: Guilford Press.

Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. American Psychologist, 54, 462– 479.

Bargh, J. A., Gollwitzer, P. M., Lee-Chai, A., Barndollar, K., & Tro¨tschel, R. (2001). The automated will: Nonconscious activation and pursuit of behavioral goals. Journal of Personality and Social Psychology, 81, 1014 –1027.

Bargh, J.A., Morsella, E. (2009). Unconscious behavioural guidance systems. In: Agnew, C., Graziano, W., Kelly, J., editors. Then a miracle occurs: Focusing on behaviour in social psychological theory and research. New York: Oxford University Press.

Batel, P., Pessione, F., Bouvier, A. M., & Rueff, B. (1995). Prompting alcoholics to be referred to an alcohol clinic: the effectiveness of a simple letter. *Addiction*, *90*(6), 811-814.

Baum WM, Rachlin HC. 1969. Choice as time allocation. J. Exp. Anal. Behav. 12:861–74.

Baumann S., Gaertner B., Schnuerer I., Bischof G., John U., Freyer-Adam J. How well do TTM measures work among a sample of individuals with unhealthy alcohol use that is characterized by low readiness to change? *Psychol Addict Behav* 2013; 27: 573–83.

Baumeister R. F., Heatherton T. F., Tice D. M. *Losing Control: How and Why People Fail at Self-Regulation*. San Diego, CA: Academic Press; 1994.

Baumeister R.F., Schmeichel B.J., Vohs K.D. Self-regulation and the executive function. The Self as controlling agent. In: Kruglanski A. W., Higgins E. T., editors. *Social Psychology: Handbook of Basic Principles*. New York: Guilford Press; 2007, pp. 516–39.

Baxter S, Allmark P: Reducing the time-lag between onset of chest pain and seeking professional medical help: a theory-based review. BMC Med Res Methodol 2013, 13:15.

Baxter S, Killoran A, Kelly MP, Goyder E: Synthesizing diverse evidence: the use of primary qualitative data analysis methods and logic models in public health reviews. Public Health 2010, 124:99–106.

Benton D. Portion size: what we know and what we need to know. Crit Rev Food Sci Nutr. 2015;55(7):988–1004.

Bickel WK, Jarmolowicz DP, Mueller ET, Gatchalian KM. 2011. The behavioral economics and neuroeco- nomics of reinforcer pathologies: implications for etiology and treatment of addiction. Curr. Psychiatry Rep. 13:406–15.

Bickel, W. K., Johnson, M. W., Koffarnus, M. N., MacKillop, J., & Murphy, J. G. (2014). The behavioral economics of substance use disorders: reinforcement pathologies and their repair. *Annual review of clinical psychology*, *10*, 641.

Bien T. H., Miller W. R., Tonigan S. J. Brief interventions for alcohol problems: a review. Addiction 1993; 88: 315–36.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., ... & Devins, G. (2004). Mindfulness: A proposed operational definition. Clinical psychology: Science and practice, 11(3), 230-241.

Blankenship, K. M., Friedman, S. R., Dworkin, S., & Mantell, J. E. (2006). Structural interventions: concepts, challenges and opportunities for research.*Journal of Urban Health*, *83*(1), 59-72.

Blankers, M., Koeter, M. W., & Schippers, G. M. (2013). Baseline predictors of treatment outcome in Internet-based alcohol interventions: a recursive partitioning analysis alongside a randomized trial. *BMC public health*, *13*(1), 1.

Blankers, M., Koeter, M. W., & Schippers, G. M. (2011). Internet therapy versus internet self-help versus no treatment for problematic alcohol use: A randomized controlled trial. *Journal of Consulting and Clinical Psychology*,*79*(3), 330.

Blumenthal-Barby, J. S., & Krieger, H. (2015). Cognitive biases and heuristics in medical decision making: a critical review using a systematic search strategy. *Medical Decision Making*, *35*(4), 539-557.

Bonnefoy, J., Morgan, A., Kelly, M.P., Butt, J., Bergman, V., with P. Tugwell, V. Robinson, M. Exworthy, J. Mackenbach, J. Popay, C. Pope, T. Narayan, L. Myer, S. Simpson, T. Houweling, L. Jadue (2007). Constructing the evidence base on the social determinants of health: A guide. Report to the World Health Organization Commission on the Social Determinants of Health, from Measurement and Evidence Knowledge Network.

Bonell C, Fletcher A, Morton M, Lorenc T. 'Realist Randomised Controlled Trials': a new approach to evaluating complex public health interventions. Soc Sci Med. 2012;75(12):2299–306.

Bonell C, Jamal F, Harden A, Wells H, Parry W, Fletcher A, Petticrew M, Thomas J, Whitehead M, Campbell R, Murphy S, Moore L: Systematic review of the effects of schools and school environment interventions on health: evidence mapping and synthesis. Public Health Res 2013, 1. doi:10.3310/phr01010.

Borsari B, Carey KB. Descriptive and injunctive norms in college drinking: A meta-analytic integration. Journal of Studies on Alcohol. 2003; 64:331–341.

Bott K., Rumpf H.-J., Bischof G., Meyer C., Hapke U., John U. German version of the alcohol abstinence self-efficacy scale (AASE-G). In: Glöckner-Rist A., Rist F., Küfner H., editors. *Elektronisches Handbuch Zu Erhebungsinstrumenten Im Suchtbereich (EHES) Version 300* Mannheim: Zentrum für Umfragen, Methoden und Analysen; 2003.

Brennan, I., Moore, S. C., Byrne, E., & Murphy, S. (2011). Interventions for disorder and severe intoxication in and around licensed premises, 1989–2009.*Addiction*, *106*(4), 706-713.

Brotherstone H, Miles A, Robb KA, Atkin W, Wardle J (2006). The impact of illustrations on public understanding of the aim of cancer screening. Patient Education and Counseling; 63:328–35.

Brown, B. B. (1968). *Delphi process: a methodology used for the elicitation of opinions of experts* (No. RAND-P-3925). RAND Corp Santa Monica CA.

Caldwell, D. M., & Welton, N. J. (2016). Approaches for synthesising complex mental health interventions in meta-analysis. *Evidence Based Mental Health*, *19*(1), ebmental-2015-102275.

Calhoun, G., & Morse, W. C. (1977). Self-concept and self-esteem: Another perspective. *Psychology in the Schools*.

Cantor, N., Mischel, W., 1979. Prototypicality and personality: effects on free recall and personality impressions. J. Res. Pers. 13, 187–205.

Campbell, M., Egan, M., Lorenc, T., Bond, L., Popham, F., Fenton, C., & Benzeval, M. (2014). Considering methodological options for reviews of theory: illustrated by a review of theories linking income and health.*Systematic reviews*, *3*(1), 1.

Campbell R, Pound P, Morgan M, Daker-White G, Britten N, Pill R, Yardley L, Pope C, Donovan J: Evaluating meta-ethnography: systematic analysis and synthesis of qualitative research. Health Technol Assess 2011, 15:43.

Carey, K. B., Scott-Sheldon, L. A. J., Elliott, J. C., Bolles, J. R., & Carey, M. P. (2010). Computer-delivered interventions to reduce college stu- dent drinking: A meta-analysis. *Addiction, 104,* 1807–1819.

Carroll, M. E., Anker, J. J., & Perry, J. L. (2009). Modeling risk factors for nicotine and other drug abuse in the preclinical laboratory. Drug and Alcohol Dependence, 104, 70 –78.

Carver, C. S., & Scheier, M. F. (1982). Control theory: A useful conceptual framework for personality–social, clinical, and health psychology.*Psychological bulletin*, *92*(1), 111.

Caton CL, Dominguez B, Schanzer B, Hasin DS, Shrout PE, Felix A, et al. (2005). Risk factors for long-term homelessness: findings from a longitudinal study of first-time homeless single adults. *American Journal of Public Health*;95(10):1753-9.

Chafetz M., Blane H., Abram H., Golner J., Lacy E., McCourt W. et al. Establishing treatment relations with alcoholics. J Nerv Ment Dis 1962; 134: 395–409.

Chan, K. K., Neighbors, C., Gilson, M., Larimer, M. E., & Marlatt, G. A. (2007). Epidemiological trends in drinking by age and gender: Providing normative feedback to adults. *Addictive Behaviors, 32,* 967–976.

Chartrand TL, Bargh JA. (1999) The chameleon effect: the perception–behavior link and social interaction. *J Pers Soc Psychol* 76:893–910.

Chassin, L., Tetzloff, C., Hershey, M., 1985. Self-image and social-image factors in adolescent alcohol use. J. Stud. Alcohol 46, 39–47.

Chevalier, M., 1975. Increase in sales due to in-store display. Journal of Marketing Research 12, 426-431.

Chun, M. M., Golomb, J. D., & Turk-Browne, N. B. (2011). A taxonomy of external and internal attention. *Annu Rev Psychol, 62*, 73-101.

Chung SH, Herrnstein RJ. 1967. Choice and delay of reinforcement. J. Exp. Anal. Behav. 10:67–74.

Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places. *Journal of personality and social psychology*, *58*(6), 1015.

Clegg, S. (2005). Evidence-based practice in educational research: A critical realist critique of systematic review. British journal of sociology of education,26(3), 415-428.

Cleveland, M. J., Lanza, S., Ray, A., Turrisi, R., & Mallett, K. (2012). Transitions in first-year college student drinking behaviors: Does pre-college drinking moderate the effects of parent- and peer- based intervention components? Psychology of Addictive Behav- iors, 26, 440–450.

Collins DJ, Lapsley HM (2008). The costs of tobacco alcohol and illicit drug abuse to Australian Society in 2004/5. National Drug Strategy Monograph Series No. 64.

Conger, J. J. (1956). Reinforcement theory and the dynamics of alcoholism. Quarterly Journal of Studies on Alcohol, 18, 296e305.

Conrod PJ, Castellanos-Ryan N, Mackie C. Long-term effects of a personality-targeted intervention to reduce alcohol use in adolescents. Journal of Consulting and Clinical Psychology. 2011; 79:296– 306. [PubMed: 21500886]

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: a motivational model of alcohol use. Journal of Personality and Social Psychology, 69, 990-1005.

Cox WM, Klinger E. A motivational model of alcohol use. Journal of Abnormal Psychology. 1988; 97:168–180.

Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. (2008) Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ*. 337: a1655.

Crabtree B, Miller WL. Using codes and code manuals: A template organizing style of interpretation. In: Crabtree BF MW, Miller WL, editors. Doing Qualitative Research, vol. 2nd. Thousand Oaks: Sage; 1999. p. 163–78.

Croxson, B., Propper, C., & Perkins, A. (2001). Do doctors respond to financial incentives? UK family doctors and the GP fundholder scheme. *Journal of Public Economics*, *79*(2), 375-398.

Cunradi CB, Caetano R, Schafer J. Alcohol-related problems, drug use, and male intimate partner violence severity among US couples (2002). *Alcoholism: Clinical and Experimental Research*;26:493-500.

Cunningham J. A., Breslin F. C. Only one in three people with alcohol abuse or dependence ever seek treatment. *Addict Behav* 2004; 29: 221–3.

Cunningham, J. A., Gulliver, A., Farrer, L., Bennett, K., & Carron-Arthur, B. (2014). Internet interventions for mental health and addictions: current findings and future directions. *Current psychiatry reports*, *16*(12), 1-5.

Cunningham, J. A., Neighbors, C., Wild, C., & Humphreys, K. (2012). Ultra-brief intervention for problem drinkers: results from a randomized controlled trial. *PloS one*, *7*(10), e48003.

Curhan, R.C., 1974. The effects of merchandising and temporary promotional activities on the sales of fresh fruits and vegetables in supermarkets. Journal of Marketing Research 11, 286-294.

Cyders MA, Flory K, Rainer S, Smith GT. The role of personality dispositions to risky behavior in predicting first-year college drinking. Addiction. 2009; 104:193–202.

Dahlgren, G., & Whitehead, M. (1991) Policies and strategies to promote social equity in health. Stockholm: Stockholm Institute of Future Studies.

Dansereau DF, Simpson DD (2009). A picture is worth a thousand words: The case for graphic representations. Professional Psychology: Research and Practice; 40(1):104–10.

Darnton, A. (2008). Reference report: An overview of behaviour change models and their uses. *UK: Government Social Research Behaviour Change Knowledge Review*.
Das P, Horton R. Rethinking our approach to physical activity. Lancet 2012;380(9838):189–90.
Davies D. L. Normal drinking in recovered alcohol addicts. Q J Stud Alcohol 1962; 23: 94–104.
Dayan, E., & Bar-Hillel, M. (2011). Nudge to nobesity II: Menu positions influence food orders. Judgment and Decision Making, 6(4), 333-342.
Davison, K.K., & Lawson C.T. (2006). Do attributes of the physical environment influence children's physical activity? A review of the literature. International Journal of Behavioral Nutrition and Physical Activity, 3, 19. #
Deatrick, J., Alderfer, M., Knafl, G., & Knafl, K. (2006). Identifying patterns of managing chronic conditions. In D. R. Crane &, ed. E. S. Marshall (Eds., ed.),Handbook of families and health: Interdisciplinary perspectives (pp. 62–80). Thousand Oaks, CA: Sage.
DellaVigna, S. (2009). Psychology and economics: Evidence from the field. *Journal of Economic literature*, *47*(2), 315-372.
DeMartini KS, Carey KB. The role of anxiety sensitivity and drinking motives in predicting alcohol use: A critical review. Clinical Psychology Review. 2011; 31:169–177.
Department of Health (2010). New NHS Campaign Reveals Unseen Alcohol Damage. http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/MediaCentre/Pressreleasesarchive/DH_111622 2010.
De Vet, E., de Ridder, D.T.D., & de Wit J.B.F. (2011) Environmental correlates of physical activity and dietary behaviours among young people: a systematic review of reviews. Obesity Reviews, 12(5), 130-42.
de Wildt, W. (2000). *Achilles leefstijl* 1 [Achilles Lifestyle 1]. Zeist, the Netherlands: Cure & Care.
Diepeveen, S., Ling, T., Suhrcke, M., Roland, M. and Marteau, T. M. (2013) 'Public acceptability of government intervention to change health-related behaviours: a systematic review and narrative synthesis', *BMC Public Health*, 13(1), p. 756.
Dijksterhuis A, Smith PK, Van Baaren RB, et al. 2005. The unconscious consumer: Effects of environment on consumer behavior. *J Cons Psychol*.;15:193–202.
Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). Brief alcohol screening and intervention for college students (BASICS): A harm reduction approach. New York, NY: Guilford Press.
Dixon-Woods M, Agarwal S, Jones D, Young B, Sutton A (2005). Synthesising qualitative and quantitative evidence: a review of possible methods. J Health Serv Res Policy, 10:45-53.
Dolan, P., Hallsworth, M., Halpern, D., King, D., & Vlaev, I. (2010). MINDSPACE: influencing behaviour through public policy. Cabinet Office.
Drinkaware. Social and personal problems related to alcohol. Accessed online at https://www.drinkaware.co.uk/research/data/consequences/ on 15 Jul 2015.
Eberl C, Wiers RW, Pawelczack S, Rinck M, Becker ES, Lindenmeyer J: Approach bias modification in alcohol dependence: do clinical effects replicate and for whom does it work best? Dev Cogn Neurosci 2013, 4:38–51.
Edwards, G., Orford, J., Egert, S., Guthrie, S., Hawker, A., Hensman, C., ... & Taylor, C. (1977). Alcoholism: a controlled trial of" treatment" and" advice". *Journal of studies on alcohol*, *38*(5), 1004-1031.
Egbert AM, Reed JS, Powell BJ, Liskow BI, Liese BS (1985). Alcoholics who drink mouthwash:

the spectrum of non-beverage alcohol use. *Journal of Studies on Alcohol*;46(6):473-81.
Elster, J. (1986). *Rational choice*. NYU Press.
Engels, R. C., Hermans, R., Van Baaren, R. B., Hollenstein, T., & Bot, S. M. (2009). Alcohol portrayal on television affects actual drinking behaviour. *Alcohol and alcoholism*, agp003.
Engels, R. C., Slettenhaar, G., Ter Bogt, T., & Scholte, R. H. (2011). Effect of alcohol references in music on alcohol consumption in public drinking places.*The American Journal on Addictions*, *20*(6), 530-534.
English L, Lasschuijt M, Keller KL. Mechanisms of the portion size effect. What is known and where do we go from here? Appetite. 2015;88:39–49.
Evans, D. (2003). Hierarchy of evidence: a framework for ranking evidence evaluating healthcare interventions. Journal of clinical nursing, 12(1), 77-84.
Everett S, Snuth R, Tribble J. (1998). Tobacco and alcohol use in top-grossing American films. J Community Health 23:317–24.
Faith, M.S., Fontaine, K.R., Baskin, M.L., & Allison, D.B. (2007). Toward the Reduction of Population Obesity: Macrolevel Environmental Approaches to the Problems of Food, Eating, and Obesity. Psychological Bulletin, 133(2), 205-226
Fazio, R. H. (1990). Multiple processes by which attitudes guide behavior: The MODE model as an integrative framework. Advances in experimental social psychology, 23, 75-109.
Finfgeld-Connett, D. (2008). Web-based treatment for rural women with alcohol problems: preliminary findings. *Computers, informatics, nursing: CIN*,*27*(6), 345-353.
Fein, S., & Spencer, S. J. (1997). Prejudice as self-image maintenance: Affirming the self through derogating others. *Journal of personality and Social Psychology*, *73*(1), 31.
Fenaughty, A.M., & MacKinnon, D.P. (1993). Immediate effects of the Arizona alcohol warning poster. Journal of Public Policy & Marketing, 69–77.
Ferguson, M. J., Bargh, J. A., & Nayak, D. A. (2005). After-effects: How 528 MOSS AND ALBERY automatic evaluations influence the interpretation of subsequent, unrelated stimuli. Journal of Experimental Social Psychology, 41, 182–191.
Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7,* 117–140.
Field, M., Eastwood, B., 2005. Experimental manipulation of attentional bias increases the motivation to drink alcohol. Psychopharmacology (Berl.) 183, 350–357.
Fillmore, M. T., Vogel-Sprott, M., & Gavrilescu, D. (1999). Alcohol effects on intentional behavior: Dissociating controlled and automatic influences. Experimental and Clinical Psychopharmacology, 7, 372–378.
Fleming MF, Barry KL, Manwell LB, Johnson K, London R: Brief physician advice for problem alcohol drinkers. JAMA 1997; 277(13):1039-1044.
Ford, J. A., Wong, G., Jones, A. P., & Steel, N. (2016). Access to primary care for socioeconomically disadvantaged older people in rural areas: a realist review. BMJ open, 6(5), e010652.
Forsyth, A. J. (2008). Banning glassware from nightclubs in Glasgow (Scotland): observed impacts, compliance and patron's views. *Alcohol and alcoholism*, *43*(1), 111-117.
Frank, R.E., Massy, W.F., 1970. Shelf position and space effects on sales. Journal of Marketing Research 7, 59-66.
Franken, I.H.A., 2003. Drug craving and addiction: integrating psychological and neuropsychopharmacological approaches. Prog. Neuropsychopharmacol. Biol. Psychiatry 27, 563–579.

Freemantle N, Gill P, Godfrey C, Long A, Richards C, Sheldon T (1993). Brief interventions for alcohol use. Effective Healthcare Bulletin 7 November, Nuffield Institute for Health, University of Leeds, Centre for Health Economics, University of York, Royal College of Physicians London.

Freyer J., Bott K., Riedel J., Wedler B., Meyer C., Rumpf H. J. *et al*. Psychometric properties of the 'Processes of Change' scale for alcohol misuse and its short form (POC-20). *Addict Behav* 2006; 31: 821–32.

Freyer-Adam, J., Baumann, S., Schnuerer, I., Haberecht, K., Bischof, G., John, U., & Gaertner, B. (2014). Does stage tailoring matter in brief alcohol interventions for job-seekers? A randomized controlled trial. *Addiction*,*109*(11), 1845-1856.

Garlington, W.K. & Dericco, D.A. (1977), The effect of modelling on drinking rate, Journal of Applied Behaviour Analysis, 10, pp. 207-211.

Gawronski, B., & Bodenhausen, G.V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. Psychological Bulletin, 132, 692-731.

Geier AB, Rozin P, Doros G (2006). A new heuristic that helps explain the effect of portion size on food Intake. *Psychological Science*; 17(6):521–5.

Gerrard, M., Gibbons, F.X., Reis-Bergan, M., Trudeau, L., Vande Lune, L.S., Buunk, B., 2002. Inhibitory effects of drinker and nondrinker prototypes on adolescent alcohol consumption. Health Psychol. 21, 601–609.

Gibbons, F.X., Gerrard, M., 1995. Predicting young adults' health risk behavior. J. Pers. Soc. Psychol. 69, 505–517.

Gibbons, F. X., Gerrard, M., & Lane, D. J. (2003). A social reaction model of adolescent health risk. *Social psychological foundations of health and illness*, 107-136.

Given (2008), Typological Analysis, The Sage Encyclopedia of Qualitative Research Methods, The SAGE Encyclopedia of Qualitative Research Methods.

Gladwin, S. C., & England, M. M. (2011). U.S. Patent No. 7,953,937. Washington, DC: U.S. Patent and Trademark Office.

Goldberg, L. (1943). Quantitative studies on alcohol tolerance in man. Acta Physiologica Scandinavica, 5(Suppl 16), 1–126.

Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European review of social psychology*, *4*(1), 141-185.

Gough D, Thomas J, Oliver S: Clarifying differences between review designs and methods. Syst Rev 2012, 1:28.

Greenhalgh, T., & Peacock, R. (2005). Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources.*Bmj*, *331*(7524), 1064-1065.

Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. (2004). Diffusion of innovations in service organisations: systematic literature review and recommendations for future research. Milbank Q, 82:581-629.

Guéguen, N., Héléne, L.G., & Jacob, C. (2004). Sound level of background music and alcohol consumption: an empirical evaluation 1. Perceptual and motor skills, 99(1), 34-38.

Guéguen, N., Jacob, C., Le Guellec, H., Morineau, T., & Lourel, M. (2008). Sound level of environmental music and drinking behavior: a field experiment with beer drinkers. *Alcoholism: clinical and experimental research*, *32*(10), 1795-1798.

Haig A, Dozier M. (2003) BEME Guide No 3: Systematic searching for evidence in medical

education – Part 2: Constructing searches. *Med Teach*. 25(5) 463-84.
Hall, P. A. and Marteau, T. M. (2014) 'Executive function in the context of chronic disease prevention: Theory, research and practice', *Preventive Medicine*, [online] Available from:http://www.sciencedirect.com/science/article/pii/S0091743514002497.
Haines, M.P. and Spear, S.F. (1996). Changing the perception of the norm: A strategy to decrease binge drinking among college students. Journal of American College Health, 43, 134- 140.
Han, T., Alexander, M., Niggebrugge, A., Hollands, G. J. and Marteau, T. M. (2014) 'Impact of tobacco outlet density and proximity on smoking cessation: A longitudinal observational study in two English cities', *Health & Place*, 27, pp. 45–50.
Hannöver W., Rumpf H. J., Meyer C., Hapke U., John U. 95. German version of the alcohol decisional balance scale (ADBS-G). In: Glöckner-Rist A., Rist F., Küfner H., editors. *Elektronisches Handbuch Zu Erhebungsinstrumenten Im Suchtbereich (EHES) Version 300.*Mannheim: Zentrum für Umfragen, Methoden und Analysen; 2003.
Hasin DS, Stinson FS, Ogburn E, Grant BF. Prevalence, correlates, disability, and comorbidity of *DSM-IV* alcohol abuse and dependence in the United States: Results from the national epidemiologic survey on alcohol and related conditions. Archives of General Psychiatry 2007;6:830–842.
Heather N. Breaking new ground in the study and practice of alcohol brief interventions. Drug Alcohol Rev 2010; 29: 584–8.
Heather, N., Tebbutt, J. S., Mattick, R. P., & Zamir, R. (1993). Develop- ment of a scale for measuring impaired control over alcohol consump- tion: A preliminary report. *Journal of Studies on Alcohol, 54,* 700–709.
Herman CP, Polivy J, Pliner P, Vartanian LR. Mechanisms underlying the portion-size effect. Physiology & Behavior 2015;144:129–36.
Herrnstein RJ. 1961. Relative and absolute strength of response as a function of frequency of reinforcement. J. Exp. Anal. Behav. 4:267–72.
Hester R. K., Delaney H. D. Behavioral self-control program for Windows: results of a controlled clinical trial. *J Consult Clin Psychol* 1997; 65: 686–93.
Hibbs JR, Benner L, Klugman L, Spencer R, Macchia I, Mellinger A, et al. (1994). Mortality in a cohort of homeless adults in Philadelphia. *New England Journal of Medicine*; 331(5):304-9.
Higgins, J. P. and Green, S. (Eds.). (2011). *Cochrane handbook for systematic reviews of interventions* (Vol. 5). Chichester: Wiley-Blackwell.
Higgins, S. T., Heil, S. H., & Lussier, J. P. (2004). Clinical implications of reinforcement as a determinant of substance use disorders. Annual Review of Psychology, 55, 15.1–15.31.
Hillman (2003). Alcohol related brain damage on the rise. Alcohol Alert Institute of Alcohol Studies London:16-8
Hockley I (2008). The picture superiority effect in associative recognition. Memory and Cognition;36:1351–9.
Hoffmann, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., Michie, S. (2014). Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *Bmj*, *348*, g1687.
Hofmann, W., Friese, M., & Wiers, R. W. (2008). Impulsive versus reflective influences on health behaviour: A theoretical framework and empirical review. Health Psychology Review, 2, 111-137.

Hofmeyr, A., Ainslie, G., Charlton, R., & Ross, D. (2011). The relationship between addiction and reward bundling: An experiment comparing smokers and non-smokers. *Addiction, 106,* 402–409.

Hogg, M. A. (2007). Uncertainty–identity theory. *Advances in experimental social psychology*, *39*, 69-126.

Hollands, G. J., Shemilt, I., Marteau, T. M., Jebb, S. A., Lewis, H. B., Wei, Y., ... & Ogilvie, D. (2015). Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. *The Cochrane Library*.

Hollands, Shemilt, I., Marteau, T.M., Jebb, S.A., Lewis, Wei, Higgins, and Ogilvie, D. (2014b). "Presentation of aversive visual images in health communication or changing health behaviour" (Protocol).

Hollands, G.J., Shemilt, I., Marteau, T.M., Jebb, S.A., Kelly, M.P., Nakamura, R., Suhrcke, M., Ogilvie, D. (2012). "Unfudging nudging: identifying evidence for poorly-specified interventions in public health", Poster, 20th Cochrane Colloquium.

Hollands GJ, Shemilt I, Marteau TM, Jebb SA, Kelly MP, Nakamura R, et al. (2013). Altering choice architecture to change population health behaviour: a large-scale conceptual and empirical scoping review of interventions within micro-environments. Cambridge: University of Cambridge.

Holmberg, Lennart and Ingrid Holmberg (1969), "The Perception of the Area of Rectangles as a Function of the Ratio between Height and Width," *Psychological Research Bulletin*, 9 (Sum- mer), 6.

Houben K, Wiers RW, Jansen A: Getting a grip on drinking behavior training working memory to reduce alcohol abuse. Psychol Sci 2011, 22:968–975.

House of Lords (2011). "Behaviour Change". 2nd Report of Session 2010-12, Science and Technology Select Committee, House of Lords, United Kingdom Parliament. Last accessed 19 Oct 2014 at http://www.publications.parliament.uk/pa/ld201012/ldselect/ldsctech/179/179.pdf

Houts PS, Doak CC, Doak LG, Loscalzo MJ (2006). The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence. Patient Education and Counselling;61:173–90.

Hovland, C. I., Janis, I. L., & Kelley, H. H. (1954). Communication and persuasion. New Haven.

Hsu, R., Myers, A. E., Ribisl, K. M. and Marteau, T. M. (2013) 'An observational study of retail availability and in-store marketing of e-cigarettes in London: potential to undermine recent tobacco control gains?',*BMJ Open*, 3(12), p. e004085, [online] Available from: http://bmjopen.bmj.com/content/3/12/e004085.

Hughes, K., Quigg, Z., Eckley, L., Bellis, M., Jones, L., Calafat, A., ... & van Hasselt, N. (2011). Environmental factors in drinking venues and alcohol-related harm: the evidence base for European intervention. *Addiction*, *106*(s1), 37-46.

Hustad, J. T., Pearson, M. R., Neighbors, C., & Borsari, B. (2014). The role of alcohol perceptions as mediators between personality and alcohol-related outcomes among incoming college-student drinkers. *Psychology of Addictive Behaviors*, *28*(2), 336.

Jacob, C. (2006). Styles of background music and consumption in a bar: An empirical evaluation. *International Journal of Hospitality Management*, *25*(4), 716-720.

Jellinek E. M. Phases of alcohol addiction. Q J Stud AlcoholAlcohol 1952; 13: 673–84.

Jones B, Rachlin H. 2006. Social discounting. Psychol. Sci. 17:283–86.

Kabat-Zinn, J. (1994). Wherever you go, there you are: Mindfulness meditation in everyday life. New York, NY: Hyperion.

Kadden, R.; Carroll, K.; Donovan, D.; Cooney, N.; Monti, P.; Abrams, D., et al. Cognitive-behavioral coping skills therapy manual: A clinical research guide for therapists treating individuals with alcohol abuse and dependence. NIAAA; Rockville, MD: 1995.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the econometric society*, 263-291.

Kahler, C. W., Epstein, E. E., & McCrady, B. A. (1995). Loss of control and inability to abstain: The measurement of and the relationship be- tween two constructs in male alcoholics. *Addiction, 90,* 1025–1036.

Kalnikaite, V., Rogers, Y., Bird, J., Villar, N., Bachour, K., Payne, S., Todd, P.M., Schöning, J., Krüger, A. (2011). How to Nudge In Situ: Designing Lambent Devices to Deliver Information Salience in Supermarkets. Proceedings of the 13th ACM International conference on Ubiquitous computing (Ubicomp '11).

Kaner EFS, Dickinson HO, Beyer F, Pienaar E, Campbell F, Schlesinger C, et al. (2007). Effectiveness of brief alcohol interventions in primary care populations. *Cochrane Database of Systematic Reviews*, Issue 2.

Kerr WC, Patterson D, Koenen MA, Greenfield TK. Large drinks are no mistake: Glass size, not shape, affects alcoholic beverage drink pours. Drug Alcohol Rev. 2009;28(4):360–5.

Klee R. (1997) *INtroduciton to the Philosophy of Science. Cutting Nature at its Seams*. New York: Oxford University Press.

Klein, B., Wright, Joshua D., 2007. The economics of slotting contracts. Journal of Law and Economics 50, 421e454.

Kohn, P. M., & Smart, R. G. (1984). The impact of television advertising on alcohol consumption: an experiment. *Journal of Studies on Alcohol*, *45*(4), 295-301.

Kohn, P. M., Smart, R. G., & Ogborne, A. C. (1984). Effects of two kinds of alcohol advertising on subsequent consumption. *Journal of Advertising*, *13*(1), 34-48.

Koski-Jannes, A., & Cunningham, J. (2001). Interest in different forms of self-help in a general population sample of drinkers. *Addictive Behaviors, 26,* 91–99.

Kozlowski, L. T., & Wilkinson, D. A. (1987). Use and misuse of the concept of craving by alcohol, tobacco, and drug researchers. British journal of addiction, 82(1), 31-36.

Kushel MB, Vittinghoff E, Haas JS. (2001). Factors associated with the health care utilization of homeless persons. *JAMA*;285:200-6.

Kutz, H., Leserman, J., Dorrington, C., Morrison, C. H., Borysenko, J. Z., & Benson, H. (1985). Meditation as an adjunct to psychotherapy. Psychotherapy and psychosomatics, 43(4), 209-218.

Lamb, S. E., Becker, C., Gillespie, L. D., Smith, J. L., Finnegan, S., Potter, R., . . . Taxonomy, I. (2011). Reporting of complex interventions in clinical trials: development of a taxonomy to classify and describe fall-prevention interventions. *Trials, 12*, 125. doi: 10.1186/1745-6215-12-125.

Lancet (2009). Alcohol misuse needs a global response. *Lancet*;373:433.

Larimer, M. E., Lee, C. M., Kilmer, J. R., Fabiano, P. M., Stark, C. B., Geisner, I. M., ... & Neighbors, C. (2007). Personalized mailed feedback for college drinking prevention: a randomized clinical trial. *Journal of consulting and clinical psychology*, *75*(2), 285.

Leeman, R. F., Corbin, W. R., Nogueira, C., Krishnan-Sarin, S., Potenza, M. N., & O'Malley, S. S. (2013). A human alcohol self-administration paradigm to model individual differences in impaired control over alcohol use. *Experimental and clinical*

Lewin, K 1951. *Field Theory in Social Science: Selected Theoretical Papers*. D Cartwright (ed.). New York, NY: Harper & Row.

Lewis MW, Grimes AJ. (1999) Meta-triangulation: building theory from multipleparadigms. Acad Manage Rev, 24:672-690.

Lewis, M. A., & Neighbors, C. (2007). Optimizing personalized normative feedback: The use of gender-specific referents. *Journal of Studies on Alcohol and Drugs, 68,* 228–237.

Linke S., McCambridge J., Khadjesari Z., Wallace P., Murray E. Development of a psychologically enhanced interactive online intervention for hazardous drinking. Alcohol Alcohol 2008; 43: 669–74.

Littlefield AK, Sher KJ, Wood PK. Is "maturing out" of problematic alcohol involvement related to personality change? Journal of Abnormal Psychology. 2009; 118:360–374.

Litvin, E. B., Abrantes, A. M., & Brown, R. A. (2013). Computer and mobile technology-based interventions for substance use disorders: An organizing framework. *Addictive Behaviors*, *38*(3), 1747-1756.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological bulletin*, *127*(2), 267.

Logue, A. W. (2000). Self-control and health behavior. In W. K. Bickel, R. Vuchinich, W. K. Bickel, R. Vuchinich (Eds.), *Reframing health behav- ior change with behavioral economics* (pp. 167–192). Mahwah, NJ: Erlbaum.

Lombardi, M. M., & Choplin, J. M. (2010). Anchoring and estimation of alcohol consumption: Implications for social norm interventions. *Journal of Alcohol and Drug Education*, *54*(2), 53.

Lorenc T, Petticrew M, Whitehead M, Neary D, Clayton S, Wright K, Thomson H, Cummins S, Sowden A, Renton A: Crime, fear of crime and mental health: synthesis of theory and systematic reviews of interventions and qualitative evidence. Public Health Res 2013, 13:496.

Lucas PJ, Baird J, Arai L, Law C, Roberts HM (2007). Worked examples of alternative methods for the synthesis of qualitative and quantitative research in systematic reviews. BMC Med Res Methodology, 7:4.

Ly, K. and Dilip Soman (2013). "Nudging Around the World". Research Report Series. Rotman School of Management, University of Toronto. Last accessed on 19 Oct 2014 at http://www.um.es/documents/1922922/1973600/Nudgingpercent20Aroundpercent20Thepercent20World.pdf/3af04386-ba8b-4742-b339-73626bf2be94.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. Journal of abnormal psychology, 95(1), 15.

Madden, G., & Bickel, W. (Eds.). (2010). *Impulsivity: The behavioral and neurological science of discounting.* Washington, DC: American Psy- chological Association. doi:10.1037/12069-000

Makela P., Havio M., Seppa K. Alcohol-related discussions in health care—a population view. Addiction 2011; 106: 1239–48.

Makowsky CR, Whitehead PC. Advertising and alcohol sales: a legal impact study. *Journal of Studies on Alcohol* 1991;**52**(6):555–67.

Maisto, SA.; Bishop, TM.; Hart, EJ. Theories of college student drinking. In: Correia, CJ.; Murphy, JG.; Barnett, NP., editors. College student alcohol abuse: A guide to assessment, intervention, and prevention. Hoboken, NJ: Wiley; 2012. p. 81-112.

Mandelberg JH, Kuhn RE, Kohn MA (2000). Epidemiologic analysis of an urban, public emergency department's frequent users. *Academy of Emergency Medicine*;7:637-46.

Marlatt, G. A. (2002). Buddhist philosophy and addictive behavior. Cognitive and Behavioral Practice, 9, 44e50, 1077-7229/02/44.

Marlatt, GA. Basic principles and strategies of harm reduction. In: Marlatt, GA., editor. Harm reduction: Pragmatic strategies for managing high-risk behaviors. Guilford; New York: 1998. p. 49-66.

Marlatt G. A., Demming B., Reid J. B. Loss of control drink- ing in alcoholics: an experimental analogue. J Abnorm Psychol 1973; 81: 233–41.

Marlatt, G. A., & George, W. H. (1984). Relapse prevention: Introduction and overview of the model. *British Journal of Addiction*, *79*(3), 261–273. doi:10.1111/j.1360-0443.1984.tb00274.x

Marteau, T.M., Hollands, G.J., Fletcher, P.C. (2012). Changing human behaviour to prevent disease: the importance of targeting automatic processes. Science, 337(6101), 1492-1495..

Marteau, T. M., Ogilvie, D., Roland, M., Suhrcke, M. and Kelly, M. P. (2011) 'Judging nudging: can nudging improve population health?', *BMJ*, 342(jan25 3), pp. d228–d228.

Mazur JE, Logue AW. 1978. Choice in a "self-control" paradigm: effects of a fading procedure. J. Exp. Anal. Behav. 30:11–17.

McCambridge, J., & Cunningham, J. A. (2014). The early history of ideas on brief interventions for alcohol. Addiction, 109(4), 538-546.

McElrea, H., & Standing, L. (1992). Fast music causes fast drinking.*Perceptual and Motor skills*, *75*(2), 362-362.

McKercher, B. (2016). Towards a taxonomy of tourism products. *Tourism Management, 54*, 196-208.

McTavish, F. M., Chih, M. Y., Shah, D., & Gustafson, D. H. (2012). How patients recovering from alcoholism use a smartphone intervention. *Journal of dual diagnosis*, *8*(4), 294-304.

Merton RK: Social Theory and Social Structure. New York: Free Press; 1968.

Michie, S., Abraham, C., Eccles, M.P., Francis, J.J., Hardeman, W., & Johnston, M. (2011a). Strengthening evaluation and implementation by specifying components of behaviour change interventions: a study protocol. Implementation Science, 6, 10.

Michie, S., Hyder, N., Walia, A., & West, R. (2011b). Development of a taxonomy of behaviour change techniques used in individual behavioural support for smoking cessation. *Addictive behaviors*, *36*(4), 315-319.

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., ... & Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Annals of behavioral medicine*,*46*(1), 81-95.

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), 1.

Michie S, West R, Campbell R, Brown B, Gainforth H. ABC of Behaviour Change Theories An Essential Resource for Researchers, Policy Makers and Practitioners. London: Silverback Publishing; 2016.

Miles, M. B., & Huberman, A. M. (1994). An expanded sourcebook: Qualitative data analysis. Thousand Oaks, CA: Sage.

Miller, WR. Enhancing motivation for change in substance abuse treatment. Treatment Improvement Protocol (TIP). Series 35(DHHS Publication No. (SMA) 99-3354). Available at http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=hstat5.chapter.61302.

Miller, W. R., Andrews, N. R., Wilbourne, P. & Bennett, M. E. (1998) A wealth of alternatives: effective treatments for alcohol problems. In: Miller, W. R. & Heather, N., eds. Treating Addictive Behaviors: Processes Of Change, 2nd edn, pp. 203–216. New York: Plenum Press.

Miller, W. R., Brown, J. M., Simpson, T. L., Handmaker, N. S., Bien, T. H., Luckie, L. F., Montgomery, H. A., Hester, R. K. & Tonigan, J. S. (1995) What works? A methodological analysis of the alcohol treatment outcome literature. In: Hester, R. K. & Miller, W. R., eds. Handbook of Alcoholism Treatment Approaches: Effective Alternatives , 2nd edn, pp. 12–44. Boston, MA: Allyn and Bacon.

Miller, W. R., & Rollnick, S. (1991). Motivational interviewing: Preparing people to change addictive behavior. New York, NY: Guilford Press.

Milliman RE. The influence of background music on the behavior of restaurant patrons. *J Cons Res*. 1986;13:286–289.

Milliman, R., 1982. Using Background music to affect the behavior of supermarket shoppers. Journal of Marketing 46, 86–91.

Mintzer MZ, Snodgrass JG (1999). The picture superiority effect: Support for the distinctiveness model. The American Journal of Psychology;112(1):113–46.

Monti, PM.; Abrams, DB.; Kadden, RM.; Cooney, NL. Treating alcohol dependence: A coping skills training guide. Guilford; New York: 1989.

Moreira MT, Smith LA, Foxcroft D. (2009). Social norms interventions to reduce alcohol misuse in university or college students. *Cochrane Database of Systematic Reviews*, Issue 3.

Moss, A. C., & Albery, I. P. (2009). A dual-process model of the alcohol–behavior link for social drinking. *Psychological Bulletin*, *135*(4), 516.

Moss, A. C., Albery, I. P., Dyer, K. R., Frings, D., Humphreys, K., Inkelaar, T., ... & Speller, A. (2014). The effects of responsible drinking messages on attentional allocation and drinking behaviour. *Addictive behaviors*.

Muraven M., Baumeister R. F. Self-regulation and depletion of limited resources: does self control resemble a muscle? *Psychol Bull* 2000; 126: 247–59.

Muraven M., Collins R. L., Nienhaus K. Self-control and alcohol restraint: an initial application of the self-control strength model. *Psychol Addict Behav* 2002; 16: 113–20.

Murphy, J. G., Dennhardt, A. A., Skidmore, J. R., Borsari, B., Barnett, N. P., Colby, S. M., & Martens, M. P. (2012). A randomized controlled trial of a behavioral economic supplement to brief motivational interventions for college drinking. *Journal of consulting and clinical psychology*, *80*(5), 876.

Murphy, C. M., MacKillop, J. (2014). Mindfulness as a Strategy for Coping with Cue-Elicited Cravings for Alcohol: An Experimental Examination.*Alcoholism: Clinical and Experimental Research*, *38*(4), 1134-1142.

Nakamura, R., Pechey, R., Suhrcke, M., Jebb, S. A. and Marteau, T. M. (2014) 'Sales impact of displaying alcoholic and non-alcoholic beverages in end-of-aisle locations: An observational study', *Social Science & Medicine*, 108, pp. 68–73

National Institute of Health and Clinical Excellence (NICE) (2014). Behavior change: individual approaches (Public Health Guidance 49). National Institute of Health and Clinical Excellence.

Neal DT, Wood W, Quinn JM. Habits-a repeat performance. Current Directions in Psychological Science 2006;15:198–202.

Neighbors C, Lee CM, Lewis MA, Fossos N, Larimer ME. Are social norms the best predictor of outcomes among heavydrinking college students? Journal of Studies on Alcohol and Drugs. 2007; 68:556–565.

Neighbors, C., Lewis, M. A., Atkins, D. C., Jensen, M. M., Walter, T., Fossos, N., ... & Larimer, M. E. (2010). Efficacy of web-based personalized normative feedback: a two-year randomized controlled trial. *Journal of consulting and clinical psychology*, *78*(6), 898.

NHS Centre for Reviews and Dissemination (NHS CRD). University of York. Brief interventions and alcohol use. Effective Health Care 1993;1 (7):13.

Niedenthal, P.M., Cantor, N., Kihlstrom, J.F., 1985. Prototype matching: a strategy for social decision making. J. Pers. Soc. Psychol. 48, 575–584.

Noblit GW, Hare RD: Meta-ethnography: Synthesizing Qualitative Studies. London: Sage Publications Inc; 1988.

North AC, Hargreaves DJ, McKendrick J. The influence of in-store music on wine selections. *J Appl Psychol*. 1999;84:271–276.

O'Farrell J, Murphy CM (1995). Marital violence before and after alcoholism treatment. *Journal of Consulting and Clinical Psychology*63:256-62.

Ogborne AC, Smart RG. Will restrictions on alcohol advertising reduce alcohol consumption?. *British Journal of Addiction* 1980;**75**(3):293–6.

Osberg TM, Atkins L, Buchholz L, Shirshova V, Swiantek A, Whitley J, Oquendo N. Development and validation of the College Life Alcohol Salience Scale: A measure of beliefs about the role of alcohol in college life. Psychology of Addictive Behaviors. 2010; 24:1–12.

Osberg TM, Billingsley K, Eggert M, Insana M. From. Animal House to Old School: A multiple mediation analysis of the association between college drinking movie exposure and freshman drinking and its consequences. Addictive Behaviors. 2012; 37:922–930.

Osberg TM, Insana M, Eggert M, Billingsley K. Incremental validity of college alcohol beliefs in the prediction of freshman drinking and its consequences: A prospective study. Addictive Behaviors. 2011; 36:333–340.

Ossip-Klein DJ, Vanlandingham W, Prue DM, Rychtarik RG: Increasing attendance at alcohol aftercare using calendar prompts and home based contracting. Addict Behav 1984; 9:85-89.

Ostafin, B. D., Bauer, C., & Myxter, P. (2012). Mindfulness decouples the relation between automatic alcohol motivation and heavy drinking. *Journal of Social and Clinical Psychology*, *31*(7), 729.

Otten, R., Cladder-Micus, M. B., Pouwels, J. L., Hennig, M., Schuurmans, A. A., & Hermans, R. C. (2014). Facing temptation in the bar: counteracting the effects of self-control failure on young adults' ad libitum alcohol intake.*Addiction*, *109*(5), 746-753.

Oxman AD, Schunemann HJ, Fretheim A. (2006). Improving the use of research evidence in

guideline development: 8. Synthesis and presentation of evidence. Health Res Policy Syst, 4:20.
Park, C.W., Iyer, E.S., Smith, D.C., 1989. The effects of situational factors on in-store grocery shopping behavior: the role of store environment and time available for shopping. Journal of Consumer Research 15, 422e433.
Paterson B, Thorne S, Canam C, Jillings C. (2001). Meta-Study of Qualitative Health Research: A Practical Guide to Meta-Analysis and Meta-Synthesis. Thousand Oaks, California, USA: Sage Publications.
Pawson, R. (2006) *Evidence-based Policy. A Realist Perspective*. London: Sage.
Pawson R. (2003) Nothing as practical as good theory. *Evaluation*. 9(4): 471-90.
Pawson R, Greenhalgh T, Harvey G, Walshe K. (2005) Realist review – a new method of systematic review designed for complex policy interventions. *J Health Serv Res Policy*. 10: 21-34.
Pawson, R., & Tilley, N. (1997). *Realistic evaluation*. Sage.
Pechey, R., Couturier, D. L., Hollands, G. J., Mantzari, E., Munafò, M. R., & Marteau, T. M. (2016). Does wine glass size influence sales for on-site consumption? A multiple treatment reversal design. *BMC public health*, *16*(1), 1.
Pechey, R., Burge, P., Mentzakis, E., Suhrcke, M. and Marteau, T. M. (2014) 'Public acceptability of population-level interventions to reduce alcohol consumption: A discrete choice experiment', *Social Science & Medicine*, 113, pp. 104–109.
Perkins HW, Berkowitz AD. Perceiving the community norms of alcohol use among students: Some research implications for campus alcohol education programming. International Journal of the Addictions. 1986; 21:961–976.
Perkins HW. Surveying the damage: A review of research on consequences of alcohol misuse in college populations. Journal of Studies on Alcohol. 2002; 14:91–100. [Special issue: College drinking, what it is, and what do to about it. Review of the state of the science].
Petticrew M, Roberts H: Systematic reviews in the social sciences: A Practical Guide. Oxford: Blackwell; 2006.
Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In *Communication and persuasion* (pp. 1-24). Springer New York.
Piaget, J. (1969). The intellectual development of the adolescent.
Poikolainen K. Effectiveness of brief interventions to reduce alcohol intake in primary health care populations: a meta-analysis. Preventive Medicine 1999;28(5):503–9.
Popay J, Rogers A, Wiliams G. (1998). Rationale and standards for the systematic review of qualitative literature in health services research. Qualitative Health Research, 8:341-351.
Popper K: The Logic of Scientific Discovery. London: Routledge; 1959.
Portnoy, D. B., Scott-Sheldon, L. A., Johnson, B. T., & Carey, M. P. (2008). Computer-delivered interventions for health promotion and behavioral risk reduction: a meta-analysis of 75 randomized controlled trials, 1988–2007.*Preventive medicine*, *47*(1), 3-16.
Poulos CX, Hinson RE, and Siegel S. The role of Pavlovian processes in drug tolerance and dependence: Implications for treatment. *Addictive Behaviour* 6: 205-202, 1981.
Pound P, Campbell R. Exploring the feasibility of theory synthesis: a worked example in the field of health related risk-taking. Soc Sci Med. 2015;124:57–65.
Prochaska, J. O., & DiClemente, C. C. (1986). Toward a comprehensive model of change. In *Treating addictive behaviors* (pp. 3-27). Springer US.
Quigley, M. (2013). "Nudging for health: on public policy and designing choice architecture".

Medical Law Review 21: 4, 588-621.
Quigley, B. M., & Collins, R. L. (1999). The modeling of alcohol consumption: a meta-analytic review. Journal of studies on alcohol, 60(1), 90-98.
Raghubir P, Krishna A. Vital dimensions in volume perception: can the eye fool the stomach? J Mark Res. 1999;313–326.
Rangel, A., Camerer, C., & Montague, P. R. (2008). A framework for studying the neurobiology of value-based decision making. *Nature Reviews Neuroscience*, *9*(7), 545-556.
Reader, T. W., Gillespie, A., & Roberts, J. (2014). Patient complaints in healthcare systems: a systematic review and coding taxonomy. *BMJ Qual Saf, 23*(8), 678-689.
Rehm J, Baliunas D, Borges GL, Graham K, Irving H, Kehoe T, et al. (2010), The relation between different dimensions of alcohol consumption and burden of disease: an overview. *Addiction* ;105(5):817-43.
Renaud SC (2001). Diet and Stroke. *Journal of Nutritional Health and Aging*;5(3):167-172.
Rhodes, F., Fishbein, M., & Reis, J. (1997). Using behavioral theory in computer-based health promotion and appraisal. *Health Education & Be- havior*, *24*(1), 20–34. doi:10.1177/109019819702400105
Riper, H., Kramer, J., Smit, F., Conijn, B., Schippers, G., & Cuijpers, P. (2008). Web-based self-help for problem drinkers: a pragmatic randomized trial. *Addiction*, *103*(2), 218-227.
Roballey, T. C., McGreevy, C., Rongo, R. R., Schwantes, M. L., Steger, P. J., Wininger, M. A., & Gardner, E. B. (1985). The effect of music on eating behavior. *Bulletin of the Psychonomic Society*, *23*(3), 221-222.
Robinson, T.E., Berridge, K.C., 1993. The neural basis of drug craving: an incentive-sensitization theory of addiction. Brain Res. Rev. 18, 247–291.
Robinson E, Oldham M, Cuckson I, Brunstrom JM, Rogers PJ, Hardman CA. Visual exposure to large and small portion sizes and perceptions of portion size normality: Three experimental studies. Appetite. 2016;98:28–34.
Roehrich, L., & Goldman, M. S. (1995). Implicit priming of alcohol expectancy memory processes and subsequent drinking behavior. Experimental and Clinical Psychopharmacology, 3, 402– 410.
Rohsenow DJ, Marlatt GA. (1981). The balanced placebo design: methodological considerations, *Addictive Behaviours* 6, 107-122.
Rogers, R. W. (1983). Cognitive and physiological processes in fear appeals and attitude change: A revised theory of protection motivation. In Cacioppo, B.L. & Petty, L.L. (Eds.), Social psychophysiology: A source book (pp. 153-176). London: Guildford Press.
Rogers, T. and Erin Frey (2014). "Changing Behavior Beyond the Here and Now". Blackwell Handbook of Judgment and Decision Making.
Rosenstock, I. M. (1975). Patients' compliance with health regimens. *Jama*,*234*(4), 402-403.
Rozin, P., Scott, S., Dingley, M., Urbanek, J. K., Jiang, H., & Kaltenbach, M. (2011). Nudge to nobesity I: Minor changes in accessibility decrease food intake. Judgment and Decision Making, 6(4), 323-332.
Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will? *Journal of Personality*, *74*(6), 1557–1586.
Schoenmakers, T. M., de Bruin, M., Lux, I. F., Goertz, A. G., Van Kerkhof, D. H., & Wiers, R. W. (2010). Clinical effectiveness of attentional bias modification training in abstinent alcoholic patients. *Drug and alcohol dependence*, *109*(1), 30-36.

Schoenmakers, T.M., & Wiers, R.W. (2009). Craving and attentional bias respond differ- ently to alcohol priming: A field study in the pub. European Addiction Research, 16 (1), 9–16.

Schoenmakers, T., Wiers, R. W., Jones, B. T., Bruce, G., & Jansen, A. (2007). Attentional re-training decreases attentional bias in heavy drinkers without generalization. *Addiction*, *102*(3), 399-405.

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevi- cius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science, 18,* 429–434.

Schwartz, S. H. (1977). Normative influences on altruism. *Advances in experimental social psychology*, *10*, 221-279.

Schwarzer, R. (2001). Social-Cognitive Factors in Changing Health-Related Behaviors. Current Directions in Psychological Science, 10(2), 47-51.

Scisco JL, Blades C, Zielinski MJ, Muth ER. Dividing a fixed portion into more pieces leads to larger portion size estimates of JELL-O® squares. Perception 2012;41:988–90.

Shah M, Schroeder R, Winn W, Adams-Huet B (2011). A pilot study to investigate the effect of plate size on meal energy intake in normal weight and overweight/obese women. *Journal of Human Nutrition and Dietetics*; 24(6): 612–5.

Shapiro, S. L., Schwartz, G. E., & Bonner, G. (1998). Effects of mindfulness-based stress reduction on medical and premedical students. Journal of behavioral medicine, 21(6), 581-599.

Sheeran, P., Aarts, H., Custers, R., Rivis, A., Webb, T. L., & Cooke, R. (2005). The goal-dependent automaticity of drinking habits. British Journal of Social Psychology, 44, 47–63.

Shemilt, I., Hollands, G. J., Marteau, T. M., Nakamura, R., Jebb, S. A., Kelly, M. P., Suhrcke, M. and Ogilvie, D. (2013) 'Economic Instruments for Population Diet and Physical Activity Behaviour Change: A Systematic Scoping Review', *PLoS ONE*, 8(9), p. e75070, [online] Available from:http://dx.doi.org/10.1371/journal.pone.0075070.

Siegel, S. (1983). Classical conditioning, drug tolerance, and drug dependence in Y. Israel, FB Glaser, H Kalant, RE Popham, W Schmidt & RG Smart (Eds) *Research Advances in Alcohol and Drug Problems* 7, New York: Plenum Press, 207-246.

Siegfried, N., Pienaar, D. C., Ataguba, J. E., Volmink, J., Kredo, T., Jere, M., & Parry, C. D. (2014). Restricting or banning alcohol advertising to reduce alcohol consumption in adults and adolescents. *The Cochrane Library*.

Simons JS, Gaher RM, Oliver MNI, Bush JA, Palmer MA. An experience sampling study of associations between affect and alcohol use and problems among college students. Journal of Studies on Alcohol. 2005; 66:459–469.

Skog O. J. The collectivity of drinking cultures: a theory of the distribution of alcohol consumption. Br J Addict 1985; 80: 83–99.

Slovic, P., Finucane, M., Peters, E., & MacGregor, D. G. (2002). Rational actors or rational fools: Implications of the affect heuristic for behavioral economics. *The Journal of Socio-Economics*, *31*(4), 329-342.

Smart RG, Cutler RE. The alcohol advertising ban in British Columbia: problems and effects on beverage consumption. *British Journal of Addiction* 1976;**71**:13–21.

Smith, P. C., & Curnow, R. (1966). " Arousal hypothesis" and the effects of music on purchasing behavior. *Journal of Applied Psychology*, *50*(3), 255.

Sobell M. B., Sobell L. C. *Problem Drinkers: Guided Self-Change Treatment*. New York: Guilford Press; 1993.

Sobell, L. C., Sobell, M. B., Riley, D. M., Klajner, F., Leo, G. I., Pavan, D., & Cancilla, A. (1986). Effect of television programming and advertising on alcohol consumption in normal drinkers. *Journal of Studies on Alcohol*, *47*(4), 333.

Solar, O., & Irwin, A. (2010). A conceptual framework for action on the social determinants of health (Social Determinants of Health Discussion Paper 2 (Policy and Practice)). Geneva: WHO.

Sorensen, H., 2008. Long tail media in the store. Journal of Advertising Research 48, 329.

Southwick, L, Steele, C, Marlatt, A. & Lindell, M (1981) Alcohol-related expectancies: defined by phase of intoxication and drinking experience, Journal of Consulting and Clinical Psychology, 49, pp. 713-721.

Spijkerman, S., Van den Eijnden, R.J.J.M., Overbeek, G., Engels, R.C.M.E., 2007. The impact of peer and parental norms and behavior on adolescent drinking: the role of drinker prototypes. Psychol. Health 22, 7–29.

Stavri Z, Michie S. (2012). Classification systems in behavioral science: Current systems and lessons from the natural, medical and social sciences. Health Psychol Rev.;6:113-140

Steenhuis I, Vermeer W (2009). Portion size: Review and framework for interventions. *International Journal of Behavioral Nutrition and Physical Activity*; 6(1):58–67.

Stein KD, Goldman MS, Del Boca FK. The influence of alcohol expectancy priming and mood manipulation on subsequent alcohol consumption. *J Abnorm Psychol.* 2000;109:106–115.

Stewart, N., Chater, N., & Brown, G. D. A. (2006). Decision by sampling. Cognitive Psychology, 53, 1–26.

Stockwell, T. (2006). A review of research into the impacts of alcohol warning labels on attitudes and behaviour. *British Columbia, Canada: University of Victoria, Centre for Addictions Research of BC*.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behaviour. Personality and Social Psychology Review, 8(3), 220-247.

Sunstein, C. R. (2012). Storrs Lectures: Behavioral Economics and Paternalism, The. *Yale LJ*, *122*, 1826.

Sussman, S., Pokhrel, P., Ashmore, R.D., Brown, B.B., 2007. Adolescent peer group identification and characteristics: a review of the literature. Addict. Behav. 32, 1602–1627.

Swinburn, B., Egger, G., & Raza, F. (1999). Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. Preventive Medicine, 29, 563–570.

Tait R. J., Christensen H. Internet-based interventions for young people with problematic substance use: a systematic review. Med J Aust 2010; 192: S15–21.

Tajfel, H. (1982). Social psychology of intergroup relations. *Annual Re- view of Psychology, 33,* 1–39.

Tajfel, H. T., & Turner, J. JC (1979). An integrative theory of intergroup conflict. *The social psychology of intergroup relations*, 33-47.

Taylor, M. J., Vlaev, I., Maltby, J., Brown, G. D., & Wood, A. M. (2015). Improving social norms interventions: Rank-framing increases excessive alcohol drinkers' information-seeking. *Health psychology*, *34*(12), 1200.

Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. Journal of consulting and clinical psychology, 68(4), 615.

Tesch R. (1990). Qualitative research: analysis types and software tools. New York: Falmer.

Testa, M., Hoffman, J. H., Livingston, J. A., & Turrisi, R. (2010). Preventing college women's sexual victimization through parent based intervention: A randomized controlled trial. Prevention Science, 11, 308–318.

Teunissen, H.A., Spijkerman, R., Larsen, H., Kremer, K.A., Kuntsche, E., Gibbons, F.X., & Engels, R.C. (2012). Stereotypic information about drinkers and students' observed alcohol intake: An experimental study on prototype–behavior relations in males and females in a naturalistic drinking context. Drug and Alcohol Dependence, 125, 301306.

Thaler, R., & Sunstein C. (2008). Nudge: Improving Decisions about Health, Wealth, and Happiness. USA: Penguin Books.

Thomas J, Harden A. (2008): Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Med Res Methodology, 8:45.

Tiffany, S. T. (1990). A cognitive model of drug urges and drug-use behavior: role of automatic and nonautomatic processes. Psychological review, 97(2), 147.

Triandis, H. C. (1977). *Interpersonal behavior*. Brooks/Cole Pub. Co..

Tricco AC, Tetzlaff J, Moher D. (2010). The art and science of knowledge synthesis. J Clin Epidemiology.

Trice H. M., Roman P. M. The sick role, labelling theory, and the deviant drinker. Int J Soc Psychiatry 1968; 14: 245– 51.

Tugwell P, Petticrew M, Kristjansson E, Welch V, Ueffing E, Waters E, Bonnefoy J, Morgan A, Doohan E, Kelly MP: Assessing equity in systematic reviews: realising the recommendations of the Commission on Social Determinants of Health. BMJ 2010, 341:c4739.

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory.* New York, NY: Basil Blackwell.

Turrisi, R., Larimer, M. E., Mallett, K. A., Kilmer, J. R., Ray, A. E., Mastroleo, N. R., Geisner, I. M., Grossbard, J., Tollison, S., Lostut- ter, T. W., & Montoya, H. (2009). A randomized clinical trial evaluating a combined alcohol intervention for high-risk college students. Journal of Studies on Alcohol and Drugs, 70, 555–567.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive psychology*, *5*(2), 207-232.

van Deursen, D. S., Salemink, E., Smit, F., Kramer, J., & Wiers, R. W. (2013). Web-based cognitive bias modification for problem drinkers: protocol of a randomised controlled trial with a 2x2x2 factorial design. *BMC public health*,*13*(1), 674.

Varvil-Weld, L., Scaglione, N., Cleveland, M. J., Mallett, K. A., Turrisi, R., & Abar, C. C. (2014). Optimizing timing and dosage: does parent type moderate the effects of variations of a parent-based intervention to reduce college student drinking?. *Prevention science*, *15*(1), 94-102.

Vasiljevic, M., Pechey, R., & Marteau, T. M. (2015). Making food labels social: The impact of colour of nutritional labels and injunctive norms on perceptions and choice of snack foods. *Appetite*, *91*, 56-63.

Velicer W. F., Prochaska J. O. Stage and non-stage theories of behavior and behavior change: a comment on Schwarzer. *Appl Psychol* 2008; 57: 75–83.

Verge, Charles G. and Richard S. Bogartz (1978), "A Functional Measurement Analysis of the Development of Dimensional Coordination in Children," *Journal of Experimental Child Psychology*, 25 (August), 337–353.

Vinci, C., Peltier, M. R., Shah, S., Kinsaul, J., Waldo, K., McVay, M. A., & Copeland, A. L. (2014). Effects of a brief mindfulness intervention on negative affect and urge to drink among college student drinkers. *Behaviour research and therapy*, *59*, 82-93.

Vinson, D. C., & Devera-Sales, A. (2000). Computer-generated written behavioral contracts with problem drinkers in primary medical care.*Substance Abuse*, *21*(4), 215-222.

Vlaev, I., Chater, N., Stewart, N., & Brown, G. D. A. (2011). Does the brain calculate value? *Trends in Cognitive Sciences, 15,* 546 –554.

Vogel-Sprott, M. (1992). Alcohol tolerance and social drinking: Learning the consequences. New York: Guilford Press.

Vuchinich, R. E., & Simpson, C. A. (1998). Hyperbolic temporal discount- ing in social drinkers and problem drinkers. *Experimental and Clinical Psychopharmacology, 6,* 292–305.

Walker D, Smarandescu L, Wansink B. Half Full or Empty: Cues that lead wine drinkers to unintentionally overpour. Subst Use Misuse. 2014;49(3):295–302.

Wallace P, Cutler S, Haines A, Randomised controlled trial of general practitioner intervention in patients with excessive alcohol consumption. BMJ 1988; 297:663-668

Wallace, P., Murray, E., McCambridge, J., Khadjesari, Z., White, I. R., Thompson, S. G., ... & Linke, S. (2011). On-line randomized controlled trial of an internet based psychologically enhanced intervention for people with hazardous alcohol consumption. *PloS one*, *6*(3), e14740.

Walters S. T., Neighbors C. College prevention: a view of present (and future) web-based approaches. Alcohol Res Health 2011; 34: 222–4.

Wansink, B., & Van Ittersum, K. (2003). Bottoms up! The influence of elongation on pouring and consumption volume. *Journal of Consumer Research*, *30*(3), 455-463.

Wansink B, van Ittersum K (2005). Shape of glass and amount of alcohol poured: comparative study of effect of practice and concentration. BMJ;331(7531):1512–4.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. Journal of Personality and Social Psychology, 54, 1063e1070.

Watt A, Cameron A, Sturm L, Lathlean T, Babidge W, Blamey S, Facey K, Hailey D, Norderhaug I, Maddern G. (2008). Rapid reviews versus full systematic reviews: an inventory of current methods and practice in health technology assessment. Int J Technol Assess Health Care, 24:133-139.\

Watt M, Stewart S, Birch C, Bernier D. Brief CBT for high anxiety sensitivity decreases drinking problems, relief alcohol outcome expectancies, and conformity drinking motives: Evidence from a randomized controlled trial. Journal of Mental Health. 2006; 15:683–695.

Webb TL, Sheeran P. (2006). Does changing behavioural intentions engender behavior change? A meta-analysis of the experimental evidence. Psychological Bulletin;132 249–68.

Weinstein, A., Cox, W.M., 2006. Cognitive processing of drug-related stimuli: the role of memory and attention. J. Psychopharmacol. (Oxf.) 20, 850–859.

Widiger, T. A., & Smith, G. T. (1994). Substance use disorder: Abuse, dependence and

dyscontrol. Addiction, 89(3), 267-282.
Wiers, R. W., & Stacy, A. W. (2006). Implicit cognition and addiction. Current Directions in Psychological Science, 15(6), 292-296.
Wikler, A. (1948). Recent progress in research on the neurophysiologic basis of morphine addiction. The American Journal of Psychiatry, 105(0002-953X, 0002-953X), 329–338.
Wigmore, S. W., & Hinson, R. E. (1991). The influence of setting on consumption in the balanced placebo design. *British Journal of Addiction*,*86*(2), 205-215.
Wilk A, Jensen NM, Havighurst TC. Meta-analysis of randomized control trials addressing brief interventions in heavy alcohol drinkers. Journal of General Internal Medicine 1997;12(5):274–83.
Wilkie, W.L., Desrochers, D.M., Gundlach, G.T., 2002. Marketing research and public policy: the case of slotting fees. Journal of Public Policy & Marketing 21, 275-288.
Wilkinson, J.B., Mason, J.B., Paksoy, C.H., 1982. Assessing the impact of short-term supermarket strategy variables. Journal of Marketing Research 19, 72-86.
Witkiewitz, K., Bowen, S., Douglas, H., & Hsu, S. H. (2013). Mindfulness-based relapse prevention for substance craving. *Addictive behaviors*, *38*(2), 1563-1571.
Witkiewitz, K., & Bowen, S. (2010). Depression, craving, and substance use following a randomized trial of mindfulness-based relapse prevention. *Journal of consulting and clinical psychology*, *78*(3), 362.
Woicik PA, Stewart SH, Pihl RO, Conrod PJ. The Substance Use Risk Profile Scale: A scale measuring traits linked to reinforcement-specific substance-use profiles. Addictive Behaviors. 2009; 34:1042–1055.
Wong G., "Mixed methods synthesis: a worked example" in Hannes, K., & Lockwood, C. (2011). *Synthesizing qualitative research: Choosing the right approach*. John Wiley & Sons.
Wong, G., Greenhalgh, T., Westhorp, G., & Pawson, R. (2013). Development of methodological guidance, publication standards and training materials for realist and meta-narrative reviews: the RAMESES (Realist And Meta-narrative Evidence Syntheses–Evolving Standards) project.
Wood, M. D., Fairlie, A. M., Fernandez, A. C., Borsari, B., Capone, C., Laforge, R., et al. (2010). Brief motivational and parent interventions for college students: A randomized factorial study. Journal of Consulting and Clinical Psychology, 78, 349–361.
World Health Organization (2014). Global Status Report on Alcohol and Health 2014. Geneva: World Health Organization.
World Health Organization (2004). Global Status Report on Alcohol 2004. Geneva: World Health Organization.
World Health Organization Regional Committee for Europe (2008). Behaviour change strategies and health: the role of health systems. Geneva: World Health Organization.
Wigmore, S. W., & Hinson, R. E. (1991). The influence of setting on consumption in the balanced placebo design. *British journal of addiction*, *86*(2), 205-215.
Williams, L. E., & Bargh, J. A. (2008, October 24). Experiencing physical warmth promotes interpersonal warmth. Science, 322, 606 – 607.
Young L, Nestle M. (2002). The contribution of expanding portion sizes to the US obesity epidemic. *American Journal of Public Health*; 92:246–9.

Zgierska, A., Rabago, D., Chawla, N., Kushner, K., Koehler, R., & Marlatt, A. (2009). Mindfulness meditation for substance use disorders: A systematic review. *Substance Abuse*, *30*(4), 266-294.

Appendices

Appendix 1.1 *Auditable trail for the review of theory of dual-process models of health-related behaviour and cognition*

Week of	Stage / justification
1 Mar 2015	Completed systematic review of CA interventions in alcohol consumption in public drink spaces
15 Oct 2015	Drafted protocol of a realist review of CA interventions in alcohol consumption
3 Feb 2016	Determined dual-process models of health-related behaviour were missing from realist review
15 Feb 2016	Began drafting protocol of review of theory of dual-process models of health-related behaviour (including *a priori* inclusion criteria)
22 Apr 2016	Determined some frequently cited theories of health-related behaviour change relied on conscious reflection and thus were not true dual-process models
7 May 2016	Oriented synthesis to locus of attention (i.e. individual as an irrational agent, as a social agent, as an agent in a physical environment, as a self-regulated agent)

Appendix 1.2 *Search strings and hits for the review of theory of dual-process models of health-related behaviour and cognition*

MEDLINE and MEDLINE In-Process & Non-Indexed Citations (OvidSP; 1946 to present)
EMBASE (OvidSP; 1974 to present)
PsycINFO (OvidSP; 1806 to present)
(8317 hits)

1. dual process OR dual-process
2. non-conscious OR automat* OR unconscious OR habitual OR impulsive OR instinct* OR intuitive OR involuntary OR unforced OR unintentional OR unmediat* OR ration*
3. conscious OR reflex* OR voluntary OR intent* OR rational OR reflect* OR premeditat* OR purpos* OR intent* OR intend* OR plan* OR reason* OR determ* OR will* OR autonomous OR uncompell* OR unconstrain* OR exp Volition OR unprescrib* OR will* OR irration*
4. model* OR theor* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formul
5. exp Behavior/ or exp Mental Processes/
6. exp Psychology/
7. exp Health/
8. OR (1 AND 4 AND 5 AND 6 AND 7) OR (2 AND 4 AND 5 AND 6 AND 7) OR (3 AND 4 AND 5 AND 6 AND 7)
9. Limit 8 to (abstracts and English language and human)

CINAHL
(0 hits)
((dual process OR dual-process) AND (model* OR theory* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formally) AND (exp Health/) AND (exp Behavior*/ OR exp Mental Processes/) AND (Psychology)) OR ((non-conscious OR automat* OR unconscious OR habitual OR impulsive OR instinct* OR intuitive OR involuntary OR unforced OR unintentional OR unmediated* OR ration*) AND (model* OR theory* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formally) AND (exp Health/) AND (exp Behavior*/ OR exp Mental Processes/) AND (Psychology)) OR ((conscious OR reflex* OR voluntary OR intent* OR rational OR reflect* OR premeditate* OR purpose* OR intent* OR intend* OR plan* OR reason* OR deter* OR will* OR autonomous OR uncompell* OR unconstrained* OR exp Volition OR unprescrib* OR will* OR irrigation*) AND (exp Health/) AND (exp Behavior*/ OR exp Mental Processes/) AND (Psychology))

ASSIA (ProQuest; 1987 to present)
ERIC
ProQuest Dissertations and Theses Global
Sociological Abstracts
(4,014 hits)
((dual process OR dual-process) AND (model* OR theory* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formul) AND (exp Health/) AND (exp Behavior*/ OR exp Mental Processes/) AND (Psychology)) OR ((non-conscious OR automat* OR unconscious OR habitual OR impulsive OR instinct* OR intuitive OR involuntary OR unforced OR unintentional OR unmediated* OR ration*) AND (model* OR theory* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formul) AND (exp Health/) AND (exp Behavior*/ OR exp Mental Processes/) AND (Psychology)) OR ((conscious OR reflex* OR voluntary OR intent* OR rational OR reflect* OR premeditate* OR purpose* OR intent* OR intend* OR plan* OR reason* OR deter* OR will* OR autonomous OR uncompell* OR unconstrained* OR exp Volition OR unprescrib* OR will* OR irrigation*) AND (exp Health/) AND (exp Behavior*/ OR exp Mental Processes/) AND (Psychology))

Limit to English, (psychotherapy OR neurosciences OR public health OR social psychology OR psychology OR educational psychology OR sociology OR clinical psychology OR developmental psychology OR behavioral psychology OR mental health OR cognitive psychology OR cognitive therapy OR behaviorial sciences OR behavioral sciences OR therapy OR health care OR experimental psychology OR counseling psychology)

ISI Web of Science, including Science Citation Index Expanded (1945 to present), Social Sciences Citation Index (1956 to present), Arts & Humanities Citation Index (1975 to present), Conference Proceedings Citation Index—Science (1900 to present), Conference Proceedings Citation Index—Social Science & Humanities (1990 to present), Book Citation Index—Science (2005 to present), Book Citation Index—Social Sciences & Humanities (2005 to present)

(10 hits)

TOPIC: (((dual process OR dual-process) AND (model* OR theor* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formul) AND (exp Health/) AND (exp Behavior/ or exp Cognition/ or exp Mental Processes/) AND (Psychology)) OR ((non-conscious OR automat* OR unconscious OR habitual OR impulsive OR instinct* OR intuitive OR involuntary OR unforced OR unintentional OR unmediat* OR ration*) AND (model* OR theor* OR design* OR pattern* OR typ* OR config* OR concept* OR method* OR rational* OR formul) AND (exp Health/) AND (exp Behavior/ or exp Cognition/ or exp Mental Processes/) AND (Psychology)) OR ((conscious OR reflex* OR voluntary OR intent* OR rational OR reflect* OR premeditat* OR purpos* OR intent* OR intend* OR plan* OR reason* OR determ* OR will* OR autonomous OR uncompell* OR unconstrain* OR exp Volition OR unprescrib* OR will* OR irration*) AND (exp Health/) AND (exp Behavior/ or or exp Mental Processes/) AND (Psychology)))

Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.

Appendix 1.3 *Data extraction and critical appraisal form for the review of theory of dual-process models of health-related behaviour and cognition*

IDENTIFYING INFORMATION	
Record name	
Authors	
Year	
INCLUSION CRITERIA	
Psychological theory?	
Dual-process model of behaviour?	
Related to health behaviour?	
STUDY CHARACTERISTICS	
Target health behaviour	
Theory description	
Connection to other theories (especially antecedent theories)	
Theoretical constructs defined	
Causal pathways defined	
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	
Causal pathways are well-specified?	
‘Simple’ or ‘complex’, i.e. referring to structural determinants?	
Specifies particular aspects of health?	
May be applied to more than 1 health domain?	

Assumptions are explicit?	

Appendix 1.4 *Characteristics of included studies*

Bandura 1991

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	The Social Cognitive Theory (Bandura 1981) argues that an individual who attempts to change their behaviour engages in rehearsed responses in order to achieve a different behavioural outcome than they experience in the past. Flowing from carefully considered behavioural intentions, repeat rehearsals are thought to help affix the new behaviour.
Connection to other theories (especially antecedent theories)	Theory of Self-Efficacy (Bandura 1977)
Theoretical constructs defined	Self-regulation; self efficacy
Causal pathways defined	One's self-observation after behaviour, combined with judgemental processes (including personal standards, referential performances, valuation of activity, and performance determinants) result in a self-reaction (positive or negative)
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Y
Assumptions are explicit?	Explicit

Bargh & Chartrand 2006

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y

Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	Alcohol
Theory description	Environmental cues stimulate both controlled and unconscious responses which activate one or more behavioural pattern. In the case of controlled responses, environmental cues automatically activate some volitional cognitive process for an individual (e.g. conscious perception of targeted cues), who then reflects on their state of behaviour (e.g. they decide to maintain said behaviour or alter it)
Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Behaviour-relevant cognitive activity; automaticity
Causal pathways defined	Internal thoughts about behavioural intention in addition to perceptions about one's behaviour from external perspective are brought to bear on a behaviour-relevant cognitive activity.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	Y
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Carver & Scheier 1982

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	Control Theory incorporates negative a negative-reinforcing loop between input and output determinants of behaviour
Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Input function (perception); output function

	(behaviour); reference value; comparator
Causal pathways defined	Behaviour is executed after consideration of environmental impact and one's value of an alternative behaviour (including no action) but is subject to external disturbances
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Y
Assumptions are explicit?	Implicit

Cialdini et al. 1990

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	Among other things, an individual may feel social pressure where there exists a discrepancy between their personal behaviour and the group's standard(s). Descriptive norms are held to detail 'what most members of society do' in a given behaviour context, whereas injunctive norms are held to detail 'what should be done' regardless of society.
Connection to other theories (especially antecedent theories)	Norm Activation Theory; Social Identity Theory; Self-Categorisation Theory; Theory of Stereotype Activation
Theoretical constructs defined	Descriptive norms; injunctive norms
Causal pathways defined	Injunctive norms (others' approval) and descriptive norms (what others do) help to drive behaviour
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N

May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Fein & Spencer 1997

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	Stereotypes are hardened perceptions of group norms which most keenly distinguish an in-group from out-groups. In this way, a particular stereotype about one or more out-groups can be a source of self-affirmation because it enables individuals to focus on their personal identity as mediated by their membership of a particular group.
Connection to other theories (especially antecedent theories)	Downward Social Comparison Theory (Wills 1981)
Theoretical constructs defined	Stereotypes; in-group identity
Causal pathways defined	Behaviour reflects that self-perception is maintained through inside-outside characterisations of social groups
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Gibbons et al. 2003

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	Risky health behaviours

Theory description	A habit may become fixed because, as the Model shows, an individual performing a behaviour for the first time tends to opt for the 'social reaction' path yet switches onto the 'intentional path' as they perform the behaviour again and again
Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Behavioural intention; behavioural willingness; social comparison; risk images
Causal pathways defined	Behavioural intention is driven by behavioural willingness—the result of attitudes, subjective norms, and risk images
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Gollwitzer 1993

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	An individual may create a rehearsal system in order to lighten the cognitive load introduced by a particular behavioural scenario such that a desired behaviour becomes automatic.
Connection to other theories (especially antecedent theories)	Social Cognitive Theory of Self-Regulation (Bandura 1991)
Theoretical constructs defined	Behavioural intention; implemention
Causal pathways defined	Implementation of behavioural intentions is driven by 'if-then' logical cues
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple

Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Hogg 2007

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	Individuals may experience anxiety if they cannot determine how they measure up in relation to a particular social group
Connection to other theories (especially antecedent theories)	Theory of Stereotype Activation (Fein & Spencer 1997); Theory of Self-Categorisation (Turner et al. 1987)
Theoretical constructs defined	Uncertainty
Causal pathways defined	One's uncertainty with regard to how they are perceived by others results in behaviour that conforms with the standards of a favourable group
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	N
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Implicit

Lewin 1951

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	The degree to which a change in behaviour is obtained depends in part on the environment within which the change is fostered.

Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Habit; behaviour change
Causal pathways defined	Behavioural change is driven by the unfreezing and freezing of habits
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Loewenstein et al. 2001

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	The Risk as Feelings Model suggests that unconscious, automatic cognitive processing occurs before and alongside deliberative processing. An individual's affect may therefore drive their assignation of probabilities to the range of possible behavioural consequences even as their sensory perceptions filter environmental cues. Volitional reflection on behaviour ultimately interacts with the individual's feelings and attitudes in informing the consequent behaviour.
Connection to other theories (especially antecedent theories)	Affect Heuristic (Slovic et al. 2002)
Theoretical constructs defined	Feelings; subjective probabilities; anticipated outcomes; cognitive evaluation
Causal pathways defined	Emotional reactions to risky situations diverge from cognitive assessments
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple

Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Implicit

Michie et al. 2011

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	
Theory description	Behaviour is the result of an individual's possession of the cognitive and physical ability to perform the behaviour in question (capability), the material means with which the behaviour can be completed (opportunity), and the cognitive and emotional capacity in directing agency to accomplish a given task (motivation). What is more is that behaviour has a bidirectional relationship with all 3 factors, indicating that past behaviour naturally influences one's current material and psychological circumstances.
Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Opportunity; motivation; capability
Causal pathways defined	Behaviour is the result of capability interacting with opportunity interacting with motivation—constructs which are executed via education, persuasion, incentivisation, coercion, training, enablement, modelling, environmental restructuring, and restrictions
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Moss & Albery 2009

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	During the pre-consumption phase, priming activates various cognitive patterns—including expectations for alcohol consumption based in part on short- and long-term memories associated with alcohol intake—and thereby accesses certain behavioural patterns. After alcohol consumption begins, cognitive function becomes impaired. Such function is associated with effortful, explicit decision-making processes and is demonstrably harmed by alcohol consumption (Fillmore et al. 1999).
Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Opportunity; motivation; capability
Causal pathways defined	During pre-consumption, propositional reasoning is filtered through cue exposure, association activation and resulting in alcohol consumption; after consumption, the influence of propositional reasoning is weakened.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Complex
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Petty & Cacioppo 1986

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	

Theory description	Information is processed through both analytical and emotional lenses, the latter of which filters affective cues based, in part, on the information's messenger.
Connection to other theories (especially antecedent theories)	Risk as Feelings Model (Loewenstein et al. 2001)
Theoretical constructs defined	Elaboration; affect
Causal pathways defined	The central route of information processing involves message elaboration; the peripheral route considers positive and negative environmental cues
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Schwartz 1977

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	The Norm Activation Model outlines how a particular behaviour is actualised by the application of a norm(s). An individual first consciously considers the range of likely consequences arising from their behaviour and assigns normative weight to those consequences partly from the perspective of if and how it will be viewed by other people.
Connection to other theories (especially antecedent theories)	Focus Theory of Normative Conduct (Cialdini et al. 1990); Theory of Reasoned Action (Azjen & Fishbein 1980)
Theoretical constructs defined	Norms; ascription of responsibility; awareness of consequences
Causal pathways defined	Behaviour is driven by executing one's personal norm—the result of awareness of consequences, ascription of responsibility, and subjective norms.

CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Sheeran et al. 2005

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	Alcohol
Theory description	The Theory of Perceptual Stimuli and Social Cues accounts for all classes of perceptual stimuli (e.g. visual or auditory stimuli) associated with the environment in which a target behaviour is also observed. This refined model encompasses cues associated with the immediately surrounding environment of a targeted behaviour (e.g. an environment in which two or more individuals are socializing). It also includes input stimuli that are more broadly relevant (e.g. seeing others socialise) to the targeted behaviour (socializing), which triggers cognitive activity around the activity with associated activities (e.g. consuming alcohol).
Connection to other theories (especially antecedent theories)	Chameleon Effect (Bargh & Chartrand 1999)
Theoretical constructs defined	Social cues; proximal and distal stimuli
Causal pathways defined	Alcohol consumption is driven in part by conscious and unconscious sensory perception of alcohol-relevant cues, including social cues, in one's environment
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	Y

May be applied to more than 1 health domain?	Y
Assumptions are explicit?	Explicit

Slovic et al. 2002

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	Affect explains how individuals calculate risk from the perspective of their emotional responses to situations entailing risk and not necessarily on the probability of those situations obtaining.
Connection to other theories (especially antecedent theories)	Risk as Feelings Model (Loewenstein et al. 2001)
Theoretical constructs defined	Affect; risk
Causal pathways defined	In the need to make decisions quickly, emotions may influence decisions.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Strack & Deutsch 2004

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	"It is assumed that social behavior is controlled by 2 interacting systems that follow different operating principles. The reflective system generates behavioral decisions that are based on knowledge about facts and values, whereas the

	impulsive system elicits behavior through associative links and motivational orientations. The proposed model describes how the 2 systems interact at various stages of processing, and how their outputs may determine behavior in a synergistic or antagonistic fashion."
Connection to other theories (especially antecedent theories)	Tversky & Kahneman (1971)
Theoretical constructs defined	Perception; motivation; propositional categorisation; noetic decision-making; behavioural decision
Causal pathways defined	Perception, motivational orientation, and behavioural schemata (constituting experiential awareness) interact with propositional categorisation, noetic decision-making and behavioural decision (constituting noetic awareness) to produce behaviour.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Tajfel & Turner 1979

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	
Theory description	Designation as a member of one social group is an important component of an individual's self-categorisation. Collective standards that determine in-group and out-group membership help guide individual behaviour.
Connection to other theories (especially antecedent theories)	Self-Categorisation Theory (1987)
Theoretical constructs defined	Social identity
Causal pathways defined	An individual's identity is driven by their self-

	perceived membership of a group, which prompts certain behaviours and discourages others.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Triandis 1977

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	The Theory of Interpersonal Behaviour holds that habituation is engaged after conscious processing (involving evaluation and beliefs about outcomes) and unconscious processing (involving normative beliefs, self-concept, roles, and emotions) have been realised. Those dual tracks help to inform behavioural intentions, which in turn interact with habituated actions (i.e. repeat, regular behaviour in the past) in cueing a particular behaviour.
Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Norms; self-concept; attitude; affect; intention; habits; facilitating conditions
Causal pathways defined	Intention is the result of attitude (combining past beliefs), social factors (norms, roles), and affect (emotional state), and leads to behaviour.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear

Assumptions are explicit?	Implicit

Turner 1987

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	An individual is first introduced to a group and begins to form an idea of about what it might mean to be in-group, drawing up a class of idiosyncratic values, principles and behaviours from observed interactions with the group. The extent to which an individual feels that their identity already does or could potentially share something with the group determines in part the extent to which an individual may seek to become a member of that group. In this way, from the perspective of the individual, their personal identity and the group identity may become interlocking and mutually reinforcing. And in actualising identity, individual behaviour may be shaped. Therefore, the possibility of influencing individual behaviour may depend in part on identifying and emphasizing particular social norms of the group to which an individual believes they are a member.
Connection to other theories (especially antecedent theories)	Social Identity Theory (Turner & Tajfel 1979)
Theoretical constructs defined	Social identity; categorisation
Causal pathways defined	Recognition of group identity is driven in part by assignation of identity to collective behaviours and characteristics.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Tversky & Kahneman 1979

INCLUSION CRITERIA	
Psychological theory?	Y
Dual-process model of behaviour?	Y
Related to health behaviour?	Y
STUDY CHARACTERISTICS	
Target health behaviour	General
Theory description	Individuals demonstrate inconsistent preferences with regard to risk in consideration of losses and gains attendant on a given behaviour. To wit, they will risk more to avoid losses than they will risk to achieve gains.
Connection to other theories (especially antecedent theories)	--
Theoretical constructs defined	Risk aversion; risk-seeking
Causal pathways defined	Individuals are risk-averse in considering losses and risk-seeking in considering gains.
CRITICAL APPRAISAL	
Theoretical constructs are well-specified?	Y
Causal pathways are well-specified?	Y
'Simple' or 'complex', i.e. referring to structural determinants?	Simple
Specifies particular aspects of health?	N
May be applied to more than 1 health domain?	Unclear
Assumptions are explicit?	Explicit

Appendix 1.5 *Characteristics of excluded studies*

Record name	**Year**	**Reason for exclusion**
Abel et al.	2014	Did not include dual-process model of behaviour
Adachi et al.	2007	Did not include dual-process model of behaviour
Adams	1999	Did not relate to health
Adams	1923	Did not relate to health
Aigner	2011	Did not include dual-process model of behaviour
Al-Otaiba	2010	Did not include dual-process model of behaviour
Alexander	1984	Did not include dual-process model of behaviour or health
Allport	1920	Did not relate to health
Amaria	2009	Did not relate to health
Anderson	1994	Did not relate to health
Anderson	2004	Did not relate to health
Angott	2011	Did not relate to health

Annan	2001	Did not relate to health
Arana	2006	Did not relate to health
Arcurio	2014	Did not include dual-process model of behaviour
Aron & Aron	1986	Did not relate to health
Ashare	2011	Did not include theory of behaviour
Baek	2012	Did not relate to health
Baek	2014	Did not include dual-process model of behaviour
Bailey Carr	2009	Did not include dual-process model of behaviour
Baker	2012	Did not relate to health
Baldi	1996	Did not relate to health
Baldinger	1997	Did not include dual-process model of behaviour
Benedetti	2009	Did not include dual-process model of behaviour
Berger, A.	1983	Did not relate to health
Berger, H.	1983	Did not relate to health
Bills	1929	Did not relate to health
Bills	1934(a)	Did not relate to health
Bills	1934(b)	Did not relate to health
Bills	1934(c)	Did not relate to health
Bogardus	1920(a)	Did not relate to health
Bogardus	1920(b)	Did not relate to health
Bonawitz	2010	Did not relate to health
Bouthillette	1961	Did not relate to health
Brannen	2005	Did not relate to health
Bray & Kehle	2011	Did not relate to health
Brown et al.	1988	Did not relate to health
Bruce & Freeman	1942	Did not relate to health
Bruder et al.	2015	Did not relate to health
Bryant et al.	2014	Did not relate to health
Bryant et al.	2009	Did not relate to health
Burnham	1932	Did not relate to health
Cahill	2015	Did not relate to health
Cahill	2011	Did not relate to health
Cancelliere	2011	Did not relate to health
Carpenter	1995	Did not include dual-process model of behaviour
Cassidy & MacDonald	2010	Did not relate to health
Chang	2009	Did not include dual-process model of behaviour
Chin	1992	Did not relate to health
Cialdini & Griskevicius	2010	Did not relate to health
Columbus, A.	2005(a)	Did not relate to health
Columbus, A.	2006(b)	Did not relate to health
Columbus, A.	2006(c)	Did not relate to health
Columbus, A.	2006(d)	Did not relate to health

Columbus, A.	2006(e)	Did not relate to health
Columbus, A.	2006(f)	Did not relate to health
Columbus, A.	2006(g)	Did not relate to health
Columbus, A.	2007(h)	Did not relate to health
Columbus, A.	2008(i)	Did not relate to health
Columbus, F.	2001	Did not relate to health
Daniel	2011	Did not include dual-process model of behaviour
Davies	1973	Did not relate to health
DeLeon	1996	Did not relate to health
Derbigny	2011	Did not relate to health
Dunsmoor	2012	Did not relate to health
Edwards et al.	2006	Did not include dual-process model of behaviour
Ehrlich	2000	Did not relate to health
El Nokali	2011	Did not include dual-process model of behaviour
Emami	1966	Did not relate to health
Fast	2003	Did not relate to health
Filingeri	1985	Did not include dual-process model of behaviour
Finney	2011	Did not include dual-process model of behaviour
Gabriel	2000	Did not relate to health
Garner	2015	Did not relate to health
Gilkerson & Taylor	2005	Did not relate to health
Gillies	2007	Did not relate to health
Goguen	1973	Did not include dual-process model of behaviour
Gordon	1998	Did not include dual-process model of behaviour
Greenwald	1984	Did not include dual-process model of behaviour
Grimmett	1954	Did not relate to health
Grix	2014	Did not include dual-process model of behaviour
Horne	1906	Did not include dual-process model of behaviour
Howells	1933	Did not include dual-process model of behaviour
Hsieh	2010	Did not relate to health
Islam	2013	Did not include dual-process model of behaviour
Jennings	1963	Did not include dual-process model of behaviour
Jensen	1987	Did not include dual-process model of behaviour
Jones et al.	2011	Did not include dual-process model of behaviour
Joscelyn	1978	Did not include dual-process model of behaviour
Kafman	1971	Did not relate to health
Khalsa	1990	Did not include dual-process model of behaviour
Kortenkamp	2009	Did not include dual-process model of behaviour
Kross et al.	2014	Did not include dual-process model of behaviour
Krum et al.	1987	Did not include dual-process model of behaviour
Kueny	1985	Did not relate to health
Lee	1999	Did not relate to health
Lewis et al.	2009	Did not include dual-process model of behaviour
Leyden	2012	Did not include dual-process model of behaviour

Lim	2009	Did not relate to health
Lin	2009	Did not relate to health
Lin	2012	Did not relate to health
Loehrlein	2012	Did not relate to health
Lowry	2000	Did not include dual-process model of behaviour
Mahgerefteh	2015	Did not include dual-process model of behaviour
Mashour	1964	Did not relate to health
Maskay & Juhasz	1983	Did not include dual-process model of behaviour
McCarthy	1998	Did not include dual-process model of behaviour
Milne	2008	Did not include dual-process model of behaviour
Moran	2009	Did not include dual-process model of behaviour
Nickles	1995	Did not relate to health
Padgett	1985	Did not relate to health
Paulsen	2012	Did not relate to health
Petersen	1997	Did not include dual-process model of behaviour
Poindexter	2014	Did not include dual-process model of behaviour
Preliou	2011	Did not include dual-process model of behaviour
Quinn et al.	2011	Did not relate to health
Redding	1993	Did not relate to health
Redish et al.	2008	Did not include dual-process model of behaviour
Reilly	1985	Did not include dual-process model of behaviour
Reinen	2014	Did not relate to health
Richardson	2005	Did not relate to health
Ro	2010	Did not relate to health
Rothman	2004	Did not include dual-process model of behaviour
Rubin	2005	Did not include dual-process model of behaviour
Ryan	1998	Did not include dual-process model of behaviour
Ryan	1980	Did not relate to health
Sankey	2002	Did not relate to health
Schaps	1970	Did not relate to health
Seeman	2003	Did not relate to health
Snow	1981	Did not relate to health
Sorensen et al.	2002	Did not include dual-process model of behaviour
Spencer	2006	Did not include dual-process model of behaviour
Stark	1985	Did not include dual-process model of behaviour
Steinberg	2009	Did not include dual-process model of behaviour
Sweitzer	2013	Did not include dual-process model of behaviour
Tost	2010	Did not relate to health
Van der Meij et al.	2015	Did not include dual-process model of behaviour
Wearing & Hart	1996	Did not include dual-process model of behaviour
Willis	1990	Did not include dual-process model of behaviour
Wimberley	1977	Did not relate to health
Zey	1992	Did not relate to health

Zheng	2012	Did not include dual-process model of behaviour

Appendix 2.1. *Search strings and hits for the Cochrane-style review*

MEDLINE and MEDLINE In-Process & Non-Indexed Citations (OvidSP; 1946 to present; 467 hits)
EMBASE (OvidSP; 1974 to present; 602 hits)
PsycINFO (OvidSP; 1806 to present; 314 hits)

1. (drinking behavior or alcohol deterrents or alcohol-related disorders or alcohol beverages).sh. or alcohol intoxication.af. or alcoholics.sh. or drink*.sh. or drunk$.af. or alcohol$.af. or beverage$.af. or beer$.af. or lager$.af. or wine$.af. or cider$.af. or alcopop$.af. or alco-pop$.af. or spirit$.af. or tequila$.af. or distilled beverage$.af. or schnapps.af. or brandy.af. or brandies.af. or liquor$.af. or liqueur$.af. or whisky.af. or whiskey$.af. or whiskies.af. or gin$.af. or rum$.af. or vodka$.af. or alcoholism.sh.
2. ((cooking and eating utensils).sh. or size$.ab. or dimension$.ab. or capacity.ab. or capacities.ab. or volume$.ab. or shape$.ab. or height$.ab. or width$.ab. or length$.ab. or depth$.ab. or portion$.ab. or serving$.ab. or product$.ab. or package$.ab. or unit$.ab. or drink$.ab. or tableware.ab. or drinkware.ab. or dinnerware.ab. or crockery.ab. or cup$.ab. or glass.ab. or glasses.ab. or mug$.ab. or pitcher$.ab. or jug$.ab. or decater$.ab. or receptacle$.ab. or container$.ab. or can$.ab.) and carton$.ab. and bottle$.ab.
3. (product packaging or food packaging or automatic food dispensers or food storage or product labeling or food labeling or drug labeling).sh.
4. (advertisements or posters or audiovisual aids or sensory feedback or auditory perception or illusions or visual pattern recognition or video-audio media or visual perception or auditory perception or photography or medical illustration or multimedia or spatial analysis or spatial behavior or spatial learning or spatial memory or space perception or spatial navigation or spatial processing or perceptual distortion or form perception or olfactory perception or social perception or taste or taste perception or touch perception or weight perception or health education or health promotion or communication or information dissemination or repetition priming or aversive therapy or attention or psychological feedback or sensory feedback or psychomotor performance).sh. or visual aid.ab. or visual presentation.ab. or visual representation.ab. or visual information.ab. or visual media.ab. or visual display.ab. or visual stimuli.ab. or health information.ab. or health message.ab. or health education.ab. or health promotion.ab. or fear appeal.ab. or fear arous*.ab. or threat appeal.ab. or threat arous*.ab. or risk communication$.ab. or health warning$.ab. or warning message$.ab. or image*.ab. or pictur*.ab. or pictorial.ab. or illustrat*.ab. or cartoon$.ab. or graphic*.ab. or photograph*.ab. or aversi*.ab. or negative.ab. or affective.ab. or threat*.ab. or danger*.ab. or disgust*.ab. or distate*.ab. or disturb*.ab. or unpleasant.ab. or unattractive.ab. or unappealing.ab. or repel*.ab. or repuls*.ab. or repugnan*.ab. or conditioning.ab. or emotion.ab. or fear.ab. or warn*.ab. or risk*.ab. or motivat*.ab. or persuas*.ab. or presentation$.ab. or select*.ab. or proxim*.ab.
5. (modif* or chang* or alter* or adjust* or adapat* or add* or increas* or more or greater or higher or larger or longer or subtract* or restrict* or remov* or constrain* or restrain*

or limit* or lower* or reduc* or decreas* or smaller or less* or fewer or choice$ or choose or option$ or consum* or intak* or perform* or behavio* or attidu* or habit*).ab.
6. exp Restaurants/ OR pub OR public house OR bar OR barroom OR drinking establishment OR drinkhouse OR cafe OR cafeteria OR diner OR inn OR dive OR eatery OR grill OR eating houseOR night club OR shop OR tavern OR bistro OR lounge OR saloon OR alehouse OR canteen OR tap OR taproom OR beer garden OR drinkery OR watering hole
7. RCT.ab. or randomized controlled trial.sh. or clinical trial.sh. or evaluation studies.sh. or comparative study.sh. or random*.ab. or placebo*.ab. or trial.ab. or wait-list.ab. or waitlist.ab. or experiment*.ab. or intervention*.ab. or blind method.ab. or single blind.ab. or double blind.ab. or triple blind.ab. or blind procedure.ab. or dummy.ab. or pre test.ab. or pretest.ab. or post test.ab. or posttest.ab. or pre-intervention.ab. or preintervention.ab. or post-intervention.ab. or postintervention.ab. or assign*.ab. or allocat*.ab. or volunteer*.ab. or control*.ab. or compar*.ab. or systematic review.sh. or meta-analysis.sh. or meta-synthes*.ab. or metasynthes*.ab. or metasummar*.ab. or meta-summar*.ab. or metastud*.ab. or meta-stud*.ab. or metanarrative$.ab. or meta-narrative$.ab.
8. OR/ 1 AND 2
9. OR/ 1 AND 3
10. OR/ 1 AND 4
11. AND/ 5-10
12. Limit 11 to (English language and humans)

CINAHL (287 hits)
(Drinking Behavior OR Alcohol Deterrents OR Alcohol-Related Disorders OR Alcoholic Beverages OR Alcohol Intoxication OR Alcoholics OR Alcoholism OR drink* OR drunk$ OR alcohol$ OR beverage$ OR beer$ OR lager$ OR wine$ OR cider$ OR alcopop$ OR alco-pop$ OR spirit$ OR tequila$ OR distilled beverage$ OR schnapps OR brandy OR brandies OR liquor$ OR liqueur$ OR whisky OR whiskey$ OR whiskies OR gin$ OR rum$ OR vodka$ OR cocktail$) AND (Cooking and Eating Utensils OR size$ OR dimension$ OR capacity OR capacities OR volume$ OR shape$ OR height$ OR width$ OR length$ OR depth$ OR portion$ OR serving$ OR product$ OR package* OR unit$ OR drink$ OR tableware OR drinkware OR dinnerware OR crockery OR cup$ OR glass OR glasses OR mug$ OR pitcher$ OR jug$ OR decanter$ OR receptacle$ OR container$ OR can$ OR carton$ OR bottle$) AND (Product Packaging OR Food Packaging OR Automatic Food Dispensers OR Food Storage OR Product Labeling OR exp Food Labeling OR Drug Labeling) AND (Advertisements OR Posters OR Audiovisual Aids OR Sensory Feedback OR Auditory Perception OR Illusions OR Visual Pattern Recognition OR Video-Audio Media OR Visual Perception OR Auditory Perception OR Photography OR Medical Illustration OR Multimedia OR Spatial Analysis OR Spatial Behavior OR Spatial Learning OR Spatial Memory OR Space Perception OR Spatial Navigation OR Spatial Processing OR Perceptual Distortion OR Form Perception OR Olfactory Perception OR Social Perception OR Taste Perception OR Touch Perception OR Weight Perception OR Health Education OR Health Promotion OR Communication OR Information Dissemination OR Repetition Priming OR Aversive Therapy OR Attention OR Psychological Feedback OR Sensory Feedback OR Psychomotor Performance OR information OR message* OR education OR promotion OR risk communication$ OR health warning$ OR warning message$ OR image*

or pictur* or pictorial or illustrat* or cartoon$ or graphic* or photograph* OR aversi* OR negative OR affective OR threat* OR danger* OR disgust* OR distast* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* or repuls* OR repugnan* OR conditioning OR emotion* OR fear* OR warn* OR risk* or motivat* OR persuas* OR presentation$ OR select* OR proxim*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice$ OR choose OR option$ OR consum* OR intak* OR perform* OR behavio* or attidu* OR habit*) AND (restaurant OR pub OR public house OR bar OR barroom OR drinking establishment OR drinkhouse OR cafe OR cafeteria OR diner OR inn OR dive OR eatery OR grill OR eating houseOR night club OR shop OR tavern OR bistro OR lounge OR saloon OR alehouse OR canteen OR tap OR taproom OR beer garden OR drinkery OR watering hole) AND (RCT OR Randomized Controlled Trial OR Clinical Trial OR exp Evaluation Studies OR Comparative Study OR random* OR placebo* OR trial OR wait-list OR waitlist OR blind method OR single blind OR double blind OR triple blind OR blind procedure OR dummy OR experiment* OR intervention* OR pre test OR pretest OR post test OR posttest OR pre-intervention OR preintervention OR post-intervention OR postintervention OR assign* OR allocat* OR volunteer* OR control* OR compar* OR Systematic Review OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative$ OR meta-narrative$)

ERIC (202 hits)
Sociological Abstracts (789 hits)
ASSIA (ProQuest; 1987 to present; 798 hits)
ProQuest Dissertations and Theses Global (640 hits)
(Cooking and Eating Utensils OR size$ OR dimension$ OR capacity OR capacities OR volume$ OR shape$ OR height$ OR width$ OR length$ OR depth$ OR portion$ OR serving$ OR product$ OR package* OR unit$ OR drink$ OR tableware OR drinkware OR dinnerware OR crockery OR cup$ OR glass OR glasses OR mug$ OR pitcher$ OR jug$ OR decanter$ OR receptacle$ OR container$ OR can$ OR carton$ OR bottle$) AND (Product Packaging OR Food Packaging OR Automatic Food Dispensers OR Food Storage OR Product Labeling OR exp Food Labeling OR Drug Labeling) AND (Advertisements OR Posters OR Audiovisual Aids OR Sensory Feedback OR Auditory Perception OR Illusions OR Visual Pattern Recognition OR Video-Audio Media OR Visual Perception OR Auditory Perception OR Photography OR Medical Illustration OR Multimedia OR Spatial Analysis OR Spatial Behavior OR Spatial Learning OR Spatial Memory OR Space Perception OR Spatial Navigation OR Spatial Processing OR Perceptual Distortion OR Form Perception OR Olfactory Perception OR Social Perception OR Taste Perception OR Touch Perception OR Weight Perception OR Health Education OR Health Promotion OR Communication OR Information Dissemination OR Repetition Priming OR Aversive Therapy OR Attention OR Psychological Feedback OR Sensory Feedback OR Psychomotor Performance OR information OR message* OR education OR promotion OR risk communication$ OR health warning$ OR warning message$ OR image* or pictur* or pictorial or illustrat* or cartoon$ or graphic* or photograph* OR aversi* OR negative OR affective OR threat* OR danger* OR disgust* OR distast* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* or repuls* OR repugnan* OR conditioning OR emotion* OR fear* OR warn* OR risk* or motivat* OR persuas* OR

presentation$ OR select* OR proxim*) AND (Drinking Behavior OR Alcohol Deterrents OR Alcohol-Related Disorders OR Alcoholic Beverages OR Alcohol Intoxication OR Alcoholics OR Alcoholism OR drink* OR drunk$ OR alcohol$ OR beverage$ OR beer$ OR lager$ OR wine$ OR cider$ OR alcopop$ OR alco-pop$ OR spirit$ OR tequila$ OR distilled beverage$ OR schnapps OR brandy OR brandies OR liquor$ OR liqueur$ OR whisky OR whiskey$ OR whiskies OR gin$ OR rum$ OR vodka$ OR cocktail$) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice$ OR choose OR option$ OR consum* OR intak* OR perform* OR behavio* or attidu* OR habit*) AND (restaurant OR pub OR public house OR bar OR barroom OR drinking establishment OR drinkhouse OR cafe OR cafeteria OR diner OR inn OR dive OR eatery OR grill OR eating houseOR night club OR shop OR tavern OR bistro OR lounge OR saloon OR alehouse OR canteen OR tap OR taproom OR beer garden OR drinkery OR watering hole) AND (Randomized Controlled Trial OR Clinical Trial OR Evaluation Studies OR Comparative Study OR random* OR placebo* OR trial OR waitlist OR blind method OR single blind OR double blind OR triple blind OR blind procedure OR dummy OR experiment* OR intervention* OR pretest OR post test OR preintervention OR post intervention OR assign* OR allocat* OR volunteer* OR control* OR compar* OR Systematic Review OR Meta-Analysis OR meta-synthes* OR metasummar* OR metastud* OR metanarrative$)

ISI Web of Science, including Science Citation Index Expanded (1945 to present), Social Sciences Citation Index (1956 to present), Arts & Humanities Citation Index (1975 to present), Conference Proceedings Citation Index—Science (1900 to present), Conference Proceedings Citation Index—Social Science & Humanities (1990 to present), Book Citation Index—Science (2005 to present), Book Citation Index—Social Sciences & Humanities (2005 to present; 5761 hits)

TS=((Cooking and Eating Utensils OR size$ OR dimension$ OR volume$ OR height$ OR width$ OR length$ OR depth$ OR unit$ OR drink$ OR tableware OR drinkware OR dinnerware OR crockery OR cup$ OR glass OR glasses OR mug$ OR pitcher$ OR jug$ OR decanter$ OR receptacle$ OR container$ OR can$ OR carton$ OR bottle$) AND (Product Packaging OR Food Packaging OR Automatic Food Dispensers OR Food Storage OR Product Labeling OR exp Food Labeling OR Drug Labeling) AND (Advertisements OR Posters OR Audiovisual Aids OR Auditory Perception OR Visual Pattern Recognition OR Visual Perception OR Auditory Perception OR Medical Illustration OR Spatial Behavior OR Spatial Learning OR Spatial Memory OR Spatial Navigation OR Olfactory Perception OR Taste Perception OR Touch Perception OR Weight Perception OR Health Promotion OR Information Dissemination OR Repetition Priming OR Aversive Therapy OR Psychological Feedback OR Sensory Feedback OR risk communication$ OR health warning$ OR warning message$ OR conditioning OR warn* OR risk* or motivat*) AND (Drinking Behavior OR Alcohol Deterrents OR Alcoholic Beverages OR Alcohol Intoxication OR Alcoholics OR Alcoholism OR drink* OR drunk$ OR alcohol$ OR beverage$ OR beer$ OR lager$ OR wine$ OR cider$ OR alcopop$ OR alco-pop$ OR spirit$ OR tequila$ OR distilled beverage$ OR schnapps OR brandy OR brandies OR liquor$ OR liqueur$ OR whisky OR whiskey$ OR whiskies OR gin$ OR rum$ OR vodka$ OR cocktail$) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR

more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice$ OR choose OR option$ OR consum* OR intak* OR perform* OR behavio* or attidu* OR habit*) AND (restaurant OR pub OR public house OR bar OR barroom OR drinking establishment OR drinkhouse OR cafe OR cafeteria OR diner OR inn OR dive OR eatery OR grill OR eating houseOR night club OR shop OR tavern OR bistro OR lounge OR saloon OR alehouse OR canteen OR tap OR taproom OR beer garden OR drinkery OR watering hole) AND (Randomized Controlled Trial OR Clinical Trial OR random* OR placebo* OR trial OR waitlist OR blind method OR single blind OR double blind OR triple blind OR blind procedure OR dummy OR experiment* OR intervention* OR pretest OR post test OR preintervention OR post intervention OR assign* OR allocat* OR volunteer* OR control* OR compar* OR Systematic Review OR Meta-Analysis OR meta-synthes* OR metasummar* OR metastud* OR metanarrative$))

Grey literature databases
metaRegister of Randomised Controlled Trials
Trials Register of Promoting Health Interventions (TRoPHI; EPPI Centre; 2004 to present)
Cochrane Database of Systematic Reviews
Database of Promoting Health Effectiveness Reviews (DoPHER)
World Health Organization International Clinical Trials Registry Program
National Institute for Health and Clinical Excellence
Agency for Health Care Research and Quality

Appendix 2.2 *Data extraction and critical appraisal form for the Cochrane-style review of CA interventions in alcohol use in public drink settings*

IDENTIFYING INFORMATION	
Record name	
Author(s)	
Year	
INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	
Outcome focused on alcohol consumption?	
Public drink setting?	
RCT?	
STUDY CHARACTERISTICS	
Objective	
Study design	
Population	
Number of participants	

Number of men	
Age	
Intervention description (including content, delivery, setting, provider)	
Delivery format	
Sessions duration	
Available drink options	
Drink setting	
Outcome measures	
Time(s) at which outcomes assessed	
Additional comments	
RISK OF BIAS	
Adequate sequence generation?	
Allocation concealment?	
Blinding?	
Complete outcome data?	
Selective reporting?	
Other	

Appendix 2.3 *Characteristics of included studies*

Engels et al. (2011)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"*In a field experiment, we tested whether textual references to alcohol in music played in bars lead to higher revenues of alcoholic beverages."*
Study design	In a naturalistic setting (a bar lab), young adult male pairs watched a movie clip for 1 hour with two commercial breaks and were allowed to drink non-alcohol and alcoholic beverages. These participants were randomly assigned to one of four conditions varying on the type of movie (many versus few alcohol portrayals) and commercials (alcohol commercials

	present or not).
Population	Young men
Country	Netherlands
Unit of analysis	Dyad
Sample size	80
Number of men	80
Age	18-29
Intervention description (including content, delivery, setting, provider)	(1) Alcoholic movie with neutral and alcohol commercials (2) Alcoholic movie with neutral commercials (3) Non-alcoholic movie with neutral and alcohol commercials (4) Non-alcoholic movie with neutral commercials
Sessions duration	90 min
Available drink options	Alcohol: beer, wine
Drink setting	Bar laboratory
Outcome measures	Number of drinks ordered
Additional comments	Food available: nuts, chips; participants able to smoke

RISK OF BIAS		
Adequate sequence generation?	Low risk	"The songs of the playlist were played in random order by the bartender."
Allocation concealment?	Low risk	"All evenings were randomly assigned to either the alcohol condition or the control condition, with 23 evenings in both conditions; a total of 18 evenings of research were conducted in Bar A, 12 in Bar B, and 16 in Bar C; all equally divided over both conditions."
Blinding?	High risk	"The bartenders were not blind to the condition, as they had to select the specific songs from the music playlists (alcohol or nonalcohol) on those evenings."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	Low risk	Insofar as reviewer could tell

Engels et al. (2009)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y

RCT?	Y
STUDY CHARACTERISTICS	
Objective	"We tested experimentally whether portrayal of alcohol images in movies and commercials on television promotes actual drinking."
Study design	In a naturalistic setting (af bar lab), young adult male pairs watched a movie clip for 1 hour with two commrcial breaks and were allowed to drink non-alcohol and alcoholic beverages. These participants were randomly assigned to one of four conditions varying on the type of movie (many versus few alcohol portrayals) and commercials (alcohol commercials present or not).
Population	Young adult men
Country	Netherlands
Unit of analysis	Individual
Sample size	N/A
Number of men	(100percent)
Age	N/A
Intervention description (including content, delivery, setting, provider)	(1) Music with lyrics referencing alcohol (2) Music without lyrics referencing alcohol
Sessions duration	120 min
Available drink options	Alcohol: beer, wine
Drink setting	Bar laboratory
Outcome measures	Total money spent
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	Low risk	"All 40 couples were randomly assigned to one of the four differ- ent movie conditions, resulting in 20 males in each condition."
Allocation concealment?	Low risk	Insofar as reviewer could tell
Blinding?	High risk	Insofar as reviewer could tell
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	Low risk	Insofar as reviewer could tell

Gueguen et al. (2008)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y

Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"It had been found that environmental music was associated with an increase in alco- hol consumption. The presence versus absence of music, high versus slow tempo and the different styles of environmental music is associated with different level of alcohol consumption. However, the effect of the level of the environmental music played in a bar still remained in question."
Study design	Forty male beer drinkers were observed in a bar. According to a random distribution, patrons were exposed to the usual level of environmental music played in 2 bars where the experiment was carried out or were exposed to a higher level
Population	Males
Country	France
Unit of analysis	DYAD
Sample size	40
Number of men	40
Age	--
Intervention description (including content, delivery, setting, provider)	(1) Sound level of 72 decibels in 2 bars (2) Sound level of 88 decibels in 2 bars
Sessions duration	2 hours
Available drink options	Draft beer (8oz glass)
Drink setting	2 bars in a mid-size French city
Outcome measures	Drinks ordered
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	High risk	"The participants were 40 patrons (40 males, aged 18 to 25) who unknowingly participated in the study and were observed at random in 2 bars."
Allocation concealment?	High risk	Insofar as reviewer could tell
Blinding?	High risk	"The participants were 40 patrons…who unknowingly participated in the study and were observed at random in 2 bars."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	High risk	

Gueguen et al. (2004)

INCLUSION CRITERIA	
Intervention in line with	Y

CA intervention definition?	
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"The effect of background music on alcohol consumption has been widely researched in the literature, but few studies have tested the effect of sound level on drinking behavior. An experiment was carried out in two bars to test patrons' response to music's loudness."
Study design	An experiment was carried out in two bars (one rural and one urban) to test patrons' response to music's loudness. Using random assignment, patrons were exposed to a sound level which was higher than that usually employed in the bars in which the study took place.
Population	Bar patrons
Country	France
Unit of analysis	Dyad
Sample size	120
Number of men	60
Age	--
Intervention description (including content, delivery, setting, provider)	(1) Rural bar and sound level of 72 decibels (1) Rural bar and sound level of 88 decibels (2) Urban bar and sound level of 75 decibels (2) Urban bar and sound level of 91 decibels
Sessions duration	2-hours
Available drink options	--
Drink setting	2 bars in mid-size French city
Outcome measures	Drinks ordered
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	High risk	"Before selecting a participant, the sound level of the background music was manipulated according to a randomization procedure."
Allocation concealment?	High risk	"The observations were made during two Saturday nights with the consent of the owners of the bars."
Blinding?	High risk	"Two observers situated in two different places in the bars in which the experiment took place were used."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	High risk	

Jacob (2006)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"The effects of background music have been widely studied in the literature but few studies have tested effects of music in commercial settings. An experiment was carried out in a bar to test influence of three different styles of music on patrons."
Study design	Jacob (2006) tested the effects of 2 playlists offering different styles of music in a rural French bar setting. In particular, Jacob observed participants at a pub over the course of 2 evenings during which time a 'Top 40' popular music playlist was alternated with a Cartoon Music playlist.
Population	Bar patrons
Country	France
Unit of analysis	Dyad
Sample size	93
Number of men	76
Age	--
Intervention description (including content, delivery, setting, provider)	(1) Cartoon music played for 30 min in bar (2) Top 40 music played for 30 min in bar (3) Drinking songs played for 30 min in bar
Sessions duration	90 min
Available drink options	--
Drink setting	Bar in mid-size seaside resort town in France
Outcome measures	Total money spent
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	High risk	"The participants were… observed at random in a bar…" "Before selecting participants, background music was manipulated according to a randomized scheme."
Allocation concealment?	High risk	"The observations were made during 14 afternoons of three working weeks with the consent of the owner of the bar. Two observers were seated in two different locations in the

		bar."
Blinding?		"The participants were 93 patrons (76 males and 17 females) who unknowingly participated in the study and were observed at random in a bar…"
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	Low risk	Insofar as reviewer could tell

Kohn & Smart (1984a)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"[To] report an experiment to determine the effects of television beer commercials on ongoing beer consumption by young men drinkers"
Study design	The drinking behavior of 96 male normal drinking college students was assessed after they viewed a videotape of a popular prime-time television program complete with advertisements. Different versions of the videotape were used to evaluate the effects of a television program with and without alcohol scenes as crossed with the effects of three different types of advertisement (i.e., beer, nonalcoholic beverages and food). After viewing the videotape, the subjects, who were led to believe that they were participating in two separate and unrelated sets of experimental procedures, were asked to perform a taste rating of light beers, which actually provided an unobtrusive measure of their alcohol consumption.
Population	Male normal drinking college students
Country	Canada
Unit of analysis	Individual
Sample size	125
Number of men	125
Age	21-25
Intervention description (including content, delivery, setting, provider)	(1) Zero commercials during football match (2) Four commercials during football match (3) Nine commercials during football match
Sessions duration	90-min

Available drink options	--
Drink setting	Bar laboratory
Outcome measures	Number of subjects ordering alcohol at 30-min intervals
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	Low risk	"Assignment of experimental sessions to treatments was random within subsets of six…"
Allocation concealment?	High risk	Insofar as reviewer could tell
Blinding?	Low risk	"…subjects were assigned to sessions in order of recruitment, which was random."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Uncertain risk	Insofar as reviewer could tell
Other	Uncertain risk	Insofar as reviewer could tell

Leeman & Corbin (2013)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	
Study design	"We developed an alcohol self-administration paradigm to model individual differences in impaired control. The paradigm includes moderate drinking guidelines meant to model limits on alcohol consumption, which are typically exceeded by people with impaired control. Possible payment reductions provided a disincentive for excessive drinking. Alcohol use above the guideline, despite possible pay reductions, was considered to be indicative of impaired control. Heavy-drinking 21- to 25-year-olds (n = 39) were randomized to an experimental condition including the elements of the impaired control paradigm or to a free-drinking condition without these elements. Alcohol self-administration was compared between these two conditions to establish the internal validity of the experimental paradigm. In both conditions, participants self-administered beer and nonalcoholic beverages for 3 hours in a bar setting with 1–3 other participants."
Population	Heavy drinking 21-25 year olds

Country	USA
Unit of analysis	Individual
Sample size	39
Number of men	27
Age	21-25 years old
Intervention description (including content, delivery, setting, provider)	(1) Subjects informed that for each of the 4 psychomotor tasks they did not perform comparably with initial screening, they would draw from a hat for a possible pay reduction ($0, $6, $12) for potential loss up to $48. (2) No payment reduction
Sessions duration	180-min
Available drink options	5percent alcohol by volume: Budweiser, Molson Canadian, Smithwick's Ale
Drink setting	Laboratory bar
Outcome measures	Drinks ordered
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	Low risk	"Randomization to the experimental or free-drinking condition was by session, meaning that all participants in a given session were randomized to the same condition."
Allocation concealment?	Low risk	"Experimental condition participants were also told that for each of the 4 tasks they did not perform comparably with initial screening, they would draw from a hat for a possible pay reduction ($0, $6 or $12) at a follow-up appointment 1–3 days after the session."
Blinding?	Low risk	Insofar as reviewer could tell
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	Uncertain risk	Insofar as reviewer could tell

Moss et al. (2015)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y

STUDY CHARACTERISTICS	
Objective	A simulated bar environment was used to examine the impact of context, RDM posters, and brief online responsible drinking advice on actual drinking behaviour. Experiments one (n = 50) and two (n = 35) comprised female non-problem drinkers, whilst Experiments three (n = 80) and 4 (n = 60) included a mixed-gender sample of non-problem drinkers, recruited from an undergraduate student cohort. The Alcohol Use Disorders Identification Test (AUDIT) was used to assess drinking patterns. Alcohol intake was assessed through the use of a taste preference task.
Study design	"Four experiments were conducted to assess the acute impact of context and exposure to responsible drinking messages (RDMs) on attentional allocation and drinking behaviour of younger drinkers and to explore the utility of lab-based methods for the evaluation of such materials."
Population	College students
Country	UK
Unit of analysis	Individual
Sample size	225
Number of men	66
Age	21-25 year old non-problem drinkers
Intervention description (including content, delivery, setting, provider)	(1) Natural bar setting (2) Laboratory setting (3) Responsible Drinking Message poster (4) Control poster (5) Online priming + RDM poster (6) No online priming + control poster (7) RDM poster + subject verbalization of message (8) Control poster + no verbalization of message
Sessions duration	N/A
Available drink options	Beer, wine, orange juice
Drink setting	Bar laboratory
Outcome measures	Alcohol intake
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	Low risk	"Random allocation in this and subsequent studies was achieved using a random number generator at the start of the study to produce a random sequence of conditions, to which each participant was assigned on entry to each study."
Allocation concealment?	Low risk	Multiple experimental conditions that must have

		been known to experimenter
Blinding?	Low risk	"If suspicions regarding the actual nature of the task were indicated, participants were then asked to elaborate on what they thought the real purpose of the study was. No participants reported awareness of the true study aim."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Uncertain risk	Insofar as reviewer could tell
Other	Uncertain risk	Insofar as reviewer could tell

Otten et al. (2013)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"This study tested the effects of self-control failure on *ad libitum* drinking, and the potential moder- ating role of glucose and self-awareness on this relationship."
Study design	Participants were randomised to receive the treatment condition (self-control-depleting task) or control condition. The depletion condition required that individuals cross out the letter 'e' in in a page of text, followed by increasingly convoluted crossing-out rules. Participants were then offered the opportunity to select alcoholic or non-alcoholic beverages to drink during a 30-minute break, during which time researchers observed participant consumption levels. All control and treatment participants were then assigned to 1 of 2 additional conditions: self-awareness (in which participants were asked to write down the number of drinks they consumed on a piece of paper) or no treatment (control).
Population	College students
Country	Netherlands
Unit of analysis	DYAD
Sample size	108
Number of men	108
Age	21-25 years old
Intervention description	(1) Depletion task + self-tracking task

(including content, delivery, setting, provider)	(2) Depletion task + no self-tracking task (3) No depletion task + self-tracking task (4) No depletion task + no self-tracking
Sessions duration	60-min
Available drink options	--
Drink setting	Laboratory bar
Outcome measures	Alcohol intake
Additional comments	Alcohol intake

RISK OF BIAS		
Adequate sequence generation?	Low risk	"After completing questionnaires containing demographic questions, the dyads were allocated randomly to the depletion or control condition."
Allocation concealment?	Low risk	Insofar as reviewer could tell
Blinding?	Low risk	"A cover story was used to prevent participants from becoming aware of the primary aim of the experiments. First, both participants were asked to complete a questionnaire with questions about demographics, daily activities and plans for the coming hours. In addition, as a control measure, they were asked for their subjective craving for alcohol and trait self-control. These questions were embedded between filler items in order to further distract participants from the true aim of the study."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	Uncertain risk	Insofar as reviewer could tell

Sobell et al. (1986)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"The drinking behaviour of 96 male normal drinking college students was assessed after they viewed a videotape of a popular

	prime-time television program complete with advertisements."
Study design	The drinking behavior of 96 male normal drinking college students was assessed after they viewed a videotape of a popular prime-time television program complete with advertisements. Different versions of the videotape were used to evaluate the effects of a television program with and without alcohol scenes as crossed with the effects of three different types of advertisement (si.e., beer, nonalcoholic beverages and food). After viewing the videotape, the subjects, who were led to believe that they were participating in two separate and unrelated sets of experimental procedures, were asked to perform a taste rating of light beers, which actually provided an unobtrusive measure of their alcohol consumption.
Population	Male normal drinking college students
Country	Canada
Unit of analysis	Individual
Sample size	96
Number of men	96
Age	Male normal drinking college students
Intervention description (including content, delivery, setting, provider)	(1) Beer commercial + alcohol TV scenes (2) Beer commercial + no alcohol TV scenes (3) NA beverage com. + alcohol TV scenes (4) NA beverage com. + no alcohol TV scenes (5) Food commercial + alcohol TV scenes (6) Food commercial + no alcohol TV scenes
Sessions duration	60-min
Available drink options	Beer (341 mL/bottle) (up to 1023 TOTAL mL) Carling Trilight (2.5percent ethanol)
Drink setting	Bar laboratory
Outcome measures	Alcohol intake
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	High risk	"Subjects were interviewed at a local shopping mall and randomly assigned to three groups…"
Allocation concealment?	Low risk	Insofar as reviewer could tell
Blinding?	High risk	"Initial instructions. To make the two experimental procedures appear unrelated, two separate consents were used. Subjects were asked to read the first consent, which indicated that the exact nature and reasons for each of the experimental procedures would be explained at the end of the session, but that they would be informed in advance about the details of each

		procedure."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	High risk	"It was planned to have experimenters run different but equal numbers of subjects in each of the six groups. This was followed except for a procedural error, which resulted in one experimenter running five rather than six total subjects in one condition and another experimenter running five rather than four total subjects in that condition."

Wigmore & Hinson (1991)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Public drink setting?	Y
RCT?	Y
STUDY CHARACTERISTICS	
Objective	"Previous research using the balanced placebo design has demonstrated that instructions about alcohol content of a beverage affect consumption more than actual alcohol content. In the present experiment the balanced placebo design was… a 2 x 2 x 2 factorial with expectancy about alcohol content, actual alcohol content, and setting in which the experiment was conducted as factors."
Study design	In their trial, Wigmore & Hinson informed 50 percent of participants that they were to consume alcoholic beverages whereas the other 50 percent were informed they were to consume non-alcoholic beverages. Yet, unbeknownst to them, half of both groups actually received alcoholic beverages and the other half of both groups received non-alcoholic beverages.
Population	College students
Country	Canada
Unit of analysis	Individual
Sample size	84
Number of men	84
Age	
Intervention description (including content, delivery, setting, provider)	(1) Told alcohol + given alcohol + lab setting (2) Told alcohol + given no alcohol + lab setting (3) Told no alcohol + given alcohol + lab setting

	(4) Told no alcohol + given no alcohol + lab (5) Told alcohol + given alcohol + nat. bar setting (6) Told alcohol + given no alcohol + nat. bar (7) Told no alcohol + given alcohol + nat. bar (8) Told no alcohol + given no alcohol + nat. bar
Sessions duration	30-min
Available drink options	--
Drink setting	Natural and laboratory bar
Outcome measures	Alcohol intake
Additional comments	

RISK OF BIAS		
Adequate sequence generation?	Low risk	"Following the pretest procedures, each subject was accompanied to his predetermined setting by the research assistant."
Allocation concealment?	High risk	"As mentioned previously, the research assistant was instructed before each experimental session whether to inform the subject that he would receive alcoholic or non-alcoholic beverages."
Blinding?	Low risk	"[To] increase the probability of successful deception, an apparently random selection procedure is recommended (Rohsenow & Marlatt, 1981). There- fore, once seated m the setting, the research assistant instructed the subject to choose a number between 1 and 100. The research assistant then searched a table, which consisted of two columns of 50 numbers each in random order. The columns were labelled ' A ' and ' B ' . When a subject's choice was found the research assistant would then inform the subject of the predetermined beverage condition."
Complete outcome data?	Low risk	Insofar as reviewer could tell
Selective reporting?	Low risk	Insofar as reviewer could tell
Other	Low risk	Insofar as reviewer could tell

Appendix 2.4 *Characteristics of excluded studies*

Record name	**Year**	**Reason for exclusion**
Abrahamson	1994	Does not examine alcohol consumption
Adams	2014	Intervention did not take place in public drink setting
Alcohol	2000	Literature review that did not pertain to specific CA intervention

Research & Health		strategy
Alford et al.	2012	Intervention did not take place in public drink setting
Alterman et al.	1974	Intervention did not entail CA intervention components or take place in public drink setting
Ames et al..	2011	Literature review; interventions did not take place in public drink setting
Ames et al.	1987	Intervention did not entail CA intervention components or take place in public drink setting
Anton et al.	2004	Intervention did not entail CA intervention components (rather, pharmacological components) or take place in public drink setting
Bacon	1978	Literature review that did not pertain to specific CA intervention strategy
Bailey et al.	2014	Intervention did not entail CA intervention components in the same environment as the target behaviour
Barry et al.	2012	Intervention did not entail CA intervention components in the same environment as the target behaviour
Barry et al.	2013	Intervention did not entail CA intervention components in the same environment as the target behaviour
Bekman et al.	2011	Intervention did not entail CA intervention components or take place in public drink setting
Bellis et al.	2011	Literature review; interventions did not examine alcohol consumption as a primary outcome
Bernstein et al.	2014	Intervention did not examine alcohol consumption as a primary outcome
Bernstein et al.	2014	Intervention did not examine alcohol consumption as a primary outcome
Bersamin et al.	2012	Intervention did not entail CA intervention components or take place in public drink setting
Billings et al.	1976	Intervention did not entail CA intervention components in the same environment as the target behaviour
Blankenship et al.	2000	Did not include human subjects
Bleich et al.	2014	Intervention did not examine alcohol consumption as a primary outcome
Bogart et al.	2014	Intervention did not examine alcohol consumption as a primary outcome
Bogart et al.	2011	Intervention did not examine alcohol consumption as a primary outcome
Bonar et al.	2011	Intervention did not entail CA intervention components in the same environment as the target behaviour
Booth et al.	2000	Intervention did not entail CA intervention components or take place in public drink setting
Borawski et al.	2003	Intervention did not entail CA intervention components or take place in public drink setting

Bot et al.	2005	Intervention did not entail CA intervention components in the same environment as the target behaviour
Brennan et al.	2011	Interventions did not entail CA intervention components in the same environment as the target behaviour
Briscoe et al.	2004	ntervention did not entail CA intervention components or take place in public drink setting
Brister et al.	2011	Intervention did not entail CA intervention components or take place in public drink setting
British Journal of Addiction	1989	Intervention did not examine alcohol consumption as a primary outcome
Brito et al.	2013	ntervention did not entail CA intervention components or take place in public drink setting
Broome et al.	2011	Interventions did not entail CA intervention components in the same environment as the target behaviour
Brown et al.	1985	Intervention did not entail CA intervention components or take place in public drink setting
Brown et al.	2004	Intervention did not entail CA intervention components or take place in public drink setting
Bruun et al.	1959	Intervention did not entail CA intervention components or take place in public drink setting
Bruun et al.	1963	Literature review; intervention did not entail CA intervention components or take place in public drink setting
Buis et al.	2013	Intervention did not examine alcohol consumption as a primary outcome
Burns et al.	2003	Intervention did not entail CA intervention components or take place in public drink setting
Cahalan et al.	1968	Literature review; interventions did not entail CA intervention components or take place in public drink setting
Callinan et al.	2014	Intervention did not entail CA intervention components or take place in public drink setting
Cash et al.	1984	Intervention did not entail CA intervention components or take place in public drink setting
Caudill et al.	2001	Intervention did not entail CA intervention components or take place in public drink setting
Celio et al.	2011	Intervention did not entail CA intervention components or take place in public drink setting
Cercarelli et al.	2004	Intervention did not entail CA intervention components or take place in public drink setting
Cheung et al.	1997	Intervention did not entail CA intervention components or take place in public drink setting
Chinman et al.	2011	Interventions did not entail CA intervention components in the same environment as the target behaviour
Christie et al.	2001	Intervention did not examine alcohol consumption as a primary outcome
Chung et al.	2013	Intervention did not entail CA intervention components or take place in public drink setting

CJEM Scientific Abstracts	2013	Review of conference proceedings; intervention did not examine alcohol consumption as a primary outcome
Clapp et al.	2009	Interventions did not entail CA intervention components in the same environment as the target behaviour
Clarkson et al.	2002	Interventions did not entail CA intervention components in the same environment as the target behaviour
Croff et al.	2012	Interventions did not entail CA intervention components in the same environment as the target behaviour
Curran et al.	1996	Interventions did not entail CA intervention components in the same environment as the target behaviour
Davidson et al.	1999	Intervention did not entail CA intervention components (rather, pharmacological components) or take place in public drink setting
Davidson et al.	2007	Intervention did not entail CA intervention components (rather, pharmacological components) or take place in public drink setting
Dresser et al.	2011	Interventions did not entail CA intervention components in the same environment as the target behaviour
Drobes et al.	2003	Intervention did not entail CA intervention components (rather, pharmacological components) or take place in public drink setting
Edwards et al.	2014	Intervention did not entail CA intervention components (rather, pharmacological components) or take place in public drink setting
Ellickson et al.	2005	Intervention did not entail CA intervention components or take place in public drink setting
Forsyth	2008	Intervention did not examine alcohol consumption as a primary outcome
Forsyth et al.	2014	Interventions did not entail CA intervention components in the same environment as the target behaviour
Garlington et al.	1977	Intervention did not take place in public drink setting
Gilligan et al.	2012	Intervention did not entail CA intervention components or take place in public drink setting
Gosselt et al.	2013	Intervention did not examine alcohol consumption as a primary outcome
Ham et al.	2013	Intervention did not examine alcohol consumption as a primary outcome
Hankin et al.	1994	Intervention did not take place in public drink setting
Hartwell et al.	1999	Intervention did not entail CA intervention components or take place in public drink setting
Hawkins et al.	2009	Intervention did not examine alcohol consumption as a primary outcome
Heizer et al.	2002	Interventions did not entail CA intervention components in the same environment as the target behaviour
Holmila et al.	2010	Intervention did not entail CA intervention components or take

		place in public drink setting
Houben et al.	2011	Intervention did not take place in public drink setting
Houck et al.	2013	Intervention did not entail CA intervention components or take place in public drink setting
Howard-Pitney et al.	1991	Intervention did not examine alcohol consumption as a primary outcome
Hughes et al.	2012	Interventions did not entail CA intervention components in the same environment as the target behaviour
Jackson et al.	2014	Intervention did not entail CA intervention components or take place in public drink setting
Johnsson et al.	2003	Interventions did not entail CA intervention components in the same environment as the target behaviour
Kalichman et al.	2008	Interventions did not entail CA intervention components in the same environment as the target behaviour
Kasza et al.	2012	Interventions did not entail CA intervention components in the same environment as the target behaviour
Kavanagh et al.	2006	Intervention did not examine alcohol consumption as a primary outcome
Kenkmann et al.	2012	Intervention did not entail CA intervention components or take place in public drink setting
Kerber et al.	2006	Interventions did not entail CA intervention components in the same environment as the target behaviour
Lang et al.	1998	Interventions did not entail CA intervention components in the same environment as the target behaviour
Larsen et al.	2012	Interventions did not entail CA intervention components in the same environment as the target behaviour
Larsen et al.	2010	Interventions did not entail CA intervention components in the same environment as the target behaviour
Larsen et al.	2012	Interventions did not entail CA intervention components in the same environment as the target behaviour
Legrand et al.	2007	Interventions did not entail CA intervention components in the same environment as the target behaviour
Leonard et al.	2000	Intervention did not entail CA intervention components or take place in public drink setting
Lewis et al.	2005	Intervention did not examine alcohol consumption as a primary outcome
Linden et al.	2014	Intervention did not entail CA intervention components or take place in public drink setting
Littlefield et al.	2013	Intervention did not entail CA intervention components or take place in public drink setting
Lynch et al.	2014	Intervention did not entail CA intervention components or take place in public drink setting
Lyne et al.	2012	Interventions did not entail CA intervention components in the same environment as the target behaviour
Maimon et al.	2012	Intervention did not entail CA intervention components or take place in public drink setting

Martinez et al.	2008	Intervention did not entail CA intervention components or take place in public drink setting
Mauss et al.	1979	Intervention did not entail CA intervention components or take place in public drink setting
McKee et al.	2009	Interventions did not entail CA intervention components in the same environment as the target behaviour
Mills et al.	1971	Interventions did not entail CA intervention components in the same environment as the target behaviour
Mjelde-Mossey et al.	2004	Intervention did not entail CA intervention components or take place in public drink setting
Moore et al.	2009	Interventions did not entail CA intervention components in the same environment as the target behaviour
Moore et al.	2010	Interventions did not entail CA intervention components in the same environment as the target behaviour
Moore et al.	2012	Interventions did not entail CA intervention components in the same environment as the target behaviour
Morojele et al.	2011	Systematic review; interventions did not entail CA intervention components or take place in public drink setting
Morrison et al.	2002	Intervention did not examine alcohol consumption as a primary outcome
Murphy et al.	2014	Intervention did not take place in public drink setting
Murphy et al.	2006	Intervention did not entail CA intervention components in the same environment as the target behaviour
Nan et al.	2013	Intervention did not entail CA intervention components in the same environment as the target behaviour
Nees et al.	2012	Intervention did not examine alcohol consumption as a primary outcome
Neff	1997	Intervention did not entail CA intervention components or take place in public drink setting
Neff et al.	1991	Intervention did not entail CA intervention components or take place in public drink setting
Neighbors et al.	2014	Intervention did not entail CA intervention components or take place in public drink setting
Neighbors et al.	2005	Intervention did not entail CA intervention components or take place in public drink setting
Nikolaou et al.	2013	Intervention did not entail CA intervention components or take place in public drink setting
Nunesdinis et al.	1992	Intervention did not entail CA intervention components or take place in public drink setting
Nusbaumer et al.	1983	Intervention did not entail CA intervention components or take place in public drink setting
Paschall et al.	2014	Intervention did not entail CA intervention components in the same environment as the target behaviour
Patrick et al.	2010	Intervention did not entail CA intervention components in the same environment as the target behaviour
Pernanen et al.	1989	Intervention did not entail CA intervention components in the

		same environment as the target behaviour
Pomerleau et al.	1978	Intervention did not entail CA intervention components or take place in public drink setting
Purshouse et al.	2010	Intervention did not entail CA intervention components or take place in public drink setting
Rose et al.	2010	Intervention did not entail CA intervention components in the same environment as the target behaviour
Rose et al.	2012	Intervention did not entail CA intervention components in the same environment as the target behaviour
Samp et al.	2009	Intervention did not entail CA intervention components or take place in public drink setting
Scott-Sheldon et al.	2014	Intervention did not entail CA intervention components in the same environment as the target behaviour
Seage et al.	1998	Intervention did not entail CA intervention components in the same environment as the target behaviour
Snyder et al.	2004	Intervention did not entail CA intervention components or take place in public drink setting
Spijkerman et al.	2010	Intervention did not entail CA intervention components in the same environment as the target behaviour
Spoelder et al.	2013	Did not include human subjects
Stockwell et al.	1993	Intervention did not entail CA intervention components in the same environment as the target behaviour
Storm et al.	1981	Intervention did not entail CA intervention components in the same environment as the target behaviour
Stout et al.	2000	Intervention did not entail CA intervention components or take place in public drink setting
Sykes et al.	1993	Intervention did not entail CA intervention components in the same environment as the target behaviour
Teunissen et al.	2012	Intervention did not entail CA intervention components in the same environment as the target behaviour
Thombs et al.	2009	Intervention did not entail CA intervention components in the same environment as the target behaviour
Toomey et al.	2008	Intervention did not examine alcohol consumption as a primary outcome
Toomey et al.	2006	Intervention did not examine alcohol consumption as a primary outcome
Toomey et al.	2007	Intervention did not examine alcohol consumption as a primary outcome
Treno et al.	2006	Intervention did not entail CA intervention components in the same environment as the target behaviour
Truong et al.	2007	Intervention did not entail CA intervention components or take place in public drink setting
Tucker et al.	2002	Intervention did not examine alcohol consumption as a primary outcome
Van Beurden et	2000	Intervention did not entail CA intervention components in the

al.		same environment as the target behaviour
Van de Luitgaarden et al.	2006	Intervention did not entail CA intervention components in the same environment as the target behaviour
Van de Luitgaarden et al.	2007	Intervention did not entail CA intervention components in the same environment as the target behaviour
Vellerman et al.	2011	Intervention did not examine alcohol consumption as a primary outcome
Verster et al.	2015	Intervention did not entail CA intervention components in the same environment as the target behaviour
Wagenaar et al.	2000	Intervention did not entail CA intervention components in the same environment as the target behaviour
Wallin et al.	2005	Intervention did not entail CA intervention components in the same environment as the target behaviour
Wallin et al.	2003	Intervention did not examine alcohol consumption as a primary outcome
Warburton et al.	2000	Intervention did not examine alcohol consumption as a primary outcome
Warpenius et al.	2010	Intervention did not entail CA intervention components in the same environment as the target behaviour
Witkiewitz et al.	2012	Intervention did not entail CA intervention components or take place in public drink setting

Appendix 3.1 *Auditable trail for the realist review of CA interventions in alcohol consumption*

Week of	Stage / justification
1 Mar 2015	Completed systematic review of CA interventions in alcohol consumption in public drink spaces
15 Oct 2015	Drafted protocol of a realist review of CA interventions in alcohol consumption
3 Jan 2016	Began executing search strategy based on inclusion criteria
12 Jan 2016	Revisited inclusion criteria to determine if mindfulness-based CMO configurations should be included; determined they should be
20 Jan 2016	Began testing candidate middle-range theories against identified demi-regularities
3 Feb 2016	Determined dual-process models of health-related behaviour were missing from realist review

Appendix 3.2 *Search strings and hits for the realist review of CA interventions in alcohol consumption*

MEDLINE and MEDLINE In-Process & Non-Indexed Citations (OvidSP; 1946 to present)
EMBASE (OvidSP; 1974 to 2016 Jan 03)
PsycINFO (OvidSP; 1967 to Jan week 1 2016)
(5240 hits)

1. ((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*)).ti.ab.
2. (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*)
3. exp Mental Processes/
4. exp Music OR (music adj (typ* or genre* OR class*)) OR exp Sound OR volume* OR loud* OR soft* OR sound level*
5. Advertisements OR exp Posters OR exp Lighting OR exp Audiovisual Aids/ OR exp Video-Audio Media/ OR exp Photography/ OR exp Medical Illustration OR exp Multimedia/ OR exp Health Education/ OR Health Promotion/ OR exp Communication/ OR exp Information Dissemination/ OR (visual adj (aid* OR presentation OR representation* OR information OR media OR display* OR stimuli))ti,ab. OR (information OR message* OR education OR promotion)) OR (risk communication$ OR health warning$ OR warning message$ OR image* or pictur* or pictorial or illustrat* or cartoon$ or graphic* or photograph* OR aversi* OR negative OR affective OR threat*

OR danger* OR disgust* OR distast* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* or repuls* OR repugnan* OR conditioning OR emotion* OR fear* OR warn* OR risk* or motivat* OR persuas* OR presentation$ OR select* OR proxim*)

6. exp Cooking and Eating Utensils OR exp Product Packaging/ OR exp Food Packaging/ OR exp Automatic Food Dispensers OR exp Product Labeling OR exp Food Labeling OR exp Drug Labelling OR size$ OR dimension* OR capacity OR capacities OR volume* OR shape* OR height* OR width* OR length* OR depth* OR portion* OR serving* OR product* OR package* OR unit* OR drink* OR tableware OR drinkware OR dinnerware OR crockery OR cup* OR glass OR glasses OR mug* OR pitcher* OR jug* OR decanter* OR receptacle* OR container* OR can* OR carton* OR bottle*
7. exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR (meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*
8. OR/ 1 AND 2 AND 3
9. OR/ 1 AND 2 AND 4
10. OR/ 1 AND 2 AND 5
11. OR/ 1 AND 2 AND 6
12. 8-11 AND/ 7
13. Limit 12 to (English language and humans)

ISI Web of Science Core Collection
(5470 total hits)

(5 hits)
TOPIC: ((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modify* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increase* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remove* OR constrain* OR restrain* OR limit* OR lower* OR reduce* OR decrease* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consume* OR intake* OR perform* OR attidu* OR habit*) AND (exp Mental Processes/) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*))

(212 hits)
TOPIC: ((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*) AND (exp Music OR (music adj (typ* or genre* OR class*)) OR exp Sound OR volume* OR loud* OR soft* OR sound level*) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*))

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TOPIC: ((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*) AND (Advertisements OR exp Posters OR exp Lighting OR exp Audiovisual Aids/ OR exp Video-Audio Media/ OR exp Photography/ OR exp Medical Illustration OR exp Multimedia/ OR exp Health Education/ OR Health Promotion/ OR exp Communication/ OR exp Information Dissemination/ OR (visual adj (aid* OR presentation OR representation* OR information OR media OR display* OR stimuli OR information OR message* OR education OR promotion)) OR risk communication$ OR health warning$ OR warning message$ OR image* or pictur* or pictorial or illustrat* or cartoon$ or graphic* or photograph* OR aversi* OR negative OR affective OR threat* OR danger* OR disgust* OR distast* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* or repuls* OR repugnan* OR conditioning OR emotion* OR fear* OR warn* OR risk* or motivat* OR persuas* OR presentation$ OR select* OR proxim*))

(2568 hits)
(exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*) AND (exp Cooking and Eating Utensils OR exp Product Packaging/ OR exp Food Packaging/ OR exp Automatic Food Dispensers OR exp Product Labeling OR exp Food Labeling OR exp Drug Labelling OR size$ OR dimension* OR capacity OR capacities OR volume* OR shape* OR height* OR width* OR length* OR depth* OR portion* OR serving* OR product* OR package* OR unit* OR drink* OR tableware OR drinkware OR dinnerware OR crockery OR cup* OR glass OR glasses OR mug* OR pitcher* OR jug* OR decanter* OR receptacle* OR container* OR can* OR carton* OR bottle*)

Refined by: [excluding] **WEB OF SCIENCE CATEGORIES**: (DENTISTRY ORAL SURGERY MEDICINE OR UROLOGY NEPHROLOGY OR THERMODYNAMICS OR PHARMACOLOGY PHARMACY OR PLANT SCIENCES OR STATISTICS PROBABILITY OR IMMUNOLOGY OR REPRODUCTIVE BIOLOGY OR RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING OR MULTIDISCIPLINARY SCIENCES OR PHYSICS APPLIED OR GASTROENTEROLOGY HEPATOLOGY OR INFECTIOUS DISEASES OR ORTHOPEDICS OR SURGERY OR PHYSIOLOGY OR NURSING OR ONCOLOGY OR CHEMISTRY MEDICINAL OR MEDICAL INFORMATICS OR ENGINEERING BIOMEDICAL OR WATER RESOURCES OR MATHEMATICAL COMPUTATIONAL BIOLOGY OR MICROBIOLOGY OR MATERIALS SCIENCE BIOMATERIALS OR RESPIRATORY SYSTEM OR DEVELOPMENTAL BIOLOGY OR ENGINEERING CHEMICAL OR ALLERGY OR CARDIAC CARDIOVASCULAR SYSTEMS OR AGRONOMY OR OPHTHALMOLOGY OR AGRICULTURE MULTIDISCIPLINARY OR ENVIRONMENTAL SCIENCES OR OBSTETRICS GYNECOLOGY OR AGRICULTURAL ENGINEERING OR CHEMISTRY ANALYTICAL OR MATERIALS SCIENCE MULTIDISCIPLINARY OR BIOTECHNOLOGY APPLIED MICROBIOLOGY OR CELL BIOLOGY OR VETERINARY SCIENCES OR BIOLOGY OR POLYMER SCIENCE OR BIOCHEMISTRY MOLECULAR BIOLOGY OR OPTICS OR NEUROIMAGING OR DERMATOLOGY OR NANOSCIENCE NANOTECHNOLOGY OR CHEMISTRY APPLIED OR MEDICAL LABORATORY TECHNOLOGY OR CLINICAL NEUROLOGY OR ANESTHESIOLOGY OR MATERIALS SCIENCE PAPER WOOD OR PEDIATRICS OR ANATOMY MORPHOLOGY OR HEMATOLOGY OR CHEMISTRY PHYSICAL OR ZOOLOGY OR EVOLUTIONARY BIOLOGY OR PERIPHERAL VASCULAR DISEASE OR

SPORT SCIENCES OR EMERGENCY MEDICINE OR ENGINEERING ENVIRONMENTAL OR SPECTROSCOPY OR ENDOCRINOLOGY METABOLISM OR PARASITOLOGY OR COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS OR OTORHINOLARYNGOLOGY OR CHEMISTRY INORGANIC NUCLEAR OR AGRICULTURE DAIRY ANIMAL SCIENCE OR HORTICULTURE OR BIOPHYSICS OR INTEGRATIVE COMPLEMENTARY MEDICINE OR GERIATRICS GERONTOLOGY OR TROPICAL MEDICINE OR GENETICS HEREDITY OR TRANSPORTATION OR BIOCHEMICAL RESEARCH METHODS OR ENGINEERING ELECTRICAL ELECTRONIC OR TRANSPLANTATION OR ENERGY FUELS OR CHEMISTRY ORGANIC OR PHYSICS CONDENSED MATTER OR CHEMISTRY MULTIDISCIPLINARY) AND [excluding] **WEB OF SCIENCE CATEGORIES**: (LINGUISTICS OR HUMANITIES MULTIDISCIPLINARY OR TELECOMMUNICATIONS OR HISTORY PHILOSOPHY OF SCIENCE OR GEOGRAPHY PHYSICAL OR ROBOTICS OR GEOCHEMISTRY GEOPHYSICS OR RELIGION OR FAMILY STUDIES OR ENGINEERING MULTIDISCIPLINARY OR PLANNING DEVELOPMENT OR ENGINEERING MANUFACTURING OR PHYSICS PARTICLES FIELDS OR EDUCATION SCIENTIFIC DISCIPLINES OR EDUCATION EDUCATIONAL RESEARCH OR OPERATIONS RESEARCH MANAGEMENT SCIENCE OR ECOLOGY OR MYCOLOGY OR COMPUTER SCIENCE THEORY METHODS OR MUSIC OR COMPUTER SCIENCE SOFTWARE ENGINEERING OR MICROSCOPY OR BUSINESS OR PALEONTOLOGY OR MATERIALS SCIENCE CERAMICS OR AUDIOLOGY SPEECH LANGUAGE PATHOLOGY OR MANAGEMENT OR MARINE FRESHWATER BIOLOGY OR ASIAN STUDIES OR LITERATURE OR ANDROLOGY OR GEOSCIENCES MULTIDISCIPLINARY)

Timespan: All years. **Indexes**: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.

ASSIA (ProQuest; 1987 to present)
ERIC
ProQuest Dissertations and Theses Global
Sociological Abstracts
(876 total hits)

(0 hits)
ab((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*)) AND ab(((exp Mental Processes/) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-

narrative*))) AND (modify* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increase* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remove* OR constrain* OR restrain* OR limit* OR lower* OR reduce* OR decrease* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consume* OR intake* OR perform* OR attidu* OR habit*)

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(383 hits)
ab((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*)) AND ab((Advertisements OR exp Posters OR exp Lighting OR exp Audiovisual Aids/ OR exp Video-Audio Media/ OR exp Photography/ OR exp Medical illustrateion OR exp Multimedia/ OR exp Health Education/ OR Health Promotion/ OR exp Communication/ OR exp Information Dissemination/ OR (visual adj (aid* OR presentation OR representation* OR information OR media OR display* OR stimuli OR information OR message* OR education OR promotion)) OR risk communication OR health warning OR warning message OR image* OR picture* OR pictorial OR illustrate* OR cartoon OR graphic* OR photograph* OR averse* OR negative OR affective OR threat* OR danger* OR disgust* OR distant* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* OR repulse* OR repugnant* OR conditioning OR emotion* OR fear* OR warn* OR risk* OR motivate* OR persuades* OR presentation OR select* OR proxim*)) AND (modify* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increase* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remove* OR constrain* OR restrain* OR limit* OR lower* OR reduce* OR decrease* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consume* OR intake* OR perform* OR attidu* OR habit*) AND ab((exp Clinical Trial OR exp

Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*))

(477 hits)
ab((exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*)) AND ab((exp Cooking AND Eating Utensils OR exp Product Packaging/ OR exp Food Packaging/ OR exp Automatic Food Dispensers OR exp Product Labeling OR exp Food Labeling OR exp Drug Labelling OR size OR dimension* OR capacity OR capacities OR volume* OR shape* OR height* OR width* OR length* OR depth* OR portion* OR serving* OR product* OR package* OR unit* OR drink* OR tableware OR drinkware OR dinnerware OR crockery OR cup* OR glass OR glasses OR mug* OR pitcher* OR jug* OR decanter* OR receptacle* OR container* OR can* OR carton* OR bottle*)) AND (modify* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increase* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remove* OR constrain* OR restrain* OR limit* OR lower* OR reduce* OR decrease* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consume* OR intake* OR perform* OR attidu* OR habit*) AND ab((exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*))

(alcohol consumption OR public health OR sociology ORnursing OR psychotherapy ORclinical trials OR clinical psychology OR alcohol dependence OR alcohol abuseOR substance abuse OR social psychology OR interventionsOR intervention OR treatmentOR drug abuse OR alcoholismOR drinking behavior OR foreign countries OR adolescents ORsocial work OR health ORdrinking OR heavy drinking ORnutrition OR economics ORpsychology OR studies ORfemales OR african americansOR college students OR health education OR motivation ORquality of life OR united states of america OR clinical outcomesOR medical research OR gender differences OR patients OR risk OR behavioral psychology ORbehaviorial sciences OR brief interventions OR medicine ORsocial structure OR alcoholicsOR consumption OR epidemiology OR music OR risk factorsOR health behavior OR usa ORwomen) NOT (religion ANDtheology AND comparative analysis AND womens studiesAND philosophy AND spirituality AND comparative literatureAND mental health AND higher education AND religious history AND american literature ANDcultural anthropology ANDreligious education AND british and irish literature ANDpharmacology AND minority & ethnic groups AND organic chemistry AND oncology ANDpolitical science AND dentistryAND developmental

psychologyAND adult education AND families & family life AND personal relationships AND archaeologyAND biochemistry ANDcriminology AND educational psychology AND environmental engineering AND gerontologyAND romance literature ANDmicrobiology AND motivational interviewing AND naltrexoneAND school administration ANDsmoking AND cancer ANDcontinuing education AND history AND interviews ANDmanagement AND surgery ANDcase studies AND chemical engineering AND analytical chemistry AND classical studies AND european history AND literature)

CINAHL
(3099 total hits)

(0 hits)
(exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*) AND (exp Mental Processes/) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*)

(543 hits)
(exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*) AND (exp Music OR (music adj (typ* or genre* OR class*)) OR exp Sound OR volume* OR loud* OR soft* OR sound level*) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*) EXCLUDE: smoking, ethanol, periodontitis, dietary carbohydrates, blacks, handwashing, spirituality,

depression, mental disorders, antiinfective local agents, breast neoplasms, periodontal diseases, hiv infections, sex factors, chlorhexidine, hypertension, dental plaque, exercise physiology, gingivitis, herbal medicine, type 2 diabetes, Hispanics, mouthwashes, sports drinks, wounds and injuries, dental caries, plant extracts, traffic accidents, women, fluid intake

(1,115 hits)
(exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*) AND (Advertisements OR exp Posters OR exp Lighting OR exp Audiovisual Aids/ OR exp Video-Audio Media/ OR exp Photography/ OR exp Medical Illustration OR exp Multimedia/ OR exp Health Education/ OR Health Promotion/ OR exp Communication/ OR exp Information Dissemination/ OR (visual adj (aid* OR presentation OR representation* OR information OR media OR display* OR stimuli OR information OR message* OR education OR promotion)) OR risk communication$ OR health warning$ OR warning message$ OR image* or pictur* or pictorial or illustrat* or cartoon$ or graphic* or photograph* OR aversi* OR negative OR affective OR threat* OR danger* OR disgust* OR distast* OR disturb* OR unpleasant OR unattractive OR unappealing OR repel* or repuls* OR repugnan* OR conditioning OR emotion* OR fear* OR warn* OR risk* or motivat* OR persuas* OR presentation$ OR select* OR proxim*) EXCLUDE: smoking, ethanol, periodontitis, dietary carbohydrates, blacks, handwashing, spirituality, depression, mental disorders, antiinfective local agents, breast neoplasms, periodontal diseases, hiv infections, sex factors, chlorhexidine, hypertension, dental plaque, exercise physiology, gingivitis, herbal medicine, type 2 diabetes, Hispanics, mouthwashes, sports drinks, wounds and injuries, dental caries, plant extracts, traffic accidents, women, fluid intake

(1441 hits)
(exp Drinking Behavior/ OR exp Alcohol Deterrents OR exp Alcohol-Related Disorders/ OR exp Alcoholic Beverages OR exp Alcohol Intoxication/ OR exp Alcoholics OR drink* OR drunk* OR alcohol* OR beverage* OR beer* OR lager* OR wine* OR cider* OR alcopop* OR spirit* OR tequila* OR distilled beverage* OR schnapps OR brandy OR brandies OR liquor* OR liqueur* OR whisky OR whiskey* OR whiskies OR gin* OR rum* OR vodka* OR cocktail*) AND (modif* OR chang* OR alter* OR adjust* OR adapt* OR add* OR increas* OR more OR greater OR higher OR larger OR longer OR subtract* OR restrict* OR remov* OR constrain* OR restrain* OR limit* OR lower* OR reduc* OR decreas* OR smaller OR less* OR fewer OR

choice* OR choose OR option* OR consum* OR intak* OR perform* or attidu* OR habit*) AND (exp Clinical Trial OR exp Feasibility Studies OR exp Pilot Projects OR exp Controlled Trial OR exp Quasi Experimental OR exp Questionnaire OR exp Assessment OR exp Appraisal OR exp RCT OR exp Randomized Controlled Trial/ OR Clinical Trial/ OR exp Evaluation Studies OR Comparative Study OR exp Systematic Review/ OR exp Meta-Analysis OR meta-synthes* OR metasynthes* OR metasummar* OR meta-summar* OR metastud* OR meta-stud* OR metanarrative* OR meta-narrative*) AND (exp Cooking and Eating Utensils OR exp Product Packaging/ OR exp Food Packaging/ OR exp Automatic Food Dispensers OR exp Product Labeling OR exp Food Labeling OR exp Drug Labelling OR size$ OR dimension* OR capacity OR capacities OR volume* OR shape* OR height* OR width* OR length* OR depth* OR portion* OR serving* OR product* OR package* OR unit* OR drink* OR tableware OR drinkware OR dinnerware OR crockery OR cup* OR glass OR glasses OR mug* OR pitcher* OR jug* OR decanter* OR receptacle* OR container* OR can* OR carton* OR bottle*) EXCLUDE: smoking, ethanol, periodontitis, dietary carbohydrates, blacks, handwashing, spirituality, depression, mental disorders, antiinfective local agents, breast neoplasms, periodontal diseases, hiv infections, sex factors, chlorhexidine, hypertension, dental plaque, exercise physiology, gingivitis, herbal medicine, type 2 diabetes, Hispanics, mouthwashes, sports drinks, wounds and injuries, dental caries, plant extracts, traffic accidents, women, fluid intake

Appendix 3.3 *Data extraction and critical appraisal form for the realist review of CA interventions in alcohol consumption*

IDENTIFYING INFORMATION	
Record name	
Author(s)	
Year	
INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	
Outcome focused on alcohol consumption?	
Paper describes causal pathway between CA intervention logic and alcohol consumption?	
STUDY CHARACTERISTICS	
Objective	
Study design	
Population	
Intervention description (including content, delivery, setting, provider)	

Theoretical basis of intervention	
Number of participants	
Outcome measures	
Time(s) at which outcomes assessed	
Analysis methods	
Additional comments	

Appendix 3.4 *Characteristics of included studies*

Agyapong et al. 2015

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"To determine the feasibility and effectiveness of supportive text messages in long-term follow-up to reduce mood symptoms and problem drinking in patients with Depression or AUD respectively and to explore the usefulness of self-reports of health services utilization as an outcomes measure."
Study design	RCT
Population	Harmful drinkers
Intervention description (including content, delivery, setting, provider)	(1) Twice-daily supportive SMS text messages for 3 months + daily supportive text messages for next 3 months (2) No text messages + telephone call every 2 weeks to express gratitude for remaining in study
Theoretical basis of intervention	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	120
Outcome measures	Beck Depression Index change Cumulative Abstinence Duration change
Time(s) at which outcomes assessed	3, 6, 9, 12 months
Additional comments	For 3 months participants receive twice-daily text messages designed to improve their affective state and encourage uptake

	of additional prescribed treatment for alcohol, such as medication or abstinence. The messages were sent by a computer system at specified times. For the next 3 months, participants received once-daily text messages intended to do the same. Participants had been recruited from addiction counselling sessions in which cognitive-behavioural therapy and motivational interviewing principles were used, and the text messages were drafted to reflect lessons learned in those sessions. For example, one message noted, "If you keep on going, maintaining your hope and belief that something good will happen, it generally does. One day at a time."

Batel et al. 1995

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"*To assess the effectiveness of a letter referring these patients to an outpatient alcoholism treatment clinic."*
Study design	RCT
Population	Patients who had reported to an emergency unit
Intervention description (including content, delivery, setting, provider)	(1) Received personalised letter remanding to alcoholic counselling (2) No letter
Theoretical basis of intervention	N/A
Number of participants	369
Outcome measures	Treatment response (schedule alcoholism consultation; appeared at consultation)
Time(s) at which outcomes assessed	6 months
Additional comments	Batel et al. 1995 tested the effects of a personalised feedback letter on alcohol consumption among patients who had reported to an emergency unit in France. The authors note that there is an intake of individuals to emergency units who report signs of drunkenness, and of these many may exhibit signs of alcohol abuse. However, many may not request treatment for alcohol disorder and are only accessible to primary care professionals for

	relatively short periods of time. In response to this perceived need, Batel and colleagues designed this 6-month study to examine the effects of a referral personalised letter sent to individuals screened for alcoholism at an emergency unit. The referral enabled willing individuals to book an appointment with an outpatient alcoholism treatment clinic. The letter was sent no more than 2 days after the participant's release from the emergency unit. It reminded participants that on the basis of their blood alcohol content and medical examination, they were eligible for a free visit to a treatment clinic (the contact information of which was provided).

Bickel et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The current review describes the basic prin- ciples of behavioral economics that are central to reinforcer pathology, the processes that engender reinforcer pathology, and the approaches and pro- cedures that can repair reinforcement pathologies. The overall goal of this review is to present a new understanding of substance use disorders as viewed by recent advances in behavioral economics."
Study design	Literature review
Population	N/A
Intervention description (including content, delivery, setting, provider)	Person-level factors: delay discounting Environmental factors: availability of alternative reinforcement cues Repair of reinforce pathologies: constrain unhealthy choices
Theoretical basis of intervention	Reinforcer Pathology (Bickel et al. 2011) Discounting (Mazur 1987; Rachlin et al. 1991; Jones & Rachlin 2006) Delay discounting (Chung & Herrnstein 1967; Herrnstein 1961; Baum & Rachlin 1969)
Number of participants	N/A
Outcome measures	N/A
Time(s) at which outcomes	N/A

assessed	
Additional comments	Bickel et al. (2014) offers a literature review on the theoretical contribution of reinforce pathology, from behavioural economics, to help explain certain behavioural patterns within substance use disorders. Reinforcer pathology denotes an individual's premium valuation of some object or behaviour combined with a persistent desire to enjoy that object or behaviour over and against potential costs. The authors explain how reinforcement is at least partly the product of the interaction between an individual's belief and affective state with micro-environmental stimuli. In this way, the authors offer a model of behaviour that may explain a at least a subset of substance use behaviours, including alcohol consumption.

Blankers et al. 2011

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The current study examined the effectiveness of Internet-based therapy (therapy alcohol online; TAO) and Internet-based self-help (self-help alcohol online; SAO) for problematic alcohol users."
Study design	RCT
Population	Adult problem drinkers
Intervention description (including content, delivery, setting, provider)	(1) Therapy Alcohol Online (2) Self-help online (3) Waiting list control
Theoretical basis of intervention	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	205
Outcome measures	Alcohol consumption; Treatment response
Time(s) at which outcomes assessed	3, 6 months
Additional comments	Through an asynchronous system, treatment is delivered through a non-automatic messaging service (much like email). In the treatment conducted by Blankers et al. (2011), the intervention was delivered in up to 7 synchronous text-based-chat therapy

	sessions of 40-minute duration. Participants were expected to complete assignments before each therapy session, given that each of the 7 sessions was dedicated to a different them. They included: 1) general introduction to Internet-based therapy, 2) cost-benefit analysis of alcohol use and personal consumption goal setting, 3) self-control training, 4) skills in recognizing 'risky' drink environments, 5) introduction to craving and affective states that lead to alcohol consumption, 6) craving and relapse management, and 7) review of all topics. As with online self-help interventions, Internet-based therapy draws from cognitive-behavioural therapy and motivational interviewing techniques.

Blankers et al. 2013

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"Data were obtained from a randomized controlled trial assessing the effectiveness of two Internet-based alcohol interventions."
Study design	RCT
Population	Harmful alcohol users
Intervention description (including content, delivery, setting, provider)	(1) Therapy Alcohol Online (2) Self-help online (3) Waiting list control
Theoretical basis of intervention	Cognitive-Based Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	205
Outcome measures	Treatment response
Time(s) at which outcomes assessed	N/A
Additional comments	The authors described the contextual factors and intervention components involved in online self-help treatment and Internet-based therapy treatment. On the one hand, online self-help is an Internet-based program in which participants engage in a self-guided treatment one time, responding to automated prompts. The treatment incorporates techniques from cognitive-

	behavioural therapy and motivational interviewing (de Wildt 2000). The automated information is presented with interactive text and graphs in 4 parts: 1) soliciting the alcohol consumption levels by an individual and offering him or her the opportunity to set goals for future consumption, 2) offering personalised feedback denoting the individual's consumption relative to their past consumption, 3) helping the individual gain knowledge about craving management and avoiding peer pressure, 4) connecting the individual with other treatment participants through an online user interface. Notably, the first step is thought to help an individual recognise the cues from their external environment, as well as their own affective states, that trigger their craving to drink. The second and third steps are thought to help the individual learn more about setting, maintaining, and achieving the goals they set for themself in alcohol consumption, taking up an online diary if necessary to reflect on their progress. The fourth goal is intended to help make the program social in the recognition that social support may help individuals 1) learn to cope better in environments in which alcohol is present, 2) maintain their goals through mutual encouragement. The program is available 24 hours a day, 7 days a week, and program facilitators recommend that participants log in to the program once a day for at least 4 weeks.

Cunningham et al. 2012

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"This randomized clinical trial evaluated an intervention that has been validated in clinical settings and then modified into an ultra-brief format suitable for use as an indicated public health intervention (i.e., targeting the population of non-treatment seeking problem drinkers)."
Study design	RCT
Population	Non-treatment seeking problem drinkers
Intervention description (including content,	(1) Personalised feedback pamphlet (2) Control (Educational pamphlet)

delivery, setting, provider)	(3) Control
Theoretical basis of intervention	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	1767
Outcome measures	Alcohol consumption (number of standard drinks consumed in last 7 days; highest number of drinks on one occasion; AUDIT-C)
Time(s) at which outcomes assessed	3, 6 months
Additional comments	Cunningham et al. 2012 tested the effects of a personalised feedback pamphlet among individuals screened for alcohol disorders. The authors recruited participants in a large metropolitan city in Canada through a random digit dialling survey. Those who made qualifying scores on the Alcohol Use Disorders Identification Test (AUDIT) were selected for 1 of 3 intervention conditions: personalised feedback pamphlet, educational pamphlet (containing relevant but non-individualised information about alcohol), and no treatment (control condition). For the personalised feedback pamphlet condition, participants were encouraged to complete an evaluation that solicited information about the number of alcohol units consumed in an average week. Then participants were directed to compare their consumption behaviour with that of the average Canadian, disaggregated by gender. Finally, participants were notified of the potential harms that may come from drinking in excess, and strategies to moderate drinking were presented.

Cunningham et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"This paper provides a summary of the recent research on Internet interventions for the most common mental health and addictions concerns—depression, anxiety, alcohol and smoking."
Study design	Literature review

Population	Substance users
Intervention description (including content, delivery, setting, provider)	Review of meta-analysis on Internet therapy (brief internet-based interventions)
Theoretical basis of intervention	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	N/A
Outcome measures	N/A
Time(s) at which outcomes assessed	N/A
Additional comments	Cunningham et al. 2014 reported a literature review of Internet-based interventions into common mental health problems and addiction (depression, anxiety, alcohol, and smoking and alcohol consumption). The authors discuss the history of Internet-based interventions, noting that the Internet was featured in alcohol interventions beginning in the late 1990s.

Engels et al. 2011

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"*In a field experiment, we tested whether textual references to alcohol in music played in bars lead to higher revenues of alcoholic beverages."*
Study design	RCT
Population	Customers at 3 pubs
Intervention description (including content, delivery, setting, provider)	(1) Music with lyrics referencing alcohol (2) Music without lyrics referencing alcohol
Theoretical basis of intervention	Arousal Hypothesis (Smith & Curnow 1966)
Number of participants	N/A
Outcome measures	Alcohol consumption (money spent over 2 hours)
Time(s) at which outcomes assessed	2-hours
Additional comments	Engels et al. (2011) conducted a 2-arm observational study to investigate whether listening to music that contained references

	to alcohol prompted increased level of alcohol intake among consumers in public drink settings in the Netherlands. The researchers created 2 curated 2-hour playlists to be alternately played at 3 pubs. Songs selected for each playlist were selected if they shared musical characteristics, such as tempo and content—the primary difference between the two playlists is that one playlist contained alcohol references and the other did not. The authors found that subjects who listened to the playlist of songs referencing alcohol did tend to consume more alcohol as compared to those listening to the other playlist. The authors attributed this effect to priming, in which stereotypes associated with alcohol consumption were activated among participants consciously or unconsciously listening to music containing alcohol references (Bargh et al 1996; Dijksterhuis et al. 2005). Positive memories with alcohol may also be triggered by alcohol references, thereby prompting alcohol consumption (Stein et al. 2000). The authors acknowledge, however, that specificity among alcohol references varied; some songs referencing only 'drinks' may have had less of a priming effect than songs referencing, for example, brands of alcohol, but the experiment was not set up in such a way to investigate this possible heterogeneity even within one playlist.

Engels et al. 2009

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"We tested experimentally whether portrayal of alcohol images in movies and commercials on television promotes actual drinking."
Study design	RCT
Population	Young adult males
Intervention description (including content, delivery, setting, provider)	(1) Alcoholic movie with neutral and alcohol commercials (2) Alcoholic movie with neutral commercials (3) Non-alcoholic movie with neutral and alcohol commercials (4) Non-alcoholic movie with neutral commercials.
Theoretical basis of	Situational Norms (Aarts and Dijksterhuis 2003)

intervention	Modelling (Quigley and Collins 1999) Automaticity (Bargh & Chartrand 1999)
Number of participants	80
Outcome measures	Alcohol consumption (number of alcoholic units over 1-hr)
Time(s) at which outcomes assessed	1-hr
Additional comments	Engels et al. (2009) investigated the effects of a 2 movies—one depicting alcohol consumption and one not—on subsequent consumption by viewers. The authors hypothesised that participants who viewed the alcohol-related movie would drink more alcohol given the possible effects of norm-setting, habituation, and imitation. With regard to norm-setting, positive television and radio portrayals of alcohol use tend to show an attractive, seemingly social person drinking in an appealing setting (Everett et al. 1998). For example, in an advertisement, protagonists—to whom an audience can relate—may ostentatiously 'relax' by drinking alcohol. With regard to habituation, individuals may take up habits after unconsciously associating a specific cue (e.g. an alcohol-related lyric in a popular song) with a particular behaviour (e.g. drinking the type of alcohol mentioned in the song lyric). In this way, stimuli embedded in advertising may automatically result in direct unconscious triggers (e.g. craving and alcohol consumption) over time. With regard to imitation, investigation into substance use indicates that in groups in which one or more members are consuming alcohol, an individual's drinking pace is influenced by the pace set by other individuals (Quigley and Collins 1999). Research into direct imitation suggests that when an individual is seen to perform a particular behaviour (e.g. drink from a container containing alcohol), the pre-motor portrayal of that behaviour is activated in the observer's brain as if they are engaging in that behaviour (Chartrand and Bargh 1999). For example, an individual observing an alcohol-related television advertisement who observes the advertisement character take a drink understands that behaviour in part because they imagine they are about to take a drink themselves.

Finfgeld-Connett et al. 2009

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA	Y

intervention logic and alcohol consumption?	
STUDY CHARACTERISTICS	
Objective	"The purpose of this randomized study was to evaluate a 90-day web-based treatment program for women in rural areas of Missouri with problem drinking habits."
Study design	Observational
Population	Harmful-drinking women in rural areas
Intervention description (including content, delivery, setting, provider)	Online treatment consisting of reference modules, decision-making modules, and bulletin board and chat features
Theoretical basis of intervention	Harm Reduction Model (Marlatt 1998) Self-Efficacy Theory (Bandura 1997) Transtheoretical Model of Change (DiClemente 2003)
Number of participants	46
Outcome measures	Website use
Time(s) at which outcomes assessed	Constantly over 6 months
Additional comments	Finfgeld-Connet et al. 2009 targeted an Internet-based intervention to U.S. women in rural areas exhibiting alcohol misuse problems. The authors note that approximately 19 percent of American women have engaged in alcohol abuse at some point in their lives (Hasin et al. 2007). Yet the Internet as a mode of delivery offers substantial progress to women in hard-to-reach places, including those who live in rural areas (Koski-Jannes et al. 2007). The authors delivered an online self-help treatment that incorporated theory-driven intervention components modelled after the Harm Reduction Model (Marlatt 1998); the Theory of Self-Efficacy (Bandura 1997); the Transtheoretical Model of Change (DiClemente 2003); motivational interviewing (Miller 1992), and cognitive behavioural therapy (Kadden et al. 1995; Monti et al. 1989). The intervention included 23 components. Eight components included information about behavioural change, definitions of each stage of alcohol abuse, health issues related to alcoholism and foetal alcohol syndrome, recommended guidelines for alcohol consumption, and referrals to additional resources. Fifteen components offered guidelines in conducting cost-benefit analysis of alcohol consumption, learning to engage in moderate drinking or abstinence, learning to monitor one's consumption over time and setting consumption goals, and managing craving. Treatment was offered for a 90 days and was supplemented by a synchronous system in which participants could send private or public messages to other participants and

	the researchers. The authors reported that of the components visited most often by participants, 9 offered information about alcohol, alcohol-related problems, and training in self-monitoring and goal-setting. Through the synchronous system, the research coordinator offered positive reinforcement (to encourage and celebrate a participant's progress), encouragement (to suggest reference materials and additional consumption goals), reflection (to encourage self-monitoring), and probes (to prompt a participant to think about their future consumption in hypothetical environments).

Freyer-Adam et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"To investigate whether or not a stage tailored intervention is more effective than a non-stage tailored intervention of the same intensity in reducing alcohol use among job-seekers with unhealthy alcohol use, and whether initial motivation to change is a moderator of efficacy."
Study design	RCT
Population	Job-seekers at 3 job agencies in Germany
Intervention description (including content, delivery, setting, provider)	(1) Stage-tailored intervention delivered via computer-generated feedback letters and self-help manuals delivered at baseline and after 3 months (2) Non-stage tailored intervention (Planned Behaviour) delivered via computer-generated feedback letters and self-help manuals delivered at baseline and after 3 months (3) Control (no letters or manuals)
Theoretical basis of intervention	Transthereotical Model of Intentional Behaviour Change (Prochaska & Velicer 1997) Theory of Planned Behaviour (Ajzen 1991)
Number of participants	1,243
Outcome measures	Alcohol consumption (AUDIT-C score; total number of drinks consumed in last 7 days)
Time(s) at which outcomes	3, 15 months

assessed	
Additional comments	Freyer-Adam et al. 2014 tested the effects of two personalised feedback letters that drew from distinct conceptual foundations in prescribing behaviour change. One letter variant drew from the Transtheoretical Model of Intentional Behaviour Change (Velicer & Prochaska 1997; Prochaska & DiClimente 1984), and it solicited self-report data based on an individual's readiness to change, self-efficacy, and assessed stage of change (Baumann et al. 2013, Hannover et al. 2003, Bott et al. 2003, Freyer et al. 2006, respectively). This data was used to generate a personalised feedback letter that was stage-tailored to the individual's need. Notably, the text of each letter was conditional on the stage of change suggested for each individual, and participants were referred to a stage-tailored manual for additional suggestions and exercises. The second letter variant was based on the Theory of Planned Behaviour (Ajzen 1991), a non-stage tailored theory, and it assessed individuals on the basis of their attitudes, subjective norms, and perceived behavioural control. Data resulting from that assessment were used to inform feedback sent back to individuals (Ajzen 2006), who were also referred to additional resources. In particular, participants were directed to generate a plan of action with regard to changing their consumption habits, and gender-specific examples of such plans were provided.

Gueguen et al. 2004

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The effect of background music on alcohol consumption has been widely researched in the literature, but few studies have tested the effect of sound level on drinking behavior. An experiment was carried out in two bars to test patrons' response to music's loudness."
Study design	RCT
Population	Customers at 2 bars in the Netherlands
Intervention description (including content,	(1) Rural bar and sound level of 72 decibels (1) Rural bar and sound level of 88 decibels

delivery, setting, provider)	(2) Urban bar and sound level of 75 decibels (2) Urban bar and sound level of 91 decibels
Theoretical basis of intervention	Arousal Hypothesis (Smith & Curnow 1966)
Number of participants	120
Outcome measures	Alcohol consumption (number of drinks ordered)
Time(s) at which outcomes assessed	2-hrs
Additional comments	Gueguen et al. 2004 tested the effects of altering sound level in a natural setting. In both studies, the researchers hypothesised that high sound level in pub setting would prompt a higher state of arousal among pub-goers, which would be manifested through individuals purchasing more alcoholic beverages and at a faster rate. Study results indicated that high sound level did indeed lead subjects to order more alcohol and drink more quickly as compared to control conditions in both studies, in which music was played a lower volume. The authors speculate that subjects exposed to a higher sound level served primarily as a source of distraction from—or impediment to—social interactions, thereby prompting subjects to focus more of their attention on their alcohol consumption. Notably, Gueguen et al. (2004) also noted that male subjects consumed more alcohol as compared to females, and the rural-pub setting / loud-music condition saw more alcohol consumed by individuals as compared to the urban-pub setting / loud-music condition.

Gueguen et al. 2008

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"It had been found that environmental music was associated with an increase in alco- hol consumption. The presence versus absence of music, high versus slow tempo and the different styles of environmental music is associated with different level of alcohol consumption. However, the effect of the level of the environmental music played in a bar still remained in question."
Study design	RCT

Population	
Intervention description (including content, delivery, setting, provider)	(1) Sound level of 72 decibels in 2 bars (2) Sound level of 88 decibels in 2 bars
Theoretical basis of intervention	Arousal Hypothesis (Smith & Curnow 1966)
Number of participants	40
Outcome measures	Alcohol consumption (number of drinks ordered)
Time(s) at which outcomes assessed	2-hrs
Additional comments	"The observations were made during 3 Saturday nights with the consent of the owners of the bars. 2 observers situated in 2 different places in the bars where the experiment took place were used. Before selecting a participant, the sound level of the environmental music was manipulated according to a randomization scheme. The level of environmental music was randomly selected and then observations were conducted until the last participants left the bar. Then a new random selection of the environmental music was done and new par- ticipants were selected between patrons who entered the bar. The experimental environmental music played in the 2 bars was the same as the music usually played (top-forty music in both bars). In the control condition, the sound level used was the same as on usual days (72 dB). In the high level condition, the environmental music was played at a level of 88 dB in the 2 bars. Volume levels were measured by a decibel meter placed near the middle of the room (A Velleman decibel meter, model VELL 1326, Velleman, Inc., Gavere, Belgium). The high level was selected according to the previous work of Kellaris and Altsech (1992) and in our previous study Gueguen et al. (2004). It was found that 88 dB was a level considered by subjective evalua- tion as a typical level of ''foreground music.'' This level was also con- sidered by the owners of the 2 bars as the maximum level they could use. Hence it was decided to take 72 dB as the typical level ordinarily used in the bars in which the experiment took place, whereas 88 dB was considered the highest level. After selecting the sound level session, the observers waited for the patrons who first entered the bar. If the patrons were males, in a pair and that one of them ordered an 8 oz glass of draft beer, they were selected as participants. If the 2 patrons ordered an 8 oz glass of draft beer, both were observed. If the patrons were alone or were in a group of more than 2 people, observers waited until a pair of patrons entered. The observers were instructed to observe discretely the pair of participants and to count the drinks ordered until they left the bar. For each drink, one of the

	observers was instructed to note the amount of time spent by each participant to drink their glass (the time elapsed between the moment the participant received his glass and the moment the participant finished his glass). The other observer was instructed to note the number of gulps used by each customer to drink each glass. The 2 observers were instructed to note their data on a piece of cardboard."

Hollands et al. 2015

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"(1) To assess the effects of interventions involving exposure to different sizes or sets of physical dimensions of a portion, package, individual unit or item of tableware on unregulated selection or consumption of food, alcohol or tobacco products in adults and children. 2) To assess the extent to which these effects may be modified by study, intervention and participant characteristics."
Study design	Systematic review and meta-analysis
Population	Alcohol consumers
Intervention description (including content, delivery, setting, provider)	(1) Larger-sized portion, package, individual unit or item of tableware (2) Smaller-sized portion, package, individual unit or item of tableware
Theoretical basis of intervention	Environmental influences (Das 2012; Marteau 2012; Neal 2006) Choice architecture interventions (Hollands 2013a; 2013b) Influence of size (Herman 2015; Steenhuis 2009; Pratt 2012; Wansink 2005; Scisco 2012) Social norms (Young 2002) Unit Bias (Geier 2006)
Number of participants	N/A
Outcome measures	Consumption (daily energy intake from food; purchase selection)

Time(s) at which outcomes assessed	N/A
Additional comments	Hollands et al. (2015) conducted a meta-analysis of portion-size, packaging, and tableware on food and drink consumption. Despite searching for sizing criteria relevant to implements used in alcohol consumption, the authors found no eligible document that reported a main outcome of alcohol consumption. In the context of other consumption measures, the review provided evidence that larger portion, package and tableware size increase consumption of food and non-alcoholic beverages. The authors took this result, amid other theoretical and empirical literature, to suggest that alcohol served in larger portions and containers, such as glassware, will result in increased alcohol consumption compared to smaller portions and containers.

Hustad et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"e used path analysis in the present study to examine the predictive effects of personality (e.g., impulsivity, sensation seeking, hopelessness, and anxiety sensitivity) and three measures of alcohol perception: descriptive norms, injunctive norms, and perceptions regarding the perceived role of drinking in college on alcohol-related outcomes."
Study design	Observational (survey)
Population	Incoming freshmen college students
Intervention description (including content, delivery, setting, provider)	Path analysis in which personality variables (impulsivity, sensation seeking, hopelessness, and anxiety sensitivity) were modelled as distal determinants of alcohol outcomes, and perceived drinking norms (descriptive and injunctive) and the role of drinking were modelled as more proximal antecedents to alcohol use and alcohol-related problems
Theoretical basis of intervention	Personality traits (Maisto, Bishop, & Hart, 2012; Littlefield et al. 2009; Simons et al. 2005; Cyders et al. 2009; Woicik et al. 2009; DeMartini & Carey, 2011; Cox and Klinger 1988) Theory of Planned Behaviour (Ajzen 2011

	Descriptive and injunctive norms (Cialdini et al. 1991; Borsari & Carey, 2003; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007) Perceptions (Osberg et al., 2010; Osberg et al. 2011; Osberg et al., 2012) Subjective norms (Fishbein & Ajzen 2010
Number of participants	490
Outcome measures	Beliefs about personality (Substance Use Risk Profile Scale); descriptive norms (Drinking Norms Rating Form); injunctive norms ('most common attitude' survey); role of drinking in college (College Life Alcohol Salience Scale)
Time(s) at which outcomes assessed	N/A
Additional comments	Hustad et al. (2014) investigate how a social norms intervention may interact with individual-level personality traits in influencing alcohol consumption. Hustad and colleagues conduct path analysis to examine the predictive effects of these 4 personality traits on 3 norms regarding alcohol use on campus. Participants were randomly assigned to receive the survey among the first-year class at a large state university in the U.S. The authors focus on 4 well-defined personality traits in particular (impulsivity, sensation seeking, hopelessness, and anxiety sensitivity) that may play some role in priming an individual to become sensitive to and engage in alcohol consumption (Watt et al. 2006; Conrod et al. 2011). Likewise, the authors focus on an intervention strategy that engages 1 of 3 types of norms—descriptive, injunctive, and role-based—to moderate consumption, as has been demonstrated on college campuses (Neighbors et al. 2007). Descriptive norms simply model the perceptions of, in this case, alcohol consumption by other individuals, denoting frequency, overall consumption, and other behavioural patterns (Cialdini et al. 1991). Injunctive norms are specific to individuals and denote if they believe others will view their consumption habits favourably or unfavourably (Cialdini et al. 1991). For college students, many of whom are below the age of 23, norms regarding the role of drinking may reflect associations of alcohol consumption with maturation and adulthood. The authors note that the Theory of Planned Behaviour (Ajzen 2011) among other theories appears to associate personality traits with 'early factors' and social norms with 'later factors' in the causal pathway resulting in alcohol consumption by an individual. On this view, norms perform the important function of capturing an individual's self-perception by other people.

Jacob 2006

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The effects of background music have been widely studied in the literature but few studies have tested effects of music in commercial settings. An experiment was carried out in a bar to test influence of three different styles of music on patrons."
Study design	RCT
Population	Customers at 2 bars in France
Intervention description (including content, delivery, setting, provider)	(1) Cartoon music played for 30 min in bar (2) Top 40 music played for 30 min in bar (3) Drinking songs played for 30 min in bar
Theoretical basis of intervention	Arousal Hypothesis (Smith & Curnow 1966)
Number of participants	93
Outcome measures	Alcohol consumption (money spent over 30-min)
Time(s) at which outcomes assessed	30-min
Additional comments	Jacob (2006) tested the effects of 2 playlists offering different styles of music in a rural French bar setting. In particular, Jacob observed participants at a pub over the course of 2 evenings during which time a 'Top 40' popular music playlist was alternated with a Cartoon Music playlist. In line with her hypothesis, the author did note that more alcohol was consumed when Top 40 music was played and attributed the effect to priming, for similar reasons mentioned by Engels et al. (2011). In particular, Jacob speculated that popular Top 40 music could induce feelings connoted with conviviality and festivity in comparison to Cartoon Music, and thus subjects may feel more comfortable consuming alcohol. The author also noted that subject dyads (the unit of study) tended to spend more time in the bar when Top 40 music was being played as compared to when Cartoon Music was being played. Moreover, both studies reported that the notion of an association between music and context had been supported by an empirical evaluation conducted by North et al. (1999). They found that customers'

	selection of French or German wines was strongly affected by stereotypic French and German background music. French music increased sales of French wines compared to German ones whereas German music led to a reverse effect.

Kohn & Smart 1984(a)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"[To] report an experiment to determine the effects of television beer commercials on ongoing beer consumption by young men drinkers"
Study design	RCT
Population	Young men drinkers
Intervention description (including content, delivery, setting, provider)	(1) Zero commercials during football match (2) Four commercials during football match (3) Nine commercials during football match
Theoretical basis of intervention	N/A
Number of participants	125
Outcome measures	Alcohol consumption (number of subjects ordering alcohol at 3x 30-min intervals)
Time(s) at which outcomes assessed	30-, 60-, and 90-min
Additional comments	Kohn & Smart (1984) report the effects of a study to investigate of beer commercials on consumption by college male students observed over the course of 90 minutes. During that time, subjects were presented with television show programming of a football match accompanied by regular intermittent commercial allotments. Subjects were not notified as to the true intent of the experiment; rather, they were led to believe they were partaking in a survey of the potential appeal of viewing indoor football. In the first experimental condition, immediate access to beer and other refreshments was understood to be part of the viewing experience (as compared to delayed-access in the second experimental condition). The authors hypothesised that assignment to the first experimental condition would be predictive of alcohol consumption levels, and though they found

	a moderate effect the result was not statistically significant. The authors attempt to explain this result by noting that perhaps participants who received delayed-access to beer and refreshments compensated for the delay by drinking more in a shorter period of time than they might have otherwise.

Kohn & Smart 1984(b)

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"This paper reports an experiment on the effects of two kinds of alcohol advertising on subsequent consumption."
Study design	RCT
Population	Male passersby in a shopping mall, ascertained to be drinkers aged 19-45
Intervention description (including content, delivery, setting, provider)	(1) No advertisement (2) Flyer (3) Tombstone hand sheet
Theoretical basis of intervention	N/A
Number of participants	163
Outcome measures	Alcohol consumption (number of drinks consumed)
Time(s) at which outcomes assessed	N/A
Additional comments	Kohn et al. (1984) examined the effects of print advertising on *ad libitum* alcohol consumption in a public drink area. Two types of print advertising incorporating images and text were tested, one 'lifestyle' variant in which alcohol intake was observed in a variety of social settings, and a second 'product' variant in which a bottle of alcohol was depicted alongside favourable comments regarding its flavour. The authors recruited male passers-by at a large shopping mall, asking them to evaluate the appeal of both print advertisement variants or to submit a survey regarding their user experience of the mall. Subsequently, participants who elected to dine at a restaurant in the mall were secretly observed and their alcohol consumption recorded. Moreover, the authors called all participants 6-12 weeks later for a nominally independent survey about their

	alcohol consumption history in recent months. Results indicated there was no effect across the two types of print advertisement on either immediate or long-term alcohol consumption.

Larimer et al. 2007

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The current study was designed to evaluate the efficacy of a mailed feedback and tips intervention as a universal prevention strategy for college drinking."
Study design	RCT
Population	Parents of incoming 1st-year college students
Intervention description (including content, delivery, setting, provider)	(1) Mailed feedback in the form of 10 postcards with information about alcohol's effects and protective strategies (2) Control (non-feedback postcards with information about alcohol's effects and protective strategies)
Theoretical basis of intervention	Motivational Interviewing (Miller & Rollnick 2002)
Number of participants	1,488
Outcome measures	Alcohol consumption (number of drinks and hours spent drinking on a peak drinking occasion during the past month; how many days of the week they had drunk alcohol in the past month; average daily consumption)
Time(s) at which outcomes assessed	1-year
Additional comments	Larimer et al. (2007) tested the effects of a printed personalised feedback letter sent to college students and intended to prevent or moderate alcohol consumption on campuses. The authors hypothesised that such feedback would result in an outcomes of lower alcohol consumption, fewer heavy drinking episodes, and increased chance of abstinence from alcohol as compared to a control population (which did not receive personalised feedback). Moreover, Larimer and colleagues suspected that women and heavy drinkers would exhibit reduced consumption as compared to men and light-to-moderate drinkers, respectively. Trial participants were a subset of college students already

	partaking in a 5-year longitudinal study of alcohol interventions across several college campuses. For this study, participants were recruited through random assignment at a medium-sized, 4-year US college and received a plea to take part in an Internet survey. That data was integrated into a system which provided personalised feedback that was then printed and posted to each participant in the experimental condition. Over the course of the subsequent 14 days, the first of 10 postcards were sent to all participants, and the intent of the postcard was to provide additional information about alcohol, alcohol abuse, and various consumption strategies adopted by light-to-moderate drinkers. In the context of the experimental condition, participants received a series of personalised feedback postcards that noted their alcohol consumption patterns, percentile rank in relation to the student average at that university, and forecasted blood alcohol content level at peak consumption points. The last of these was accompanied by information about the physical and social impacts of alcohol at different blood alcohol content levels. In line with perceived student drinking norms solicited by the baseline survey, participants were notified about actual alcohol consumption patterns and levels across the university. Subsequent feedback postcards notified participants about ways to calculate blood alcohol content levels using demographic data as well as other proactive strategies intended to moderate alcohol consumption. Notably, each feedback postcard drew attention to descriptive norms about on-campus consumption by the average college student (e.g. “85percent of students had 0, 1, 2, 3, or at most 4 drinks when they partied”), and some postcards indicated reasons why some subset of students chose to abstain from drinking.

Leeman et al. 2013

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	“We developed an alcohol self-administration paradigm to

	model individual differences in impaired control."
Study design	RCT
Population	Heavy-drinking 21- to 25-year-olds
Intervention description (including content, delivery, setting, provider)	(1) Subjects informed that for each of the 4 psychomotor tasks they did not perform comparably with initial screening, they would draw from a hat for a possible pay reduction ($0, $6, $12) for potential loss up to $48. (2) No payment reduction
Theoretical basis of intervention	Impaired Control (Heather et al. 1993; Kahler et al. 1995) Self-Control
Number of participants	39
Outcome measures	Alcohol consumption (number of alcohol units over 3-hrs)
Time(s) at which outcomes assessed	1-, 2-, 3 hours; 1-3 business days (interview)
Additional comments	Leeman et al. (2013) tested the efficacy of an alcohol self-administration paradigm to examine the effects of impaired control on consumption. Research suggests that some subset of drinkers experience a high degree of impaired control, or the degradation of a goal not to drink or minimise drinking (Heather et al. 1993; Kahler et al. 1995). Such a theoretical construct may help to explain why, for example, some individuals exhibiting alcohol abuse may overcome intentions to not drink or limit drinking. Leeman and colleagues designed an experimental paradigm incorporating moderate drinking guidelines and potential payment reductions and sought, through this study, to establish the internal validity of these components. The experiment took place in an actual barroom, and participants were organised into 2-4 person groups to model the social interactive effects of public alcohol consumption. The addition of payment reductions to the paradigm was thought to denote negative consequences associated with over-consumption of alcohol above and beyond one's intentions. They were executed after each participant engaged in a series of cognitive and behavioural tasks at baseline and follow-up. For example, degraded performance—linked to alcohol consumption between baseline and follow-up—made some participants eligible for a pay reductions lottery. Moreover, the lottery was conducted 2-3 days after alcohol self-administration in the laboratory, which was thought to model the effects of delayed negative consequences. Overall, the authors hypothesised that participants in the treatment arm (i.e. subject to payment reductions) would consume less alcohol and demonstrate lower blood alcohol content levels at the treatment's end. Results indicated that treatment participants indeed consumed less alcohol and exhibited lower blood alcohol content levels.

Litvin et al. 2013

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"We conducted a "review of reviews" focused on summarizing findings of previous reviews with respect to moderators of TBIs' efficacy, and present an organizing framework of considerations involved in designing and evaluating TBIs for SUDs."
Study design	Review of reviews
Population	Individuals with substance use disorders
Intervention description (including content, delivery, setting, provider)	Brief alcohol technology-based intervention
Theoretical basis of intervention	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	N/A
Outcome measures	N/A
Time(s) at which outcomes assessed	N/A
Additional comments	Litvin et al. (2013) reported a review of reviews summarising findings of extant systematic reviews of text-based interventions on substance use outcomes. The authors note that review-level evidence indicates a high degree of heterogeneity in effects accompanied by little discussion of treatment mechanisms reported in trials. They go on to develop a framework for designing and evaluating such interventions that incorporates constructs for accessibility, usage, human contact, and intervention content.

Lombardi 2010

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal	Y

pathway between CA intervention logic and alcohol consumption?	
STUDY CHARACTERISTICS	
Objective	"Three experiments investigated the impact of anchors on students' estimates of personal alcohol consumption to better understand the role that this form of bias might have in social norm intervention programs."
Study design	RCT
Population	College students
Intervention description (including content, delivery, setting, provider)	Experiment I: does subject drink more/less than average student? (1) High anchor at top of questionnaire: norm for students is to drink 19 standards drinks per week (2) Low anchor at top of questionnaire: norm is 1 drink per week (3) Control (questionnaire without norm statement) Experiment II: how many drinks does subject consume per week on average? (1) High anchor questionnaire: norm for students is to drink 16 standards drinks per week (2) Low anchor at top of questionnaire: norm is 4 drink per week (3) Control (questionnaire without norm statement) Experiment III: how many drinks does subject consume when they party? (1) Provision of poster indicating most university students drink 4 or fewer drinks when they party (3) Control (questionnaire without norm statement)
Theoretical basis of intervention	Social Norms (Perkins & Berkowitz 1986; Perkins 1997) Anchoring (Tversky & Kahneman 1974; Jacowitz & Kahneman 1995)
Number of participants	405
Outcome measures	Self-reported alcohol consumption (on basis of anchored information)
Time(s) at which outcomes assessed	N?A
Additional comments	Given this theoretical understanding of anchoring bias, Lombardi examined the effects of a social norm intervention designed to educate students about mean alcohol consumption among their peer group in 3 experiments. Such group means were conceived of as potential anchors for individuals' future consumption levels. In experiment I, randomly assigned students completed a 3-question questionnaire that asked 1) if they thought they consumed more, less, or about the same amount of

	alcohol as the average student at that university, 2) how many drinks they consume on average each week, and 3) their gender. Across 3 versions of this questionnaire, students received a 'high anchor' normative statement at the top of the questionnaire noting that the average student drank 19 drinks per week; a 'low anchor' normative statement noting that the average student drank 1 drink per week; and a control version that did not include a normative statement. In actual fact, the drinking mean was 9.89 drinks per week, and thus the author added and subtracted 9 from the mean to set the high and low anchors. In experiment II, Lombardi deployed the same questionnaire as used in experiment 1 with one change. For the second question asking students how many drinks they consume in an average week, again the author tested 3 versions of the questionnaire. A 'high anchor' normative statement noted that the average student consumed 16 drinks per week; a 'low anchor' normative statement noted that it was 4 drinks per week; and the third version included no normative statement. In experiment III, the effects of a social norm poster were tested via its inclusion in the survey packet. To wit, Lombardi hypothesised that participants who received the social norm poster—which noted that "Most DePaul students have 4 or fewer drinks when they party"—would result in fewer episodes of binge drinking at follow-up. Overall, results for experiments I and II indicate that most estimates skewed toward the low anchor rather than the high anchor, indicating perhaps that the high anchors were deemed implausible. Results for experiment III indicated that a substantially fewer of participants who received the poster reported episodes of binge drinking.

McTavish et al. 2012

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"A-CHESS is a smartphone-based system for preventing relapse to heavy drinking among people leaving active alcohol dependence treatment. A-CHESS is designed to improve

	competence, social relatedness, and motivation, the three tenets of self-determination theory. This paper reports on the relative impact and use of A-CHESS 4 months after patients entered the study and discusses implications of the results on treating addiction and chronic diseases generally."
Study design	RCT
Population	Heavy drinkers in aftercare program
Intervention description (including content, delivery, setting, provider)	(1) Standard residential alcohol treatment + possession of Alcohol-Comprehensive Health Enhancement Support System (A-CHESS) smartphone for 8 months (2) Control (standard residential alcohol treatment)
Theoretical basis of intervention	Self-Determination Theory (Ryan & Deci 2000) Cognitive Behavioural Relapse Prevention Model (Marlatt & George 1984) Self-Efficacy (Bandura 1977) Social Learning (Rhodes et al. 1997) Persuasive Communication (Hovland et al. 1964) Motivational Interviewing (Miller & Rollnick 1991) Theory of Reasoned Action (Ajzen & Fishbein 1977) Stages of Change (Prochaska & DiClemente 1983)
Number of participants	349
Outcome measures	Smartphone system (A-CHESS) use
Time(s) at which outcomes assessed	N/A
Additional comments	The intervention reported in McTavish et al. (2012) included SMS text messages design to help patients recovering from alcoholism previously in residential care. However, in this study (unlike Agyapong et al. 2015) for a period of 8 months participants were given a smartphone that included a system (Alcohol-Comprehensive Health Enhancement Support System, or A-CHESS) designed to mitigate the possibility of relapse. A-CHESS services included text messaging and video, Internet surfing, GPS, and voice recognition and calling. Of greatest note, alcohol users could record their daily alcohol consumption and interact with training modules designed to prevent relapse. In doing so, A-CHESS offered participants resources to manage craving and withdrawal symptoms, access to a counselling and social support by fellow participants, and planning materials to set goals for themselves. Data was automatically transferred to each participant's case manager regarding log entries, A-CHESS services used, access to and duration of Internet webpages, and whether or not participants sent or received SMS texts.

Moss et al. 2015

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"Four experiments were conducted to assess the acute impact of context and exposure to responsible drinking messages (RDMs) on attentional allocation and drinking behaviour of younger drinkers and to explore the utility of lab-based methods for the evaluation of such materials."
Study design	RCT
Population	Non-problem drinkers among college student sample
Intervention description (including content, delivery, setting, provider)	(1) Natural bar setting (2) Laboratory setting (3) Responsible Drinking Message poster (4) Control poster (5) Online priming + RDM poster (6) No online priming + control poster (7) RDM poster + subject verbalisation of message (8) Control poster + no verbalisation of message
Theoretical basis of intervention	Attentional Preferences (Schoenmakers & Wiers 2009)
Number of participants	225
Outcome measures	Alcohol consumption (intake)
Time(s) at which outcomes assessed	N/A
Additional comments	Moss et al. (2015) examine the effects of a natural drink setting or laboratory setting on alcohol consumption. Both conditions were also tested with the inclusion of a health-message poster designed to encourage individuals to take up moderate drinking guidelines. Moss and colleagues conduct a series of experiments to test the effects of setting on alcohol as well as the effects of responsible drinking posters. Responsible drink message posters contained both positive and negative imagery and text associated with consumption, forming narrative regarding moderate drinking ('before') and over-consumption ('after'). Results indicate that individuals consumed more alcohol in an actual bar as compared to a laboratory (which did not contain any alcohol-

	related paraphernalia). Participants exposed to responsible drinking messages actually consumed more alcohol relative to participants who were not exposed to any health messages. The authors used eye-tracking devices on an additional cohort of randomised participants exposed to responsible drinking posters and noticed that they spent a minimal time reading the text compared to how much time they spent examining the positive imagery contained in each poster. It may be the case that participants did not process or accept the responsible drink message, focusing instead on the positive images associated with alcohol use.

Murphy & MacKillip 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The current study systematically examined the effects of an acute mindfulness manipulation on craving for alcohol during prolonged exposure to alcohol cues."
Study design	RCT
Population	Heavy drinkers
Intervention description (including content, delivery, setting, provider)	(1) Alcohol cue* + no treatment (2) Alcohol cue + distraction task (3) Alcohol cue + mindfulness task *Incorporated audio recordings incorporating auditory, visual, olfactory, procioceptive, and tactile cues to prompt the subject to think about alcohol
Theoretical basis of intervention	Mindfulness Therapy (Marlatt 2002; Bishop et al. 2004) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Witkiewitz et al. 2005)
Number of participants	84
Outcome measures	Craving (alcohol craving; urge distress; mood)
Time(s) at which outcomes assessed	7 times in 4-min intervals within 45-min; 3-day follow-up
Additional comments	Murphy & MacKillip (2014) tested the effects of a simple mindfulness-based intervention on self-reported craving for

	alcohol. Outcomes effects of the intervention were compared to 2 control conditions, a distraction condition designed to divert individual attention away from craving and a passive control condition in which no coping strategy was posited. Craving was elicited through the researchers' administration of an alcohol cue reactivity strategy. The authors hypothesised that the mindfulness treatment would cause alcohol craving to decrease among participants. Results indicated, however, that the distraction control condition exhibited statistically significant outcome effects as compared to the mindfulness treatment or the passive control groups. The authors note that through mindfulness sessions individuals are taught not to exert effort in retaining a particular positive or negative state of mind but rather to accept all states of mind as impermanent. This study appears to suggest that distraction away from craving—rather than dwelling about it—may be more effective as a coping strategy, at least in a controlled laboratory environment.

Murphy et al. 2012

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The goal of this randomized controlled clinical trial was to evaluate the incremental efficacy of a novel behavioral economic supplement (Substance-Free Activity Session [SFAS]) to a standard alcohol brief motivational interviewing (BMI) session for heavy-drinking college students."
Study design	Observational
Population	Heavy-drinking college students
Intervention description (including content, delivery, setting, provider)	(1) Brief Alcohol Intervention + Substance-Free Activity Session (50-min individual counselling session designed to increase the salience of the student's academic and career goals, draw attention to the potentially negative relationship between substance use and goal accomplishment and increase engagement in substance-free alternative activities) (2) Brief Alcohol Intervention + Relaxation Training control (30-min session involving diaphragmatic breathing exercise

	followed by a progressive muscle relaxation protocol)
Theoretical basis of intervention	Motivational Interviewing (Miller & Rollnick, 2002) Substance-free Reinforcement (Carroll et al. 2009; Higgins et al. 2004 Delayed Reward Discounting (Madden & Bickel, 2010; Vuchinich & Simpson, 1998; Murphy et al. 2006)
Number of participants	82
Outcome measures	Alcohol consumption (total number of standard drinks that they consumed on each day during a typical week in the past month)
Time(s) at which outcomes assessed	1- and 6-month follow-ups
Additional comments	Murphy and colleagues design a BI enhanced with a substance-free activity motivational interviewing session and test its efficacy compared to that of a control brief alcohol intervention treatment on alcohol consumption among student problem drinkers. The enhanced BI included a BI session as well as a 50-minute personalised feedback session that occurred 1 week later. The later session included discussion of an alcohol decisional balance exercise, feedback regarding the individual's drink habits relative to recommended consumption patters, and goal setting with regard to future drinking behaviour. Feedback included discussion of the student's academic and career goals as well as the ways that alcohol abuse may interfere with achieving those outcomes. Before departing, students received a manual that incorporated information about recommended studying habits as well as a diary to help them plan their daily work loads.

Nakamura et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"In this study we present the first in-depth estimate of the effect of end-of- aisle display on sales, focusing on alcohol."
Study design	RCT
Population	Customers at one UK grocery store

Intervention description (including content, delivery, setting, provider)	Shelf space, price, price promotion and weekly sales volume in 3 alcohol categories (beer, wine, spirits) and 3 non-alcohol categories (carbonated drinks, coffee, tea)
Theoretical basis of intervention	Product placement (Chevalier 1975; Curhan 1974; Frank & Massy 1970; Klein & Wright 2007; Park et al. 1989; Sorenson 2008; Wilkie et al. 2002; Wilkinson et al. 1982)
Number of participants	N/A
Outcome measures	Alcohol consumption (total purchases)
Time(s) at which outcomes assessed	13 weekly slices between March 2010 and February 2011
Additional comments	Nakamura et al. (2014) consider the effects of altering end-of-aisle store displays of alcohol on alcohol purchases in a UK grocery store. The authors note that a substantial literature of marketing research focuses on the relationship between product placement in supermarkets and other stores and retail purchasing patterns among consumers (Sorenson 2008; Wilkie et al. 2002; Klein & Wright 2007; Park et al. 1989). For example, Sorensen (2003) point out that the sale of products placed at the end the aisles in supermarkets represent 30 percent of total sales. Nakamura and colleagues focused on altering the placement of alcohol products after controlling for a range of product characteristics, including price, price promotion, and number of display locations. Notably, the end-of-aisle displays were placed in two adjoining aisles separated only by a thoroughfare down the centre of the store. Treatment products included 3 alcoholic beverages (beer, wine, spirits), and they were compared to 3 control non-alcoholic products (carbonated drink, coffee, and tea). Regression results indicated that sales volume of each of the 3 alcoholic beverages and 3 non-alcoholic beverages increased when those products were marketed in end-of-aisle display locations.

Neighbors et al. 2010

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"Web-based brief alcohol interventions have the potential to reach a large number of individ- uals at low cost; however, few

	controlled evaluations have been conducted to date. The present study was designed to evaluate the efficacy of gender-specific versus gender-nonspecific personalized normative feedback (PNF) with single versus biannual administration in a 2-year randomized controlled trial targeting a large sample of heavy-drinking college students."
Study design	RCT
Population	College freshmen
Intervention description (including content, delivery, setting, provider)	(1) Gender-specific personalised normative feedback (2) Gender-nonspecific personalised normative feedback (3) Control
Theoretical basis of intervention	Social Comparison (Festinger 1954) Social Identity (Tajfel 1982) Self-Categorisation (Turner et al. 1987)
Number of participants	818
Outcome measures	Alcohol consumption (weekly consumption; alcohol-related problems index; heavy episodic reporting)
Time(s) at which outcomes assessed	6-, 12-, 18-, 24-month
Additional comments	Neighbors et al. 2010 reported an Internet-based intervention that incorporated social norms surrounding college drinking among students. College students are subject to a range of influences with regard to drinking on campus, and among those influences is drinking done by other students. Perhaps surprisingly, researchers have found that students tend to overestimate 1) how many of their peers drink alcohol, and 2) how much their peers drink (Carey et al. 2006; Lewis & Neighbors 2007). Neighbors et al. sought to investigate the application of Personalised Normative Feedback (PNF), an intervention that aims to improve understanding about alcohol consumption among youth and employ social norms to moderate drink habits. In designing the intervention, the authors drew on theoretical literature regarding social norms, social comparison, social identity, and self-categorization (Festinger 1954, Tajfel 1982, Turner et al. 1987, respectively) in the belief that an individual orients themself in relation to 'normative referents' in choosing to engage in alcohol consumption. In this vein, the authors investigated the influence of at least one kind of 'normative referents'—same-sex referents—given that past research has found that an individual's personal drink habits (overall consumption and frequency) appear to be affected in part by referents that identify as the same-sex as the individual (Lewis & Neighbors 2007). Thus, the intervention was designed to cross-compare the efficacy of gender-specific PNF with that of gender-nonspecific PNF.

Ostafin et al. 2012

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The current research examined whether mindfulness decouples the relation between automatic alcohol motiva- tion and heavy drinking."
Study design	RCT
Population	Regular drinkers among college students
Intervention description (including content, delivery, setting, provider)	(1) Three mindfulness training sessions: 10-, 20-, and 25-min sessions dedicated to breathing, sounds, and mountain imagery (2) Control (audio recordings) training sessions: 10-, 20-, and 25-min sessions dedicated to readings of passages from a research methodology textbook (Rosenthal & Rosnow 1991)
Theoretical basis of intervention	Dyscontrolled Use (Widiger & Smith 1994; Tiffany 1990; Wiers & Stacy 2006; Deutsch & Strack 2006; Fazio 1990) Mindfulness Therapy (Bishop et al. 2004)
Number of participants	41
Outcome measures	Alcohol consumption (Heavy Drinking Behaviour calendar, including quantity consumed per occasion and binge drinking episodes) Alcohol motivation (Implicit Association Test)
Time(s) at which outcomes assessed	2-weeks
Additional comments	N/A

Otten et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and	Y

alcohol consumption?	
STUDY CHARACTERISTICS	
Objective	"This study tested the effects of self-control failure on *ad libitum* drinking, and the potential moder- ating role of glucose and self-awareness on this relationship."
Study design	RCT
Population	Undergraduate students recruited at Radboud University Nijmegen, the Netherlands
Intervention description (including content, delivery, setting, provider)	(1) Depletion task + self-tracking task (2) Depletion task + no self-tracking task (3) No depletion task + self-tracking task (4) No depletion task + no self-tracking
Theoretical basis of intervention	Self-Control (Baumeister et al. 1994; Ego Depletion (Muraven et al. 1998; Baumeister et al. 1998) Self-Regulation (Muraven & Baumeister 2000; Bagozzi & Edwards 1982; Carver & Scheier 1981; Baumeister et al. 2007) Self-Control Strength Model (Muraven et al. 2002)
Number of participants	214
Outcome measures	Alcohol consumption (alcoholic units over 1-hr)
Time(s) at which outcomes assessed	40-min
Additional comments	Otten and colleagues designed 2 experiments to examine the outcome of self-control failure on alcohol consumption. They hypothesised that 1) participants who had performed a self-control-depleting tasks would imbibe more alcohol as compared to individuals who did not, 2) male subjects would drink more than female subjects in part because self-control failure may be more pronounced in men in the context of alcohol intake, and 3) participants who completed tasks designed to enhance self-awareness would consume less alcohol than those who did not. Participants were randomised to receive the treatment condition (self-control-depleting task) or control condition. The depletion condition required that individuals cross out the letter 'e' in in a page of text, followed by increasingly convoluted crossing-out rules. Participants were then offered the opportunity to select alcoholic or non-alcoholic beverages to drink during a 30-minute break, during which time researchers observed participant consumption levels. All control and treatment participants were then assigned to 1 of 2 additional conditions: self-awareness (in which participants were asked to write down the number of drinks they consumed on a piece of paper) or no treatment (control). Results indicated that individuals who completed the self-control-depletion treatment consumed more average than

	those who did not, and that participants asked to keep track of the number of alcoholic beverages they consumed drank less than those who did not. Males consumed more alcohol than females among participants who had completed the self-control-depletion task. Yet self-awareness did appear to be a significant moderator; males assigned to both depletion and self-awareness tasks consumed significantly less alcohol as compared to males assigned to depletion who were not asked to keep track of their consumption.

Pechey et al. 2016

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"This study aimed to examine the impact of wine glass size on wine sales for on-site consumption, keeping portion size constant."
Study design	RCT
Population	Customers at 1 restaurant in Cambridge, UK
Intervention description (including content, delivery, setting, provider)	(1) Standard 300 ml glass used in restaurant (2) Larger 370 ml glass replaced standard glass (3) Standard 300 ml glass used (4) Smaller 250 ml glass replace standard glass
Theoretical basis of intervention	Portion size (Benton 2015; English et al. 2015; Herman et al. 2015; Kerr et al. 2009) Volume perception (Walker et al. 2014; Raghubir & Krishna 1999) Choice architecture (Hollands et al. 2016) Unit Bias (Geier 2006)
Number of participants	N/A
Outcome measures	Alcohol consumption (mean daily volume sold by restaurant)
Time(s) at which outcomes assessed	8 x 2-week periods, mid-March to early July 2015
Additional comments	Pechey et al. (2016) examined the effects of wine glass size on sales of wine in a UK restaurant. Commercial and health guidelines specify that wine must be served in 125 ml, 175-250 ml, or 750-ml set portions. The authors examined the effects of

	changing out differently sized but similarly shaped wine glasses over the course of 8 periods of 2-weeks, in which neither the restaurant's wine menu or prices were changed. The authors hypothesised that the effects of glass size would be moderated by the availability and purchase of wine by the bottle or glass, given cost-benefit price calculations by consumers (Benton 2015). Most importantly, Pechey and colleagues suspected that a range of different size glasses serving the same amount of liquid influence portion size perceptions (Raghubir & Krishna 1999). Results indicated that volume of wine, and therefore consumption, increased when sold in the larger wine glasses.

Portnoy et al. 2008

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The use of computers to promote healthy behavior is increasing. To evaluate the efficacy of these computer-delivered interventions, we conducted a meta-analysis of the published literature."
Study design	Systematic review and meta-analysis
Population	Individuals who receive some computer-delivered intervention
Intervention description (including content, delivery, setting, provider)	Computer-delivered interventions for health promotion and behavioural risk reduction (not specific to alcohol consumption)
Theoretical basis of intervention	N/A
Number of participants	35,685
Outcome measures	Psychological outcomes of health prevention Behavioural outcomes
Time(s) at which outcomes assessed	N/A
Additional comments	Portnoy et al. (2008) reports a meta-analysis of computer-based interventions examining several health domains. The review included 75 RCTs reporting 82 separate interventions as well as 35,685 participants. The authors calculated weighted mean effect sizes across a range of behavioural outcomes and conducted

	moderate analysis tracing the pathways between study characteristics and outcomes. Internet-based intervention participants changed in knowledge, attitudes and behavioural intentions, and in behaviour improved across several fields (including nutrition, tobacco use, substance use, safe sex practice, and alcohol binge behaviours).

Riper et al. 2008

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"Self-help interventions for adult problem drinkers in the general population have proved effective. The question is whether this also holds for self-help interventions delivered over the internet."
Study design	RCT
Population	Adult problem drinkers
Intervention description (including content, delivery, setting, provider)	(1) Self-help online (2) Control (web-based psychoeducational brochure on effects of alcohol)
Theoretical basis of intervention	Guided Self-Change Treatment (Sobell & Sobell 1993) Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	261
Outcome measures	Alcohol consumption (problem drinking; weekly consumption)
Time(s) at which outcomes assessed	6-months
Additional comments	Riper et al. (2007) targeted an Internet-based intervention to individuals identified as problem drinkers who reported to an emergency unit at a hospital in the Netherlands. The authors note that individuals screened for alcohol misuse who appear in emergency units may represent a 'hidden' population for whom traditional brief alcohol interventions are inaccessible—either because their stay in the emergency unit is too brief or because they are not recognised by primary care professionals as alcohol abusers (Cunningham & Breslin 2004; Andrews et al. 2004). Riper et al. enabled participants in the treatment condition to

	access DrinkingLess, an online, therapist-free, self-help intervention. DrinkingLess provides information on alcohol, alcohol abuse, and referrals to local resources, as well as a self-help module that includes 4 stages. Participants who progressed through the self-help module encountered 1) action planning for moderating alcohol consumption in the short-term, 2) goal setting for desired consumption levels, 3) long-term planning for maintaining desired consumption levels, and 4) training to prevent relapse. The intervention incorporates elements from cognitive-behavioural therapy and self-control principles (Hester et al. 1995; Sobell & Sobell 1993). The intervention also included an asynchronous communication system in which participants could speak with one another about their progress and challenges. Although the treatment period was of 6-week duration, participants could continue to access DrinkingLess after the trial period.

Schoenmakers et al. 2007

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"o examine whether alcohol-related attentional bias (AB) can be reduced by training heavy drinkers to attend to soft drinks as an alternative to alcohol."
Study design	RCT
Population	Heavy-drinking male college students
Intervention description (including content, delivery, setting, provider)	(1) Attention Modification Training: subject classified 60 target images as alcohol- or non-alcohol-related, and in which picture pairs represented alcoholic and 'probe' pictures (2) Control: subject classified 60 target images as alcohol- or non-alcohol-related, and in which picture pairs represented alcoholic and 'neutral' pictures
Theoretical basis of intervention	Attentional Bias (Franken 2003; Robinson & Berridge 1993; Weinstein & Cox 2006; Cox et al. 2006) Incentive Sensitisation Theory (Robinson & Berridge 1993, 2001)

Number of participants	106
Outcome measures	Attentional bias (visual-probe task score); Craving (Desires for Alcohol Questionnaire); Preference task (soft drinks or alcohol)
Time(s) at which outcomes assessed	1-hour
Additional comments	Schoenmakers (2007) also sought to prime participants in both the experimental arm (receiving attentional bias modification) and the control arm (no training) by asking participants to drink a sip of beer. It was thought that the subsequent craving response among heavy drinkers would be especially pronounced. Moreover, after the treatment conditions had concluded for both arms, subjective craving was assessed, and participants were offered alcoholic and non-alcoholic beverages. Researchers recorded the number of beverages of each kind requested by each participant. Results indicated that participants who had received attentional bias modification training grew to ignore alcohol stimuli in favour of non-alcoholic stimuli and consumed less alcohol after treatment as compared to individuals in the control arm.

Schoenmakers et al.2 010

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"A new training to decrease attentional bias (attentional bias modification training, ABM) was tested in a randomized controlled experimental study with alcohol-dependent patients as an addition to cognitive behavioral therapy."
Study design	RCT
Population	Patients with DSM-IV diagnosis of alcohol-dependence
Intervention description (including content, delivery, setting, provider)	(1) Attention Modification Training: 5 tasks in which subject classified a target image as alcohol- or non-alcohol-related and in which picture pairs represented alcoholic and 'probe' pictures ((2) Control: 5 tasks in which subject classified a target image as alcohol- or non-alcohol-related and in which picture pairs represented alcoholic and 'neutral' pictures

Theoretical basis of intervention	Attentional Bias (Field 2005; Franken 2003; Robinson & Berridge 1993; Weinstein & Cox 2006) Incentive Sensitisation Theory (Robinson & Berridge 1993, 2001)
Number of participants	43
Outcome measures	Attentional bias (visual-probe task score); Craving (Desires for Alcohol Questionnaire); Time to relapse (questionnaire); Treatment response (discharge)
Time(s) at which outcomes assessed	1-hour (each after 5 sessions); 3-months
Additional comments	Schoenmakers et al. (2010) make use of the computerised attentional bias modification training task used by van Deursen et al. (2013) above, whereby participants are trained to ignore or push away alcohol cues (such as images of alcoholic beverages) in favour of non-alcoholic cues. The authors hypothesised that the effect of alcohol bias modification training on craving would be increased via increased number of both alcohol and non-alcoholic stimuli and increased number of training sessions. In one experimental arm, participants were provided positive personalised information that noted how they could improve their response time and accuracy. On average, the researcher and participant together developed a goal of decreasing response time by 20 milliseconds and increasing accuracy to 95 percent. Results for Schoenmakers (2010) indicated that the effect of attentional bias modification disassociating from alcohol cues could be increased through personalised feedback, the provision of new stimuli, and an increased number of treatment sessions. However, no significant effects on craving were reported.

Siegfried et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"To evaluate the benefits, harms and costs of restricting or banning the advertising of alcohol, via any format, compared with no restrictions or counter-advertising, on alcohol consumption in adults and adolescents."

Study design	Systematic review
Population	N/A
Intervention description (including content, delivery, setting, provider)	Restriction or banning of alcohol advertising to reduce the consumption of alcohol and raise the age of initiation of drinking
Theoretical basis of intervention	N/A
Number of participants	80 (RCT); Unknown (3 Canadian general population ITS studies)
Outcome measures	Alcohol consumption (total number of glasses)
Time(s) at which outcomes assessed	N/A
Additional comments	Siegfried et al. (2014) conduct a systematic review and meta-analysis of alcohol advertising restrictions and bans on consumption in individuals, including both adults and adolescents. Advertisements in this review included those that appeared on television, billboards, magazines, and the Internet. Four studies met the inclusion criteria, 1 RCT (Engels et al. 2009, also included in this realist review and discussed above) and 3 interrupted time series (ITS) studies (Makowski & Whitehead 1991; Ogborne & Smart 1980; Smart & Cutler 1976). Ogborne & Smart (1980) and Smart & Cutler (1976) examined the effects of newly introduced partial advertising bans in two Canadian provinces, and Makowski & Whitehead (1991) examined the effects of downgrading a total ban on alcohol advertising to a partial ban in a third Canadian province. Results across the 3 ITS studies were inconsistent and statistically non-significant. As measured by sales of alcohol, the 2 ITS studies (Ogborne & Smart 1980; Smart & Cutler 1976)that examined the effects of newly introduced bans on alcohol advertising saw a statistically non-significant increase in beer consumption, whereas the ITS study (Makowski & Whitehead 1991) examining the partial lifting of such a ban saw a slight statistically non-significant decrease in alcohol purchases.

Sobell et al. 1986

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y

STUDY CHARACTERISTICS	
Objective	"The drinking behaviour of 96 male normal drinking college students was assessed after they viewed a videotape of a popular prime-time television program complete with advertisements."
Study design	RCT
Population	Male normal drinking college students
Intervention description (including content, delivery, setting, provider)	(1) Beer commercial + alcohol TV scenes (2) Beer commercial + no alcohol TV scenes (3) NA beverage com. + alcohol TV scenes (4) NA beverage com. + no alcohol TV scenes (5) Food commercial + alcohol TV scenes (6) Food commercial + no alcohol TV scenes
Theoretical basis of intervention	N/A
Number of participants	96
Outcome measures	Alcohol consumption (number of alcoholic units over 1-hr)
Time(s) at which outcomes assessed	1 hour
Additional comments	Sobell et al. (1986) reports the effects of viewing a television program with and without alcohol scenes on subsequent alcohol intake by male college students. The authors drew from conditioning theory (Poulos et al. 1981) in hypothesising that alcohol abusers would be more responsive to cues trigging alcohol craving—such as those associated with television programming and commercials—as compared to non-alcohol abusers. A popular prime-time television program was shown to students, and in the first experimental arm scenes in which television subjects drank alcohol were removed (unaccompanied by alcohol commercials), whereas in the second experimental arm those scenes were left to remain (accompanied by alcohol commercials). Although the authors speculated that participants in the second experimental arm would imbibe less alcohol, the results indicated that there was no significant effect between the two arms.

Taylor et al. 2015

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y

STUDY CHARACTERISTICS	
Objective	"Two types of social norm message frame for encouraging seeking of alcohol-related health information by excessive drinkers were compared: (a) how much the average person actually drinks and (b) how their drinking ranks among others. It was hypothesized, in accordance with recent evidence of how the brain represents value, that Frame (b) would be more effective than Frame (a). This is the first test comparing these frames in any domain of social norms research."
Study design	RCT
Population	Heavy-drinking UK university students
Intervention description (including content, delivery, setting, provider)	(1) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + official guidelines for alcohol consumption (2) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + comparison of subject's alcohol consumption with official guidelines (3) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + comparison of subject's reported units per week with the mean number of units per week consumed by others of the same gender in the sample (4) 4 weekly social norm message emails to notify subject that s/he drank more than recommended + comparison of subject's consumption in units per week ranked compared with others of the same gender in the sample
Theoretical basis of intervention	Choice architecture (Thaler & Sunstein 2008) Rank-framing (Stewart et al. 2006; Vlaev et al. 2011) Social Norm Message (Moreiera et al. 2009; Walters & Neighbors 2005; Chan et al. 2007; Dimeff et al. 1999; Neighbors et al. 2004)
Number of participants	101
Outcome measures	Alcohol consumption (over previous week); request for information/consultation
Time(s) at which outcomes assessed	Over 4-weeks
Additional comments	Taylor et al. (2015) tested the effects of different social norms interventions on alcohol consumption. Problem drinkers tend to overestimate alcohol consumption levels by other people, and social norm interventions indicate that this perception is false and dangerous to persist in believing (Schultz et al. 2007). Social norms may take the form of indicating: relative consumption levels between an individual and the wider population (Moreira et al. 2009) and/or the percentile ranking of an individual in comparison to the population (Chan et al. 2007). Taylor and

	colleagues attempt to compare the efficacy of both messages. Rank-framing is a concept from behavioural economics that predicts that most individuals may be affected by their self-perception of 'rank' in orientation to others (Vlaev et al. 2011). The authors hypothesise that revealing to problem drinkers how their overall consumption ranks with that of the wider general population would prompt them to turn to education materials about the effects of alcohol. Problem drinkers were screened using AUDIT-C survey, indicating the amount of alcohol they consumed in an average week. Participants in the intervention condition were then sent 4 weekly emails containing different social norm messages. One variant referred participants on to recommended guidelines with respect to alcohol consumption; a second variant compared the consumption levels of each participant to the recommended guidelines; a third variant notified participants of the comparison of their average weekly intake of alcohol with that of the average person of the same sex as the participant; and a fourth variant indicated to participants their percentile rank of weekly alcohol consumption in comparison to individuals of the same gender in the sample.

Teunissen et al. 2012

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"In an experimental 1-factor design with two levels, we tested the short-term effects of exposing students to either positive or negative stereotypic information about drinkers on their drinker prototypes and actual drinking behaviors."
Study design	RCT
Population	College students
Intervention description (including content, delivery, setting, provider)	(1) Positive prototype condition: subject read a seemingly well-known popular science magazine article that describes drinkers as generally sociable, attractive, and successful (2) Negative prototype condition: subject read a seemingly well-

	known popular science magazine article that describes drinkers as generally unsociable, unattractive, and unsuccessful
Theoretical basis of intervention	Prototypes (Cantor and Mischel 1979; Niedenthal et al. 1985) Gender prototypes (Prentice and Miller 1993; Suls and Green 2003; Gibbons and Gerrard, 1995; Chassin et al. 1985) Social influence on drinking (Bot et al. 2007; Spijkerman et al. 2010) Experimental (Chassin et al. 1985; Spijkerman et al. 2004; Andrews et al., 2008; Blanton et al. 1997; Gerrard et al. 2002; Spijkerman et al. 2007; Gibbons and Gerrard 1995; Norman et al., 2007; Spijkerman et al. 2010; Spijkerman et al. 2010)
Number of participants	192
Outcome measures	Alcohol consumption (drinker prototypes; weekly alcohol use; binge drinking; observed alcohol use)
Time(s) at which outcomes assessed	55-min
Additional comments	Teunissen and colleagues examined whether manipulating drinker prototypes affected total alcohol consumption among students in a bar laboratory. They hypothesised that negative prototypes would lead exposed participants to consume less alcohol as compared to those exposed to positive prototypes. Moreover, they expected that effects would be exaggerated among men as compared to women. Results indicated those exposed to positive prototypes consumed more alcohol relative to those exposed to negative prototypes. Moreover, male participants exposed to positive drinker prototypes consumed more alcohol as compared to those exposed to negative prototypes, whereas female participants appeared indifferent to positive or negative prototypes.

Van Deursen et al. 2013

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"he effectiveness of 12 sessions of CBM will be examined among problem drinkers aged 18–65 who are randomly assigned to one of the eight CBM conditions, after completing two

	modules of a validated cognitive behavioural intervention, DrinkingLess.”
Study design	RCT trial protocol
Population	Problem drinkers aged 18-65
Intervention description (including content, delivery, setting, provider)	(1) Web-based Cognitive Bias Modification (CBM) therapy (2) Placebo CBM therapy (3) Web-based CBM therapy + alcohol training (4) Placebo CBM therapy + alcohol training (5) Web-based CBM therapy + no-go training (6) Placebo CBM therapy + no-go training (7) Web-based CBM therapy + approach bias retraining (8) Placebo CBM therapy + placebo approach bias retraining
Theoretical basis of intervention	Incentive Sensitisation Theory (Robinson & Berridge 2008) Control and Motivation (Gladwin et al. 2011) Attentional Bias Theory (MacLeod et al. 1986)
Number of participants	351
Outcome measures	Change in alcohol consumption
Time(s) at which outcomes assessed	3-, 6-, 12-month follow-ups
Additional comments	In the van Deursen et al. (2013) trial, participants who have been screened for alcohol misuse problems will complete 2 modules of the DrinkingLess online self-help program, incorporating personalised feedback on an individual’s drinking behaviour and personal goals in setting future consumption levels. Then, they will complete 12 sessions of an experimental or placebo condition for 1 of 3 online CBM interventions. Each intervention is designed to draw the attention of a trial participant away from an image of an alcoholic beverage and towards the image of a non-alcoholic beverage in some fashion. In the attentional bias retraining arm, individuals were directed to look away from an image of an alcoholic beverage. In the alcohol-related memory arm, individuals will be coached to not respond to a picture of an alcoholic beverage and to respond to one of a non-alcoholic beverage. Finally, in the approach bias retraining arm, individuals will be taught to manipulate an online interface in pushing away the image of an alcoholic beverage and pull the image of a non-alcoholic beverage towards themselves. The authors hypothesise that participants exhibiting relatively high levels of attentional, memory, and approach biases at baseline would demonstrate greater effects of CBM training as compared to participants exhibiting relatively lower levels of automatic bias.

Varvil-Weld et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The present study [examines] the effectiveness of three different parent-based intervention conditions on student drinking outcomes as a function of parenting types and students' pre-college drinking patterns."
Study design	RCT
Population	Incoming college students and their parents
Intervention description (including content, delivery, setting, provider)	(1) Pre-college matriculation parent-based intervention (PBI) handbook, parent survey, and informed consent form (2) Pre-college matriculation PBI handbook, parent survey, and informed consent form + booster (3) Post-college matriculation PBI handbook, parent survey, and informed consent form (4) Parent survey and informed consent form
Theoretical basis of intervention	Parent-Based Intervention (Cleveland et al. 2012; Testa et al. 2010; Turrisi et al. 2009; Wood et al. 2010) Parent Typing (Abar 2012; Varvil-Weld)
Number of participants	1,900 (students)
Outcome measures	Alcohol consumption of students (change between 4 categories: non-drinkers, light weekend drinkers, heavy weekend episodic drinkers, heavy drinkers)
Time(s) at which outcomes assessed	5-month follow-up
Additional comments	Varvil-Weld et al. (2014) examine the effects of variable timing and dosage of a parent-based intervention on alcohol consumption of their children during their first year at college. The intervention includes a handbook designed to educate parents about the effects of alcohol and rates of alcohol consumption across college campuses, as well as suggest tips to parents in discussing alcohol with their children. Research indicates that parent-based intervention are effective in reducing student drinking (Cleveland et al. 2012; Turrisi et al. 2009). The authors sought to manipulate the timing and dosage of the intervention, choosing separate times (starting the summer

	before the child's first year at college and running through their first semester) to deliver the handbook in 4 experimental arms. Varvil-Weld et al. hypothesised that self-reported high-risk students would report lower alcohol consumption relative to the control arm given that their parents had received the handbook and reminder early in the summer before their first year at college. The authors also hypothesised that high-risk students would demonstrate the greatest outcome effects overall. Overall, parents were asked to read and discuss the handbook with their children. Results indicated that high-risk students reported the greatest effect in lower alcohol consumption.

Vinci et al. 2014

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"The current study tested whether a brief mindfulness meditation would lower levels of NA, increase willingness to experience NA, lower urges to drink, and increase time to next alcoholic drink in a sample of at-risk college student drinkers (N = 207)."
Study design	RCT
Population	At-risk college students
Intervention description (including content, delivery, setting, provider)	(1) Mindfulness + Negative Affect (NA*) Stimuli (2) Relaxation + NA Stimuli (3) Control + NA Stimuli (4) Mindfulness + Neutral Stimuli (5) Relaxation + Neutral Stimuli (6) Control + Neutral Stimuli *NA manipulation included provision of alcohol-related images intended to prompt craving
Theoretical basis of intervention	Negative Affect (Watson et al. 1988) Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Brewer et a. 2009; Witkiewitz & Bowen 2010) Mindfulness Therapy (Marlatt 2002; Kabat-Zinn 1994; Baer 2003; Shapior 1982)
Number of participants	207

Outcome measures	Craving (Urge to Drink; intended time to next drink) Negative Affect (PANAS)
Time(s) at which outcomes assessed	10-min, 30-min, 50-min
Additional comments	Vinci et al. (2014) examined the effects of a mindfulness-based intervention on relapse and negative affect as compared to a control intervention that incorporated physical relaxation techniques. The authors explained that mindfulness techniques could bring participants' attention to their affective and cognitive state and—among other things—lead participants to understand that their state was transient even without recourse to substance use. Participants who received the intervention were guided through a 10-minute mindfulness meditation session (adapted from Adams et al. 2013) that brought their attention to, for example, their physical sensations such as breathing. Participants who received the relaxation intervention also listened to a 10-minute tape that guided them through relaxing each of their muscle groups (Antoni 2003). Results demonstrated that—in comparison to the relaxation arm—participants in the mindfulness group reported decreased negative affect after the intervention and at follow-up.

Vinson 2000

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"We conducted a randomized pilot study of written behavioural contracts that patients wrote with help from a computer program."
Study design	RCT
Population	Patients from 8 family medicine practices
Intervention description (including content, delivery, setting, provider)	(1) Brief intervention + contract options + print, sign, review with physician (2) Brief intervention
Theoretical basis of intervention	Adherence (Putnam et al. 1994; Ossip-Klein et al. 1984; Swain & Steckel 1981)
Number of participants	80
Outcome measures	Alcohol consumption (Addiction Severity Index)

Time(s) at which outcomes assessed	12-months
Additional comments	Vinson (2000) tests the effects of a computerised behavioural control on alcohol consumption in an aftercare treatment program among problem drinkers. Problem drinkers who draft behavioural contracts along with health care professionals tend to report better maintenance of desired behaviour change (Fleming et al. 1997; Wallace et al. 1988). For ease of use and to streamline economic and time costs, a computer system was set up to offer a range of template behavioural contracts to patients, who could discuss desired personalised behavioural options with a healthcare provider before printing and signing such a document. For participants, one of the first steps in drawing up a contract was to complete a survey about their own perceptions of their history with alcohol and to report social and physical problems that may have resulted from it. Subsequently participants were offered a different range of goals to commit to, e.g. "I will seriously think about my drinking habits and patterns" and "I will keep track of how much alcohol I drink". The contract was reviewed by both the participant and their healthcare provider, and printed and signed copies were retained by both individuals.

Wallace et al. 2011

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"A two-arm randomised controlled trial was conducted entirely on-line through the Down Your Drink (DYD) website."
Study design	RCT
Population	Individuals who screened positive for hazardous alcohol consumption
Intervention description (including content, delivery, setting, provider)	(1) Down Your Drink website (2) Control comparator website
Theoretical basis of intervention	Cognitive Behavioural Relapse Prevention Model (Marlatt & George 1984)

	Cognitive Behavioural Therapy / Motivational Interviewing (Miller & Rollnick 1991)
Number of participants	7,935
Outcome measures	Alcohol consumption
Time(s) at which outcomes assessed	1-, 12-months
Additional comments	The intervention consisted of the DownYourDrink program that incorporated brief alcohol intervention components delivered over the Internet. The treatment consisted of 3 stages, focusing on decision-making, implementation, and relapse prevention, and each stage included referral materials and tasks testing the uptake of the stage by a participant. In addition, participants were encouraged to keep a diary to monitor their daily consumption as well as chart environmental and affective triggers that spurred alcohol craving. DownYourDrink incorporates principles of motivational interviewing, cognitive-behavioural therapy, and self-control principles.

Wansink & van Ittersum 2005

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"To determine whether people pour different amounts into short, wide glasses than into tall, slender ones."
Study design	Observational
Population	College students and bartenders
Intervention description (including content, delivery, setting, provider)	(1) Pour spirit into short/wide glass (2) Pour spirit into tall/narrow glass (3) Bartender pour spirit into short/wide glass (4) Bartender pour spirit into tall/narrow glass
Theoretical basis of intervention	Mechanisms of Perception (Piaget 1969) Elongation Hypothesis (Raghubir & Krishna 1999, Holmberg & Holmber1969; Verge & Vogartz 1978)
Number of participants	276 (198 college students, 86 bartenders)
Outcome measures	Difference between amount of liquid poured and amount estimated

Time(s) at which outcomes assessed	N/A
Additional comments	Wansink & van Ittersum (2005) examined whether pouring experience or increased concentration can help reduce the perceptual bias (assuming that tall glasses hold more liquid than wide ones of the same volume). Although people believe they have poured more into a tall, slender glass, even professional bartenders unknowingly pour 20 to 30 percent more alcohol into short, wide glasses than into tall, slender ones. This bias is only slightly reduced by practice, concentration, or experience. Results indicated across both bartenders and non-bartending adults, amount poured and elongation were positively associated. In short, individuals who engage in self-pouring tend to pour more in short glasses as compared to tall glasses, and yet they perceive that they have poured more into tall glasses. While experience in pouring does appear to moderate this bias, it does not eliminate it.

Wansink et al. 2003

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"Although the effects of shapes on area perceptions have been widely investigated, we replicate, extend, and generalize one of the few studies to relate the effects of shapes to consumption volumes (Raghubir and Krishna 1999). While Raghubir and Krishna demonstrate the effect of the elongation of prepoured drinks on con- sumption volume, we have people pour their own drinks in a series of controlled field experiments."
Study design	OBSERVATIONAL
Population	Bartenders
Intervention description (including content, delivery, setting, provider)	(1) Child + short/wide glass (2) Child + tall/narrow glass (3) Adult + short/wide glass (4) Adult + tall/narrow glass
Theoretical basis of intervention	Mechanisms of Perception (Piaget 1969) Elongation Hypothesis (Raghubir & Krishna 1999, Holmberg &

	Holmber1969; Verge & Vogartz 1978)
Number of participants	45
Outcome measures	Difference between amount of liquid poured and amount estimated
Time(s) at which outcomes assessed	N/A
Additional comments	"Four experimenters each visited between eight and 14 bartenders and administered the four conditions in a randomized pattern during their visits. Each bartender was asked to pour the well-established standard amount of al- cohol that would be used in each of four different drinks (1.5 oz). To avoid any misunderstanding, the bartenders were explicitly told to pour 1.5 oz of each drink. The experimenter supplied the serving glasses and the bottles of liquor, and each bartender poured directly from full 1,500 ml bottles (50.6 oz) without the aid of a pouring spout or measuring device (such as a shot glass). After being given the 1,500 ml bottle, the bartenders were asked to pour the amount of gin used to make a gin and tonic. Half of the bartenders were given tall, slender 12-oz ("highball") glasses and the others were given short, wide 12-oz ("tumbler") glasses. In addition, they were asked to pour the amount of rum in a rum and Coke, the amount of whiskey in a whiskey on the rocks, and the amount of vodka in a vodka tonic. The order in which they poured the drinks was rotated. The number of years of bartending experience was used as an indicator for pouring experience."

Wigmore & Hinson 1991

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"Previous research using the balanced placebo design has demonstrated that instructions about alcohol content of a beverage affect consumption more than actual alcohol content. In the present experiment the balanced placebo design was… a 2 x 2 x 2 factorial with expectancy about alcohol content, actual

	alcohol content, and setting in which the experiment was conducted as factors."
Study design	RCT
Population	Male undergraduates who had been drinking at least 4 months and who drank at least 12 standard drinks per week on average
Intervention description (including content, delivery, setting, provider)	(1) Told alcohol + given alcohol + lab setting (2) Told alcohol + given no alcohol + lab setting (3) Told no alcohol + given alcohol + lab setting (4) Told no alcohol + given no alcohol + lab (5) Told alcohol + given alcohol + nat. bar setting (6) Told alcohol + given no alcohol + nat. bar (7) Told no alcohol + given alcohol + nat. bar (8) Told no alcohol + given no alcohol + nat. bar
Theoretical basis of intervention	Social Learning Theory (Bandura 1977; Collins et al. 1985; Garlington & Dericco 1977; Hendricks et al. 1978) Expectancy Theory (Marlatt & Rohsenow 1980; Southwick et al. 1981; Vuchinich 1978)
Number of participants	84
Outcome measures	Alcohol consumption (alcoholic units over 30-min)
Time(s) at which outcomes assessed	30-min
Additional comments	Wigmore & Hinson (1991) examine the effects of an intervention constituted by drink setting and alcohol expectancy on alcohol consumption. Specifically, the authors designed a 2x2x2x2 trial in which verbal directions about a beverage's alcohol content, the beverage's actual alcohol content, and setting were examined in a balanced placebo cross-comparison experiment. In designing such a trial, the authors were trying to review in part the extent to which expectancy plays a role in self-perception. Expectancies as to how much alcohol one has consumed are known to influence behaviour (Marlatt & Rohsenow 1980). In their trial, Wigmore & Hinson informed 50 percent of participants that they were to consume alcoholic beverages whereas the other 50 percent were informed they were to consume non-alcoholic beverages. Yet, unbeknownst to them, half of both groups actually received alcoholic beverages and the other half of both groups received non-alcoholic beverages. Results from Wigmore & Hinson (1991) indicated that setting influenced alcohol consumption: participants led to drink *ad libitum* in the natural bar setting consumed more of both alcoholic and non-alcoholic beverages in comparison to those consuming beverages in the laboratory setting. Moreover, the consumption levels of participants were driven in part by the perceived alcohol content of the beverage each participant believed they were consuming. Participants who were told they

	were to consume alcohol drank more of both alcoholic and non-alcoholic beverages as compared to participants who were told they were to consume non-alcohol beverages, regardless if they actually drank alcoholic or non-alcoholic beverages. The authors believe that the natural bar setting exerted a powerful influence—even to the extent that consumption in the bar was not differentially influenced by the characterisations of alcohol or non-alcoholic content. The authors argue that the influence of setting may be due in part to classical conditioning in which the alcohol-related paraphernalia in the bar served as an unconscious cue to consume of a beverage, regardless if one believed it was alcohol or not (Siegel 1983).

Witkiewitz & Bowen 2013, 2010

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y
STUDY CHARACTERISTICS	
Objective	"Mindfulness-based relapse prevention (MBRP), shown to be efficacious for reduction of substance use, uses mindfulness-based practices to teach alternative responses to emotional discomfort and lessen the conditioned response of craving in the presence of depressive symptoms. The goal in the current study was to examine the relation between measures of depressive symptoms, craving, and substance use following MBRP."
Study design	RCT
Population	Individuals with substance use disorders
Intervention description (including content, delivery, setting, provider)	(1) Mindfulness-based relapse prevention sessions over the course of 2-hr sessions over 8 weeks delivered to groups of 6-10 participants (2) Treatment-as-usual sessions, including rolling admission outpatient aftercare including work in the 12-step model, process-oriented groups, relapse prevention skills, and psychoeducational materials
Theoretical basis of intervention	Craving (Kozlowski & Wilkinson 1987) Negative-reinforcement Withdrawal Model (Wikler 1948) Mindfulness Therapy (Marlatt 2002; Bishop et al. 2004; Teasdale et al. 2000)

	Mindfulness-based Relapse Prevention Therapy (Bowen et al. 2009; Witkiewitz et al. 2005; Marlatt & Gordon 1985)
Number of participants	168
Outcome measures	Drug and alcohol consumption (Timeline Follow-Back scores, reporting the number of days alcohol was consumed over the past 60 days); craving (Penn Alcohol Craving Scale); Depression (Beck Depression Inventory-II)
Time(s) at which outcomes assessed	8 weeks, 4-month follow-up
Additional comments	"The current study followed up on the significant mediating effect of craving that was reported by Bowen et al. (2009) and was designed to further examine one hypothesized mechanism of change following MBRP. […]In particular, we were interested in testing the hypotheses that (a) there is a strong, positive relation among postintervention depressive symptoms, craving 2 months following the interven tion, and days of substance use following the intervention; (b) the relation between depression symptoms and substance use can be partially explained by individuals' subjective reports of craving; (c) intervention assignment will attenuate relations between de-pressive symptoms and craving; and (d) there is an interaction among intervention assignment, depressive symptoms, and craving in the prediction of substance use. Given the focus of MBRP on helping clients to experience discomfort with decreased reactivity, we hypothesized that individuals in MBRP would be less likely to report craving in response to higher depression scores and would subsequently decrease their substance use. Results confirmed a moderated-mediation effect, whereby craving mediated the relation between depressive symptoms among the treatment-as-usual group but not among MBRP participants. MBRP attenuated the relation between postintervention depressive symptoms and craving 2 months following the intervention. This moderation effect predicted substance use 4 months following the intervention.

Zgierska et al. 2009

INCLUSION CRITERIA	
Intervention in line with CA intervention definition?	Y
Outcome focused on alcohol consumption?	Y
Paper describes causal pathway between CA intervention logic and alcohol consumption?	Y

STUDY CHARACTERISTICS	
Objective	"The goal of this article was to systematically review the existing evidence on mindfulness meditation- based interventions (MM) for SUDs."
Study design	Systematic review and meta-analysis
Population	Individuals with substance use disorders
Intervention description (including content, delivery, setting, provider)	Vipassana Meditation Mindfulness-Based Stress Reduction Spiritual Self Schema Therapy Acceptance and Commitment Therapy Dialectical Behaviour Therapy
Theoretical basis of intervention	Mindfulness (Breslin 2002; Marlatt & Chawla 2007) Mindfulness-based Stress Reduction (Kabat-Zinn 1990) Meditation (Kutz 1985)
Number of participants	--
Outcome measures	--
Time(s) at which outcomes assessed	--
Additional comments	"The comprehensive search for and review of literature found over 2000 abstracts and resulted in 25 eligible manuscripts (22 published, 3 unpublished: 8 randomized controlled trials, 7 controlled nonrandomized, 6 noncontrolled prospective, and 2 qualitative studies, and 1 case report). Although preliminary evidence suggests MM efficacy and safety, conclusive data for MM as a treatment of SUDs are lacking. Significant methodological limitations exist in most studies. Further, it is unclear which persons with SUDs might benefit most from MM."

Appendix 3.5 *Characteristics of excluded studies*

Record name	**Year**	**Reason for exclusion**
Allen et al.	1998	Did not include CA intervention (brief intervention)
Allen et al.	1997(a)	Did not include CA intervention (brief intervention)
Allen et al.	1997(b)	Did not include CA intervention (brief intervention)
Allsop et al.	1997	Did not include CA intervention (relapse prevention)
Almanza et al.	2004	Did not include CA intervention (social learning theory)
Alper	2005	Literature review; did not include CA intervention (brief intervention)
Alvarez-Bueno et al.	2015	Systematic review; did not include CA intervention (brief intervention)

Anton & Randall	2005	CA intervention arms enhanced with pharmacological components
Armstrong et al.	2009	Did not include CA intervention (brief intervention)
Assanangkornchai et al.	2007	Literature review; did not include CA intervention
Ayers & Myers	2012	Did not include alcohol consumption as an outcome
Baer et al.	2001	Did not include CA intervention (brief intervention)
Baker et al.	2012	Systematic review; did not include CA intervention (psychosocial interventions)
Balachova et al.	2014	Did not include CA intervention (brief intervention)
Barnett et al.	2010	Did not include CA intervention (brief intervention)
Bazargan-Hejazi et al.	2005	Did not include CA intervention (brief intervention)
Beauchamp et al.	1984	Did not include human subjects or alcohol
Bergmark	2008	CA intervention arms enhanced with pharmacological components
Bischof et al.	2012	Did not include CA intervention
Breslow et al.	2013	Did not include alcohol consumption as an outcome
Chang et al.	1999	Did not include CA intervention (brief intervention)
Collins et al.	2010	Did not include CA intervention
Collins et al.	2009(a)	Did not include CA intervention
Collins et al.	2009(b)	Did not discriminate between alcohol consumption and consumption of other substances
Collins et al.	2012	Did not include CA intervention
COMBINE Study Research Group	2003	CA intervention arms enhanced with pharmacological components
Daeppen et al.	2007(a)	Did not include CA intervention (brief intervention)
Daeppen et al.	2007(b)	Did not include CA intervention (brief intervention)
De Wit et al.	2003	Did not include CA intervention
Demmel & Beck	2004	Did not include alcohol consumption as an outcome
Eaton	2014	Did not include CA intervention
Factor et al.	2013	Did not include CA intervention or measure alcohol consumption as an outcome
Field et al.	2010	Did not include CA intervention
Field et al.	2015	Did not include CA intervention
Fiellin et al.	2000	Did not include CA intervention
Finfgeld-Connett	2005	Did not include CA intervention
Fleming & Manwell	1999	Did not include CA intervention (brief intervention)
Fong	2004	Did not include alcohol consumption as an outcome
Garlington	1977	Did not include alcohol consumption as an outcome
Giabbanelli & Crutzen	2014	Did not relate to alcohol
Gottlieb et al.	1994	Did not include CA intervention
Graham	2002	Did not include CA intervention (brief intervention)

Grothues et al.	2008	Did not include CA intervention (brief intervention)
Hart	2004	Did not include CA intervention (pharmacological intervention)
Havard et al.	2008	Did not include CA intervention
Hustad & Borsari	2010	Did not include CA intervention (brief intervention)
Hustad et al.	2014	Did not include CA intervention (group-based brief intervention)
Ickes et al.	2015	Did not include CA intervention
Igna et al.	2014	Did not relate to alcohol
Kahler et al.	2008	Did not include CA intervention (brief intervention)
Kalhler et al.	2010	Did not include CA intervention (brief intervention)
Kendzor et al.	2008	Did not include CA intervention
Kiluk & Carroll	2013	Did not discriminate between alcohol consumption and consumption of other substances
Klimas et al.	2014	Did not include CA intervention
Komro et al.	1996	Did not include CA intervention
Kulesza et al.	2013	Did not include CA intervention (brief intervention)
Lane et al.	2012	Did not include CA intervention (brief intervention)
Libman et al.	2015	Did not include CA intervention and unrelated to alcohol
Loeber & Duka	2009	Did not include alcohol consumption as an outcome
Logan et al.	2015	Did not include CA intervention (brief intervention)
Lonczak et al.	2001	Did not include CA intervention (brief intervention)
Longabaugh & Magill	2011	Did not discriminate between alcohol consumption and consumption of other substances
Mallett et al.	2015	Did not include CA intervention
Martens & Murphy	2010	Did not include CA intervention (brief intervention)
Martens et al.	2013	Did not include CA intervention (brief intervention)
Martin et al.	2012	Did not include CA intervention (brief intervention)
Mattson	1993	Did not include CA intervention (brief intervention)
Mattson et al.	1998	Did not include CA intervention (brief intervention)
Mattson & Litten	2005	CA intervention arms enhanced with pharmacological components
Mdege et al.	2013	Did not include CA intervention (brief intervention)
Miller et al.	2006	Did not relate to alcohol
Miller & Wilbourne	2002	Did not include CA intervention (brief intervention)
Mills et al.	2009	Did not include CA intervention
Moise et al.	2014	Did not include CA intervention
Morgenstern et al.	2007	Did not include CA intervention (brief intervention)
Muckle et al.	2012	Did not include CA intervention
Mun et al.	2015	Did not include CA intervention (brief intervention)
Murphy et al.	2010	Did not include CA intervention (brief intervention)
Neighbors et al.	2011	Did not include CA intervention
Neighbors et al.	2012	Did not include CA intervention
Newton et al.	2014	Did not discriminate between alcohol consumption and

		cannabis consumption
Newton et al.	2010	Did not discriminate between alcohol consumption and cannabis consumption
Orbells & Verplanken	2010	Did not include CA intervention
Orchen	1983	Did not include CA intervention
Pearson	2013	Literature review; did not include CA intervention (protective behavioural strategy)
Project MATCH Research Group	1997	Did not include CA intervention
Project MATCH Research Group	1998	Did not include CA intervention
Richmond et al.	1995	Did not include CA intervention
Roerecke et al.	2013	Did not include CA intervention
Rose et al.	2015	Did not include CA intervention (brief intervention)
Rose et al.	2008	Did not include CA intervention
Saitz et al.	2003	Did not include CA intervention
Saitz et al.	1994	Did not include CA intervention (pharmacological intervention)
Schwartz et al.	2014	Did not discriminate between alcohol consumption and consumption of other substances
Shiles et al.	2013	Did not include CA intervention (brief intervention)
Shin et al.	2012	Did not include CA intervention (tested pharmacological intervention and brief intervention)
Sobell et al.	1996	Did not include CA intervention
*Sobell et al.	2002	Did not include CA intervention
Soderstrom et al.	2007	Did not include CA intervention (brief intervention)
Solberg et al.	2008	Did not include CA intervention
Stein et al.	2010	Did not include CA intervention (brief intervention)
Tait et al.	2004	Did not include CA intervention (brief intervention)
*Turrisi et al.	2009	Did not include CA intervention
*Turrisi et al.	2013	Did not include CA intervention
Van Ravenzwaaij et al.	2012	Did not include *ad libitum* alcohol consumption as an outcome
Vendrame et al.	2015	Did not include CA intervention
Voas et al.	2008	Did not include CA intervention
Vodopivec-Jamsek et al.	2012	Did not include *ad libitum* alcohol consumption as an outcome
UK Alcohol Treatment Trial Research Team	2008	Did not include CA intervention
Vosbergen et al.	2014	Did not include *ad libitum* alcohol consumption as an outcome
Walitzer & Connors	2007	Did not include CA intervention (group-based brief intervention)
*Walters et al.	2000	Did not include CA intervention
Walton et al.	2010	Did not include CA intervention (brief intervention)

Watson et al.	2015	Did not include CA intervention (brief intervention)
Watson et al.	2013	Did not include CA intervention
Werch et al.	2008	Did not include CA intervention
WHO	1996	Did not include CA intervention
Williams et al.	1999	Did not include CA intervention
Witkiewitz et al.	2011	Did not include CA intervention (tested pharmacological intervention and brief intervention)
Witkiewitz et al.	2012	Did not include CA intervention
Witkiewitz et al.	2010	Did not include CA intervention