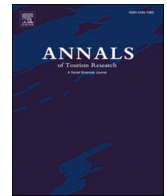




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Shadowcasting tourism knowledge through media: Self-driving sex cars?

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ARTICLE INFO

Associate editor: Scott McCabe

Keywords:

Media reporting

Shadowcasting

Futures

Sociotechnical transitions

Autonomous vehicles

Sex work

ABSTRACT

Tourism is central to late-modern life, and tourism research that threatens this centrality is prone to media attention. Framed by sociotechnical transitions theory, we introduce the concept of ‘shadowcasting’ to show how tourism knowledge disseminated through the media, combined with public comments on its reporting, cast shadows that co-constitute imagined futures. We illustrate shadowcasting through a mixed method approach that demonstrates how media reporting and public comments on a recent paper on autonomous vehicles in tourism emerged and diverged from the original paper. Our findings reveal that issues around sex and terrorism were sensationalised, generating diverse public discourses that challenge linear visions of future transport efficiency. Our concluding discussion indicates other tourism research contexts that are most inclined to shadowcasting.

Introduction

It is now widely accepted that tourism is a field of study as opposed to a discipline (c.f. Tribe, 1997). In contrast to disciplines that describe a particular method of enquiry, fields concentrate on specific phenomena or an area of interest. The activity of tourism is at the heart of global mobility, interconnected with other mobility flows and interdependencies within processes of globalisation. Tourism is paradoxically a soothing funnel for aspirations and identities in late-modern capitalist life (Gössling et al., 2018), while also producing anxieties and insecurities attached to its potential disruption, such as tourism’s vulnerability to terrorism, its contribution to climate change, or its recent suspension due to Covid-19 lockdowns. It is this status as a field of high centrality to late-modern life that can make studies of tourism, particularly ones which expose this paradox and thereby threaten societal perceptions of tourism as a panacea for social ills, prone to media attention, hype and sensationalisation.

Tourism knowledge is predominantly viewed as an attempt ‘to capture, to represent, to describe, and to explain the phenomenon of tourism’ (Tribe, 1997: 642). Yet, Tribe (ibid) also ascribes agency to tourism knowledge, albeit limited to its ability to solve business problems. We argue in this paper that this performative aspect of tourism knowledge extends beyond business interests to play a wider role in co-constructing social realities. Especially in cases where the media reports on tourism research, and publics contribute to the

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<https://doi.org/10.1016/j.annals.2020.103061>

Received 3 April 2020; Received in revised form 28 September 2020; Accepted 30 September 2020

Available online 22 October 2020

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shaping of discourse through related online comments and social media, tourism knowledge has the potential to cast shadows across public space that contribute to processes of imagining possible tourism futures. The present paper is centrally concerned with these under-theorised shadows. We therefore introduce the concept of 'shadowcasting' to show how tourism research, associated media reporting and public reactions to it are bound up in future-making, and use a recent paper on autonomous vehicles in tourism as empirical evidence to illustrate our argument.

Autonomous vehicles have received significant attention across academic, industry and media reporting. Initially, this work focused on technical capabilities, developing a consistent message and the construction of largely positive discourse. Over time, however, this morphed to examine the implications of autonomous vehicle development, and emergence, on different systems, industries and sectors. A paper in this journal by [Cohen and Hopkins \(2019\)](#) – *Autonomous vehicles and the future of urban tourism* – provided the first examination of how autonomous vehicles might impact upon tourism. Their work pointed to the enchantments and apprehensions of autonomous vehicles at different scales, questioning how they might affect tourist experiences, use of different transport modes, tourist-host interactions, and tourism employment, as well as considerations of potential spatial changes and implications for the night-time economy.

[Cohen and Hopkins' \(2019\)](#) paper was press released by the University of Surrey (UK) External Communications and Public Relations team upon its publication in November 2018. This press release led to the paper's quick sensationalisation in the global mass media, resulting in 77 English language media headlines alone, ranging from The Washington Post and The Telegraph to The Daily Beast, BroBible and The Inquirer. Coverage by the various media grew when one of the paper's more tentative suggestions, that autonomous vehicles may lead to more (commercial) sex in cars, got comically riffed on the American television talk-show *The Late Show with Stephen Colbert* (13/11/2018).

In this paper, our aim is to provide a detailed analysis of the media reporting and public comments on this reporting associated with the [Cohen and Hopkins \(2019\)](#) paper, and track a genealogy of its emergence, dominant discourses and potential implications. In doing so we shed light on the interface of tourism research and its dissemination within the media, an area of study neglected to date in tourism scholarship. In contrast to our focus on the scholarly communication of tourism research within the media and the shadows this casts on the objects of our research, research on the role of the media in relation to tourism has instead largely centred on the implications of media reporting for destination image and how the tourism sector is represented and framed (e.g. [McLennan et al., 2017](#); [Walters et al., 2016](#)). Such media analyses appropriately employ concepts such as agenda-setting, framing, priming and media sensationalism as theoretical underpinnings. These concepts, which are often subsumed under the umbrella of agenda-setting theory ([Scheufele, 2000](#)), have resonance for the present paper, however it is not our intention here to re-rehearse this theoretical framing, which is long-established and a common vantage point in communication and journalism studies ([McCombs et al., 2014](#)).

Instead, we situate our empirical analysis within scholarship on sociotechnical transitions, which provides an alternative lens for understanding how sociotechnical innovation and hype in particular is expressed through media reporting. This provides a basis for considering how research, media reporting and public reactions to it are bound up in future-making, a post-structuralist methodological innovation which we conceptualise and differentiate in this article as 'shadowcasting'. To achieve our aim, we use a mixed method approach of quantitative text and sentiment analysis combined with qualitative thematic analysis of media reports and public comments on these reports.

Innovation, hype and the role of media

Sociotechnical transitions scholarship provides conceptual tools for examining the emergence and diffusion of innovations – including autonomous vehicles (e.g. [Hopkins & Schwanen, 2018, 2019](#)), and illustrates the different roles media actors (along with a diversity of other actor groups) have in this process. The Multi-Level Perspective ([Geels, 2002](#)) represents a mid-level theory within sustainability transitions research, combining concepts from evolutionary economics, science and technology studies, structuration theory and neoinstitutional theory ([Geels, 2011](#)). It is concerned with sociotechnical systems, and the inextricability of the social and societal from the technical. Specifically, the Multi-Level Perspective focuses on the interactions between three analytical levels – niches, regimes and landscapes – which differ in levels of structuration but which are co-constituted and influence the emergence and potential uptake of novel innovations ([Geels, 2012](#); [Köhler et al., 2019](#)). Theorisation of processes occurring at the *niche* level of innovation focus on degrees of protection (i.e. from the dominant regime), different types of uncertainties (e.g. techno-economic, finance and investment, cognitive, social), and the development of alliances ([Geels et al., 2018](#)). The construction of hype, positive discourse(s) and sociotechnical expectations is often articulated as a central feature of sociotechnical niche development as a way to overcome various uncertainties ([Van Lente et al., 2013](#)) and to allow niches to grow and stabilise.

Multi-scalar media institutions operate largely within the sociotechnical *landscape*, along with, for instance, political ideologies, social values and macro-economic trends ([Geels, 2012](#)), however heterogeneous media actors also play important roles in the growth of niche innovations, and the stabilisation of regimes. Not all media are equal, of course; the reach of different forms of media varies, especially as media ownership has become increasingly compressed to fewer organisations. As part of the sociotechnical landscape, different types of media bear influence on the dynamics of niche development and regime in/stability. Yet the media also has a role to play from within and across niches and regimes. Both regime and niche actors may 'play the media' as one approach (often coupled with others) to instigate change or ensure stability of the dominant regime ([Duineveld et al., 2009](#)). But the media also acts to forward its own interests, with media outlets aligned to particular partisan positionings, and a range of new media (e.g. BuzzFeed) challenge traditional outlets. Sensationalism is often associated with media discourse (e.g. [Ge, 2016](#)), and scientists and reporters can be complicit in the construction of sensational headlines ([Ransohoff & Ransohoff, 2001](#)). There are extensive literatures pointing to the largely problematic use of sex in advertising, marketing and by the mass media. The latter has reflected heightened media attention

paid to gendered representation of sexual relationships, sexual mis/conduct and sex work (Hill & Thomson, 2000). McRobbie (2008) talks of a 'sexualized media' with a 'sexualization of popular culture' (Gill, 2006) used to heighten public awareness and/or attention to particular issues. If 'sex sells', then it can also be used (and abused) to increase focus on particular issues and innovations.

The hype-disappointment cycle differs from traditional producer or outcome/object-oriented approaches in that it focuses on communities of (potential) users and technology adopters, and the performativity of purposeful constructions of hype as part of the innovation cycle by various actors. Media reporting is often used as one way to measure innovation hype. For example, Melton et al. (2016) use New York Times coverage of alternative vehicle fuels as a proxy for societal attention, and associate waves of media attention with changing sociotechnical expectations, characterised by multiple waves of hype and disappointment. Disappointment occurs when public experiences of the innovation do not live up to the promises put forward by innovators and other associated actor groups. This results in complex dynamics whereby innovation actors seek to build excitement while also anchoring expectations to everyday norms and practices, and shifting discourse through the innovation process. Thus, across time, the way niche and regime actors interact with the media will (be) change(d). Where exactly autonomous vehicles appear on the hype cycle is unclear (see, Gartner hype cycle for emerging technologies (2019)), not least due to their different applications (e.g. for freight or passenger transport), and various levels of automation and spaces of implementation (e.g. motorways versus inner-city). It can be reasonably assumed, however, that recent collisions and fatalities associated with automated features have contributed to increased negative media reporting potentially leading to post-peak hype (Gartner, 2019).

Sensationalising innovations to gain media attention is not uncommon. Nor is media sensationalisation to attract readers. This is important as media reporting plays a significant role in generating interest and shaping attitudes towards science (Castell et al., 2015). Additionally, how research is communicated to media outlets is also significant, and this process is often at least partly out of the hands of university researchers, and instead led by a communications unit within the university. In such cases, a level of interpretation occurs, where the media outlets may be responding to the press release, rather than the paper-as-a-whole. Researchers may be understandably displeased, or indeed angered, at misleading claims that can create public confusion and mistrust in research (Yavchitz et al., 2012). Following Jóhannesson et al. (2015), we nevertheless argue that times of controversy may represent the best available occasion to observe and/or potentially contribute to the (re)making of tourism. This is because controversy – like crisis and breakdown – brings to the surface the plurality of social relations, encounters and entanglements emerging within highly situated and relational contexts. This has been shown by Star (1999) and others with relation to infrastructures, which are, by their very nature, rendered invisible, yet become highly visible when something goes – or is made – wrong. Thus, it may be suggested that the selective interpretation and sensationalisation of specific imagined possibilities for autonomous vehicles within the Cohen and Hopkins (2019) article and across diverse media, and the availability of big data to track reactions, offers a unique opportunity to observe the formation of certain practices, attitudes and perceptions emerging alongside and as part of autonomous vehicle innovation.

We position the role of media in this context as a *co-constitutive* element of the sociotechnical transition towards automation, involving a range of actor groups, including, but not limited to, innovators, policymakers, researchers, various publics and university communications teams. With an understanding that the media often makes attention-getting claims when reporting scientific results (Adams et al., 2019), we examine the responses to the article by Cohen and Hopkins (2019) but do so with a methodological orientation which we conceive and delineate as 'shadowcasting'.

The concept of 'shadowcasting'

We define shadowcasting as a methodological orientation aimed at understanding how academic research, its dissemination through the media, and public comments on that media reporting, co-constitute an imagined politics of the future that informs anticipatory action and forms of governance in the present. In this sense, academic research contributes to shadows that are cast across contingent and often contested spheres, whereby research takes on a further agency that co-produces social realities. When shadows are cast they create a presence for the objects they encounter as well as altering our perception of the objects they contact. Presence, in this context, is understood as performances of the disseminated research that 'enact' the speculations they describe (Lash & Urry, 1993). While these enactments may not necessarily lead directly to prescriptions for action they can take on an important role in defining and framing future research and the kinds of interventions that are deemed possible (Shove et al., 2012).

Shadowcasting appreciates that shared public speculation about futures may culminate in different understandings. Cohen et al. (2018) for instance analysed comments made by the public towards media reporting on a study on business travel and found that the research had contributed to the creation of differing public discourses. This suggests that the representation of academic research in the media has the potential to influence sociotechnical systems, including the innovation process. It might do this by offering critical lenses to much-hyped phenomena. While there is a long history of methodological approaches that blur the line between science and media reporting, including research dissemination (Brown, 2012), there is little understanding of how the reporting of academic research affects imaginations of the future and what kind of pathways to impact this may create.

We argue that media reporting and public reactions to it opens a space for inquiry within the growing field of the social science of future-making (Anderson & Adey, 2012; Salazar et al., 2017; Urry, 2016). The social science of future-making is a post-structuralist body of research which argues that the increasing possibilities for re-making everyday life, in part resulting from global mobilities and threats (e.g. climate change, pandemics, terrorism, financial instability), has exposed the social sciences' somewhat inflexible orientation to the re-productive relationship between the past and the present.

In this light, we argue that media agenda-setting theory can be viewed as a structuralist approach (Adams et al., 2014 refer to it as an 'objective theory'), which may not fully elucidate the relational dynamics of research, the media and publics within sociotechnical transitions. Agenda-setting theory argues for a 'cause-and-effect relationship between the power of the press and the public opinion'

(cf. Adams et al., 2014: 2). Such an approach, for example, might situate media reporting as a sub-genre within a stable sociotechnical system, contributing to the progression of linear stages moving from a less efficient to a more efficient and finished innovation. This could diminish the active role publics, and other actors, play in sociotechnical transitions and overlook the wider contexts in which innovations and media are attributed and attributing meaning.

Shadowcasting's closest foundation in studies of media effects seems to lie within McQuail's (2005) notion of a 'constructed reality' paradigm in communications studies, whereby mass media may have 'strong effects on attitudes and information processing but that these effects' are 'contingent on individual level characteristics' (Cacciatore et al., 2016:18). Yet agenda-setting is still largely characterised by predictive power and linearity, wherein the 'media transfers [issue] salience to audiences' (ibid: 11). In contrast to this, and other approaches often used in tourism research such as forecasting (Song & Li, 2008) and backcasting (Ceron & Dubois, 2007), shadowcasting is a critical, post-structuralist approach with its emphasis on how a range of actor groups co-constitute future imaginaries.

We therefore build on Pink et al. (2018) who have also argued in the case of autonomous vehicles that they are emerging from the processual opening-up of possibilities across a range of transport and media systems in the present, which constitute the future as contingent. This approach shifts focus away from deterministic hype, linear stages and passive users, towards how publics create diverse futures by negotiating the possibilities of the present. We thus draw from Anderson and Adey (2012) who argue not for researching the future as an object, but instead to examine how current social relations are constituted by the way in which the future is brought into the present and takes on imagined and affective presence.

Shadowcasting therefore offers tools to analyse media hype on potential futures, including the politics and power relations of sociotechnical transition in the present. For instance, the approach to regime governance of autonomous vehicles thus far often espouses automation as progress, promising to bring a new and better future. Adam and Groves (2007) have argued that discourses on progress have relied heavily on understanding the future as open and indeterminate, which has in turn afforded commodified futures. Depicting the future as open often follows processes of de-contextualising and emptying the future of meaning in order to create a blank slate from which to create rational plans free of obstacles. To date, governance of autonomous vehicles has focused on overcoming a series of technological challenges and safety issues that increases the market potential by improving the efficiency of transport systems (Bissell et al., 2020). The need for efficiency is constructed not in relation to 'citizens', for instance, but 'abstract users' in need of education (Stilgoe, 2018) – this ignores the diverse range of intersecting practices and contexts that may be emotionally rewarding for publics and render efficiency undesirable (Urry, 2016).

Therefore, constructing autonomous vehicles in relation to the future as open contributes to what scholars have described as a prioritisation of expert visions about possible futures (Hopkins & Schwanen, 2018) while diminishing a need to anticipate a wider range of alternative futures through public engagement. Thus, by including public reactions to the media, shadowcasting helps to not only capture and elevate public imaginations of the future but also aides in contrasting diverse sets of relations between the present and future that underpin sociotechnical transitions.

Methods

While shadowcasting is grounded in a post-structuralist ontology and epistemology, this does not preclude the use of a variety of different quantitative and qualitative techniques. Statements that make the future present can be done equally, for instance, through the domain of numbers which are then visualised, practices of imagining or imaginative theatre performances (Anderson, 2010). Unlike research which tracks the hype of sociotechnical innovations over time, the object of our analysis is the one academic publication – Cohen and Hopkins (2019), rather than the innovation per se (i.e. autonomous vehicles).

Our data were collected in a two-step process. The first phase of data collection focused on identifying and collecting the text of all past English language media coverage of the Cohen and Hopkins (2019) scientific article. Beginning in June 2019, the LexisNexis database was searched using a protocol based upon the paper's title, keywords, journal title, and authors' names and affiliations (see Fig. 1). This effort identified 18 original newspaper and magazine articles. It is important to note that most of these original articles were syndicated (e.g. the Associated Press) and, therefore, slight variations of the same article were published in numerous newspaper and magazine outlets. The Google News service and Google Search engine were also queried using the same protocol and an additional 58 website and blog articles commenting on the scientific article were identified. The total number of media coverage texts was 77 (1 press release, 18 newspaper/magazine articles, and 58 website/blog articles).

The second phase of data collection focused on identifying and collecting the text of all English language public response to both the original scientific article and the subsequent media coverage of the scientific article. Each media website which reported on the scientific article was searched for reader comments, which were typically in a discussion forum format. A total of 30 different public

```
(cohen OR surrey OR hopkins OR oxford OR "Annals of Tourism Research") AND
("driverless" OR "autonomous" OR "AV" OR "CAV" OR "self-driving" OR "urban tourism" OR
"connected and autonomous vehicles" OR "imaginings" OR "shared mobility" OR
"autonomous taxi" OR "urban night" OR "AI" OR "artificial intelligence") OR
"Autonomous vehicles and the future of urban tourism"
```

Fig. 1. Initial search protocol based on scientific article.

discussions on media websites were identified. Major social media channels were also searched; three active discussions were found on Twitter, two on Facebook, and twelve public discussions were found on Reddit. Additionally, YouTube was searched and eight videos or vlogs were found, three of which were commented on extensively by the public. In all instances, whenever a new text related to the original scientific article was encountered a web crawling or “snowball” technique was used such that a new search for reader comments appearing on that website and also on major social media channels was conducted. Importantly, to be included in the study, the text had to have a clear connection to the original scientific article, either directly referencing the original article or being part of a discussion in direct response to a text referencing the original article. Finally, for each relevant source, all text-based data (including basic emoticons) were then downloaded for further analysis. Memes and other images were excluded. In total, 3364 public reaction comments were collected across all channels.

Quantitative text analysis

A quantitative analysis of the text-based data was conducted using several open-source natural language processing tools. First, KH-Coder (Angus, 2016) was used for content analysis of the unstructured text and to detect potential themes in both the media coverage and subsequent public response to the scientific article. Using KH-Coder, all text was first pre-processed in order to eliminate stop words (e.g., ‘a’, ‘an’ and ‘the’), extract the root form of words (i.e., lemmatisation), and determine the part-of-speech (i.e., noun, verb, adjective) of each word. Texts were analysed according to category (original article, press release, media coverage, public response) and top frequency words for each grouping were identified (Table 1). Word co-occurrence networks based on the top frequency words were then created in order to further understand patterns in the ways people communicated their opinions and reactions to the original scientific article. Word co-occurrence networks are a well-established and commonly employed content analysis technique (e.g., Danowski, 1993; Osgood, 1959) used to describe the association between words in a text. KH-Coder follows the technique developed by Fruchterman and Reingold (1991) to draw networks (See Figs. 3–5). For each word co-occurrence network created with KH-Coder, the size of the nodes indicates word frequency, the thickness of lines (edges) connecting nodes indicates the strength of the connection between word pairs, and colour of nodes indicates the different communities or themes within the text of the responses that were identified using the random walk method (Pons & Latapy, 2005). For this study, the level of analysis was paragraph rather than sentence, as paragraphs represent a natural segmentation structure for texts and provide for more holistic topic contextualisation (Bourgeois et al., 2015). Three categories of text (original article, media coverage and public reaction) were analysed separately by pooling all texts within each group. The original article included 130 paragraphs, while there were 1065 combined paragraphs of media coverage, and 3364 public comments (with each separate comment considered a paragraph for analysis purposes, regardless of comment length).

Next, we used the SentiStrength program (Thelwall et al., 2010) to classify the sentiment for each set of text collected. SentiStrength was developed using words found on the MySpace social network, making this program particularly suitable for rating the short and informal text captured in social media. Importantly, SentiStrength can detect sarcasm and interpret basic emoticons. A separate score for positive (1 = weak, 5 = strong) and negative sentiment (−1 = weak, −5 = strong) was derived for each paragraph of text, and then the average sentiment was calculated for each text source. A net sentiment score was also calculated as the difference between positive and negative sentiment scores. The distributions of overall positive, negative, and net sentiment scores for each text source are reported in Figs. 6–8, with each text source further categorised by type (media coverage, newspaper/blog comments, Reddit comments, Twitter comments, YouTube/Facebook comments).

Qualitative thematic analysis

For the qualitative analysis we conducted a theoretically informed thematic analysis (Braun & Clarke, 2006). This method was selected as being appropriate as it has been argued to be a useful method for large qualitative data sets and more specifically datasets from multiple and varying sources (Terry et al., 2017). While discourse analysis was also considered, it was decided that as the aims of the qualitative analysis was to enrich the quantitative analysis, discourse analysis would not be appropriate given its in-depth focus on specifics, rather than providing the analysis with an account of the overarching themes present in the data set (Potter & Wetherell,

Table 1
Keyword frequency.

Original scientific article		Press release		Media headlines (n = 77)		Pooled comments (n = 3364 paragraphs)	
Words	Freq	Words	Freq	Words	Freq	Words	Freq
CAV	176	AV	14	Car	67	Car	895
Urban	168	Tourism	11	Sex	44	People	434
Tourism	119	Urban	10	Self-driving	37	Sex	428
City	57	Car	5	vehicle	23	Just	304
Vehicle	48	Be	4	Study	21	Drive	277
Tourist	46	Impact	4	Brothel	18	Make	205
Mobility	43	University	4	Driver-less	17	Think	190
Research	36	Vehicle	4	Autonomous	16	Thing	180
Travel	35	Autonomous	3	Say	16	Time	178
Space	34	Become	3	Lead	14	Say	175

1987).

To conduct the thematic analysis we followed the six steps (1. familiarising yourself with the data; 2. generating initial codes; 3. searching for themes; 4. reviewing themes; 5. defining and naming themes; 6. producing the report) suggested by Braun and Clarke (2006). For example, after reading and re-reading the corpus of data several times, a line-by-line analysis was undertaken on printed versions of the data with initial codes (e.g. reference to sex, reference to driverless car) noted in the margins and highlighted in the text. Following this, the data and codes were re-read to establish if there were overarching themes (e.g. constructions of sex workers) that could be used to cluster and organise the individual codes. The themes were then reviewed to examine if there were any that needed to be incorporated together, or split apart. In what follows, we present the key findings from our analysis; this presentation incorporates the quantitative and qualitative findings to provide a rich and triangulated account of our qualitative and quantitative data (Olsen, 2004).

Findings

Media coverage and keyword frequency

The original scientific article was available online on November 1st, 2018, with an initial press release on November 6th. Six days later there was a spike in coverage on websites, blogs, video and television, highlighting the ways in which communication of the scientific article manifested through different mediums at different points in time (Fig. 2).

Our analysis points to the way that sex is operationalised by the media to generate interest and hype. 'Sex' does not appear on the word frequency list for the original scientific article but is the second most frequently used word in the media headlines with 44 references in just 77 headlines (Table 1). While 'sex' therefore appears in 57% of the media headlines and has 428 mentions in the reader comments, the original article only mentions 'sex' briefly (three occurrences in one paragraph), and once in a quote provided for the press release of 472 words. Indeed, it was not just the media headlines that drew on 'sex' to capture the attention of readers, it was also central to the narratives of the media reporting, despite this reporting being based on a scientific article that only mentioned 'sex'

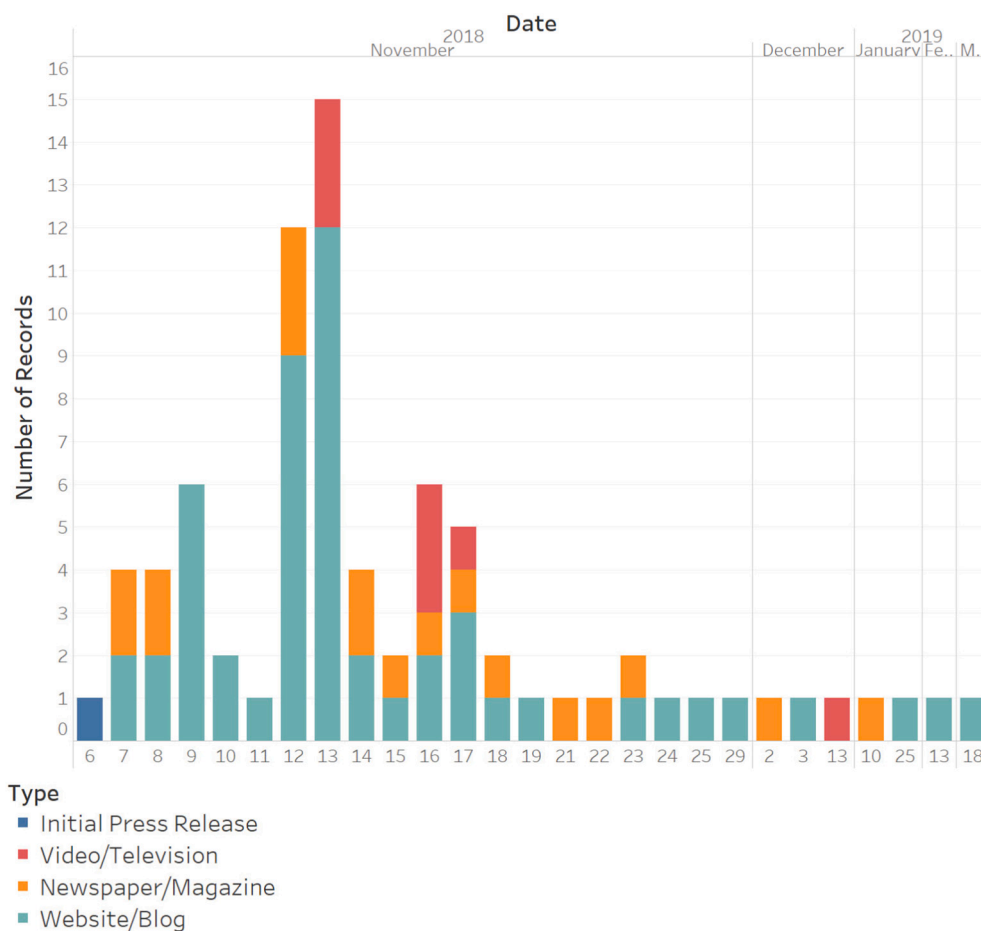


Fig. 2. Media coverage timeline: November 2018 – March 2019.

momentarily. As the following extracts from media articles highlight:

Nearly 60% of all Americans have had sex in cars. Just wait until the cars can drive themselves. ([Fastcompany.com](#))

On its 13th page, a forthcoming paper in the journal *Annals of Tourism Research* makes a bold prophecy: People are going to have sex in driverless cars—and probably sell it, too. ([QZ.com](#))

Self-driving vehicles will encourage people to have sex in cars and could lead to Amsterdam-style “red light districts on wheels,” according to a new study.

(Huffington Post)

Reference to the ‘red light district’ in the final quotation was also noted in the word search with the noun ‘brothel’ featuring in 18 (23%) of the headlines, despite not featuring in the top word frequency list for the original article. Indeed, the original article did not use the word ‘brothel’ at all. In addition to the word ‘brothel’, the sex industry and sex workers were central to the media narratives constructed in relation to the original research on autonomous vehicles and the impacts these might have on urban tourism. What is important here is that sex was minimally presented as an act of love, rather it was presented as something negatively experienced through sex work, thus drawing on a well-established media tactic of creating a moral panic ([Burns & Crawford, 1999](#)). Further, the use of the statement ‘a bold prophecy’ presents a reality in which the future (sex in driverless cars) is presented with certainty, yet its effects remain uncertain. Such construction of a sexualised but uncertain and panic-ridden future offers an attempt to draw in readers and constructs the future as an effect of market-oriented attempts at increasing media impact. It is this ‘clickbait’ ([Blom & Hansen, 2015](#)) that developed as a central theme in the data obtained from the online media articles:

Brothels could move into self-driving cars, British academics predict. (The Telegraph)

Driverless cars may have a bigger impact than first imagined, as a new study claims that pay-by-the-hour hotels and brothels will be replaced by connected and autonomous vehicles. (The Sun)

Self driving cars could become ‘mobile brothels’ that drive to the houses of clients, replacing traditional ‘hotels-by-the-hour’. (The Daily Mail)

But if you scroll past all the boring stuff, you’ll find a section on how autonomous vehicles are poised to impact both sex work and sex in general. ([Gizmodo.com](#))

Sex workers could soon trade in the pay-by-the-hour motel room for the backseat of an autonomous vehicle (AV)—like a naughty version of Uber or Lyft. ([Futurism.com](#))

This is in line with the notion that ‘sex sells’ ([Blair et al., 2006](#)) and that the communication of science is not as factual as the public might be led to believe (c.f. [Mehrer, 2015](#)). Indeed, the focus on urban tourism, tourists, mobility and travel do not feature in the top ten words used in the media headlines despite constituting the focus of the original scientific article, in which sex was only a passing reference. However, there were instances in which media articles did make a clearer attempt to report a balanced reading of the scientific article, though it was also apparent that such examples were from sources outside of mainstream journalism. As the following highlights:

The study by academics from the University of Surrey and the University of Oxford suggests that connected, autonomous vehicles (CAVs) could potentially create new tourism experiences and create a range of benefits, but could also add to congestion and cause job losses. (Article, [ITP.net](#))

Here the future is once again, albeit more explicitly, presented with varying levels of certainty and uncertainty ([Anderson, 2010](#)). Certainty in the sense that two possible ‘futures’ are presented, uncertainty in the sense that these are ‘potentials’ and ‘could[s]’, reflecting that a diverse range of future possibilities beyond those that are regime hyped do resonate with the media.

Finally, there was one example in which an open reflection on the sensationalising of sex was reflected in the article’s narrative:

Actually, the only startling thing about this study — at least for a paid cynic like Yours Truly — is that it’s hard to believe such titillating predictions are making headlines. Humans started having sex in cars pretty much right after the automobile was invented. The only difference is that now, thanks to the wonders of connected, self-driving software, you don’t have to be parked and you don’t have to climb into the back seat. As for transactional connubial relations being conducted in four-wheel vehicles, I’m pretty sure that’s not a recent invention. (Toyota Auto News)

This informant depicts the future as containing both elements of the present and changes that will likely improve on the present. This suggests the future will not be fundamentally different but contain re-configured aspects of the present and thus perhaps eliminates any need for concern. Hype, therefore, as controversy, alters seemingly stable social dynamics by exposing competing interests that frame diverging expectations for autonomous vehicles in relation to everyday practices and produces the future as heterogeneous effects ([Jóhannesson et al., 2015](#)).

Word co-occurrence network

The word co-occurrence network for the original scientific article is visually represented as Fig. 3 and reveals several patterns in the text. First, the size of the circles indicate that the most frequently occurring words are 'urban', 'tourism', and 'CAV' (connected and autonomous vehicle) which of course encapsulate the topic of the article. Interestingly, the network analysis reveals that there are a total of eight distinct subgraphs or 'themes' of associated words. These 'themes' might represent a commonly occurring phrase, such as 'autonomous vehicle' and 'night-time economy'. Another theme coincides with the methods sections of the article where words such as 'study', 'approach', 'imagining' and 'analysis' frequently occur in the same paragraphs. It is also interesting to observe that there are relatively few connections between words in different 'themes'.

Examination of the word co-occurrence network for the media coverage (including the press release) shown as Fig. 4 instantly reveals a dramatically different text structure compared to the original article. It is clear that there are several 'themes' communicated by the media, such as the article's authors and their affiliations, and where the original article was published. Similar to the text of the scientific article, the phrase 'autonomous vehicle' is frequently observed. However, there are three clear themes related to activities that dramatically expand upon the 'night-time economy' theme of the scientific article. 'Drug', 'surveillance', and 'passenger' form the core of one theme, while 'prostitution', 'legal', 'illegal', and 'red' 'light' 'district' indicate other topics emphasised in the media's coverage. Just as interesting as the themes observed, are the themes not observed. The original scientific article's themes of 'tourist' 'travel' 'public' 'transport' and 'industry' 'implication' 'potential' 'opportunity' are not reflected at all in the media's coverage.

Finally, Fig. 5 depicts the word co-occurrence network of the public's response to the media's coverage of the scientific article. While the common theme of 'autonomous vehicle' is again observed in this network, the overall structure of this network is significantly different from those of the original article and the media's coverage. A total of 11 different 'themes' emerge. Frequently occurring phrases, such as 'day' 'old', 'read' the 'article', and 'water' is 'wet' are identified within the public's response. The most frequently used words are now 'car', 'sex', and 'people' which form the core of a major theme consistent with the media's coverage. It is

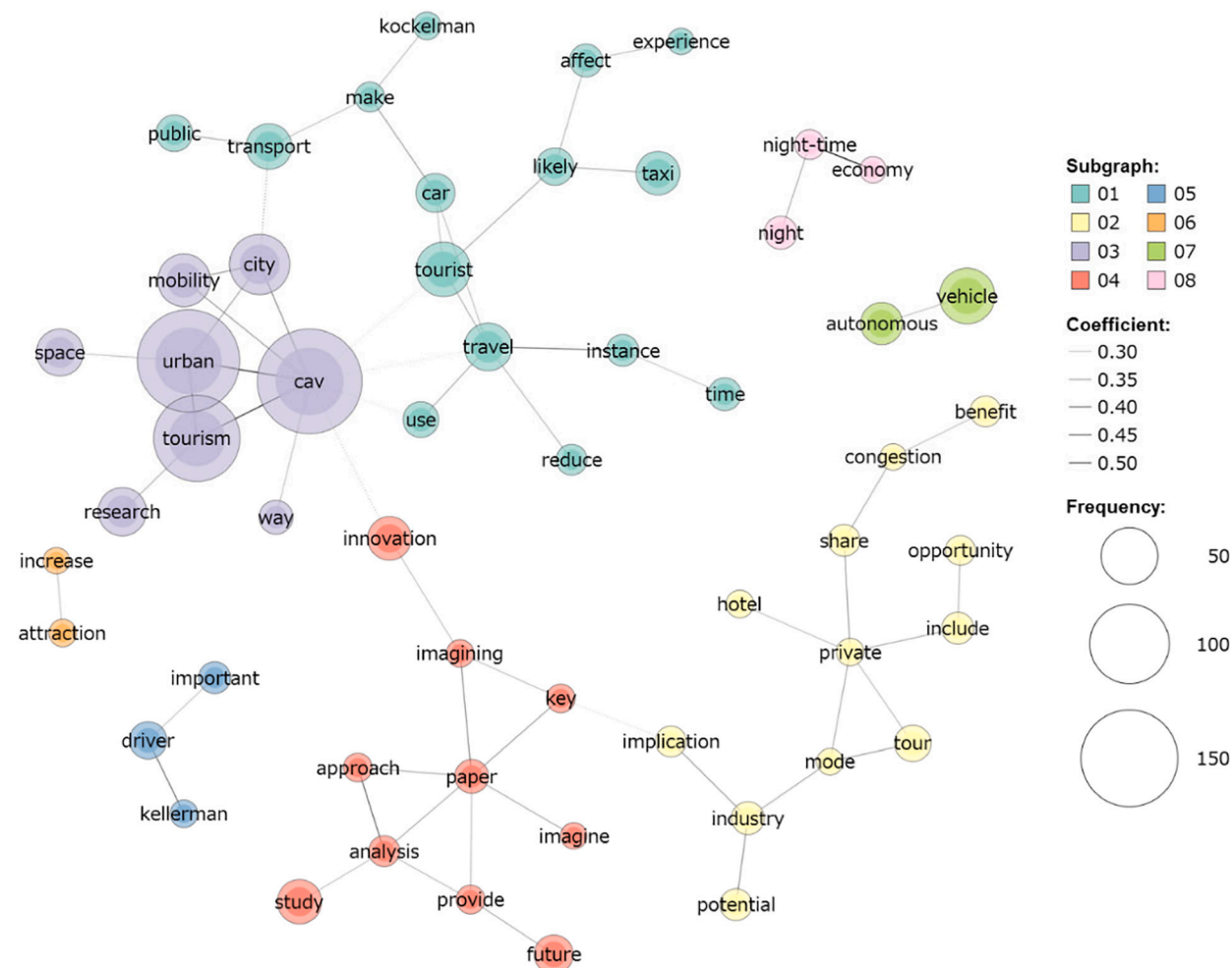


Fig. 3. Word co-occurrence network of the original scientific article: ($n = 130$ paragraphs).

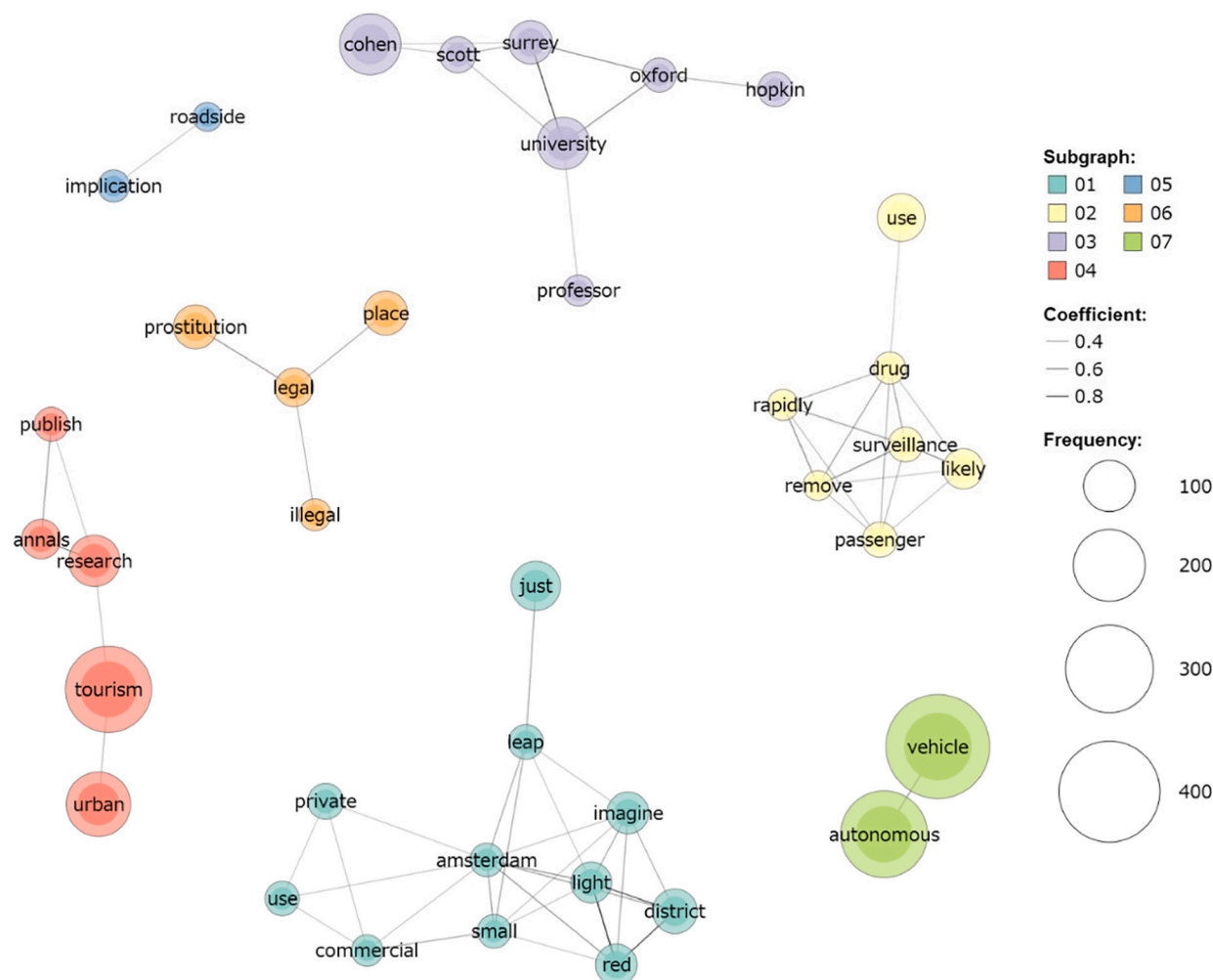


Fig. 4. Word co-occurrence network of pooled media coverage ($n = 1065$ paragraphs).

also interesting to see other themes emerge such as 'Uber' 'service', 'human' 'driver' 'accidents', 'man' 'woman' 'robot', and 'technology' 'improvement'. It is clear that the article and its subsequent media coverage have captured the public's interest and imagination and inspired a wide variety of discussions.

Sentiment analysis

The blue bars depicted in Fig. 6 show that the media coverage of the original scientific article reproduces its content in a more negative than positive light. Further, it is clear from the sentiment analysis that all other sources of coverage (e.g. comments on the media articles) are positioned on the more positive side of the neutral 0.0. This overall trend shall now be unpacked in more detail in terms of positive and negative sentiment.

Across the corpus of data, newspaper/blog and social media comments were generally more positive than media coverage (Fig. 7). Although we highlighted earlier that sensationalism and moral panic are specific strategies the mainstream media often adopt to increase readership, there were examples where media article coverage was positive. As the following examples highlight:

Potential benefits include reduced traffic congestion and emissions, improved foreign car hire processes, reduced parking requirements and cheaper taxi fares. (ScienceDaily)

In your comfortable, safe, mobile room-on-wheels, you will be able to eat, drink, sleep, work, work out, watch a football game, stream a movie and have sex. (Miami Herald)

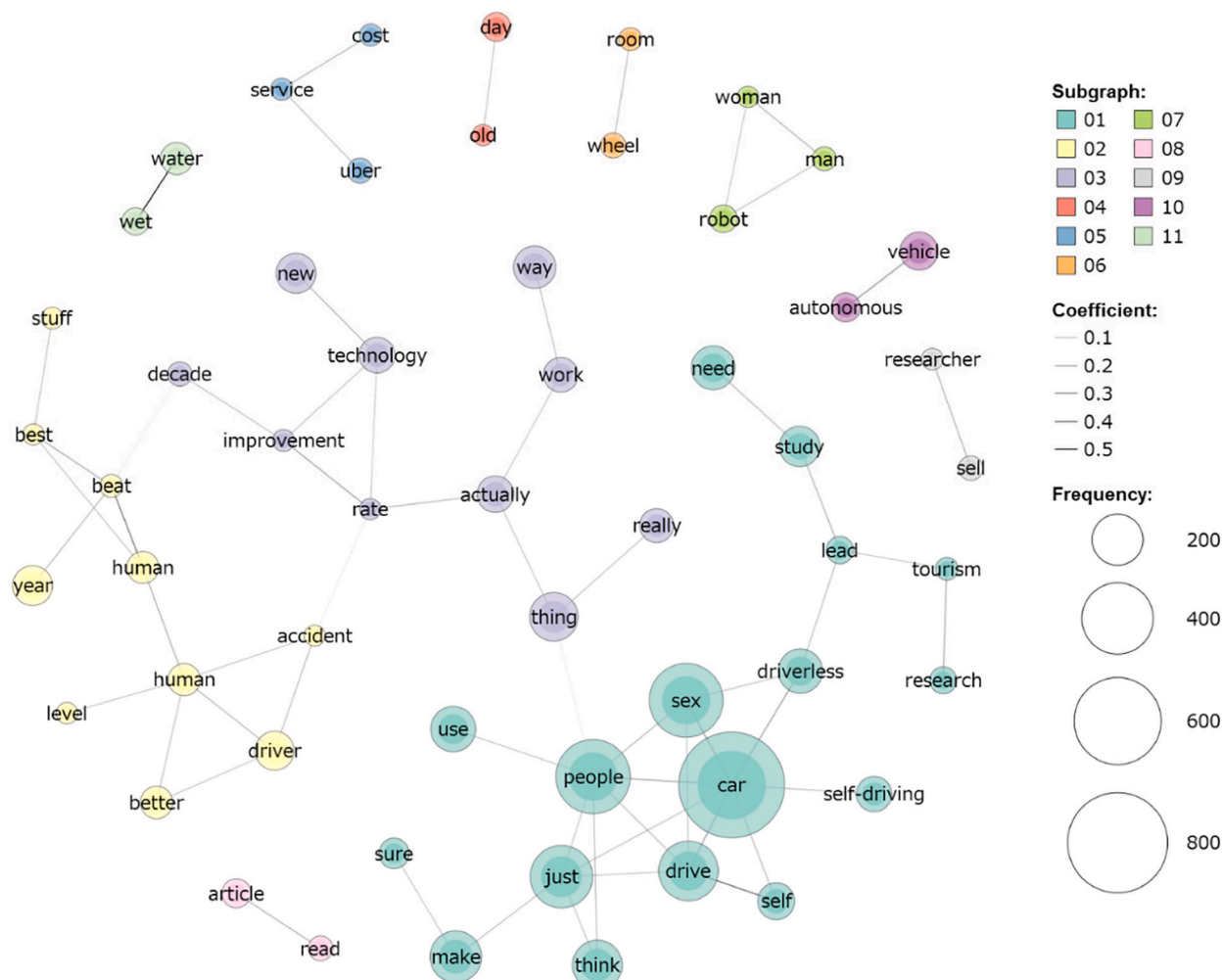


Fig. 5. Word co-occurrence network of pooled comments ($n = 3364$ paragraphs).

I suppose it was only a matter of time before someone took this crucially important question up. And thank god they did, because we can now say with increasing certainty what you were already hoping in your heart of hearts would be the case: autonomous driving will likely usher in a golden age of boning in cars. ([Inverse.com](#))

Throughout the above extracts, positive sentiment flows through the accounts in terms of possible future futures including improved efficiency, comfort, and the opportunity to engage in sexual activities while driving evoked in regime hype. In addition, the possible futures include a wide range of leisure practices that offer opportunities for self-fashioning and consumption both of which resonate well with the public ([Adam & Groves, 2007](#)).

While the above highlights some of the occurrences whereby autonomous vehicles were understood and represented in a positive light, as the sentiment analysis shows, the positivity surrounding them was largely led by those commenting on the media articles and videos. As the following user comments highlight, the suggestion of possibly having sexual intercourse in driverless cars was well received by the public imagination:

Would make my commute a hell of a lot more enjoyable! ([QZ.com](#))

I change my mind. I want a driverless car. (Twitter)

Now that you know how awesome car sex is, we are getting one! 😊 (YouTube Video)

Wait, wasn't this the whole point of automation in general? The machines do the work for us, so we can focus on screwing? ([Gizmodo.com](#))

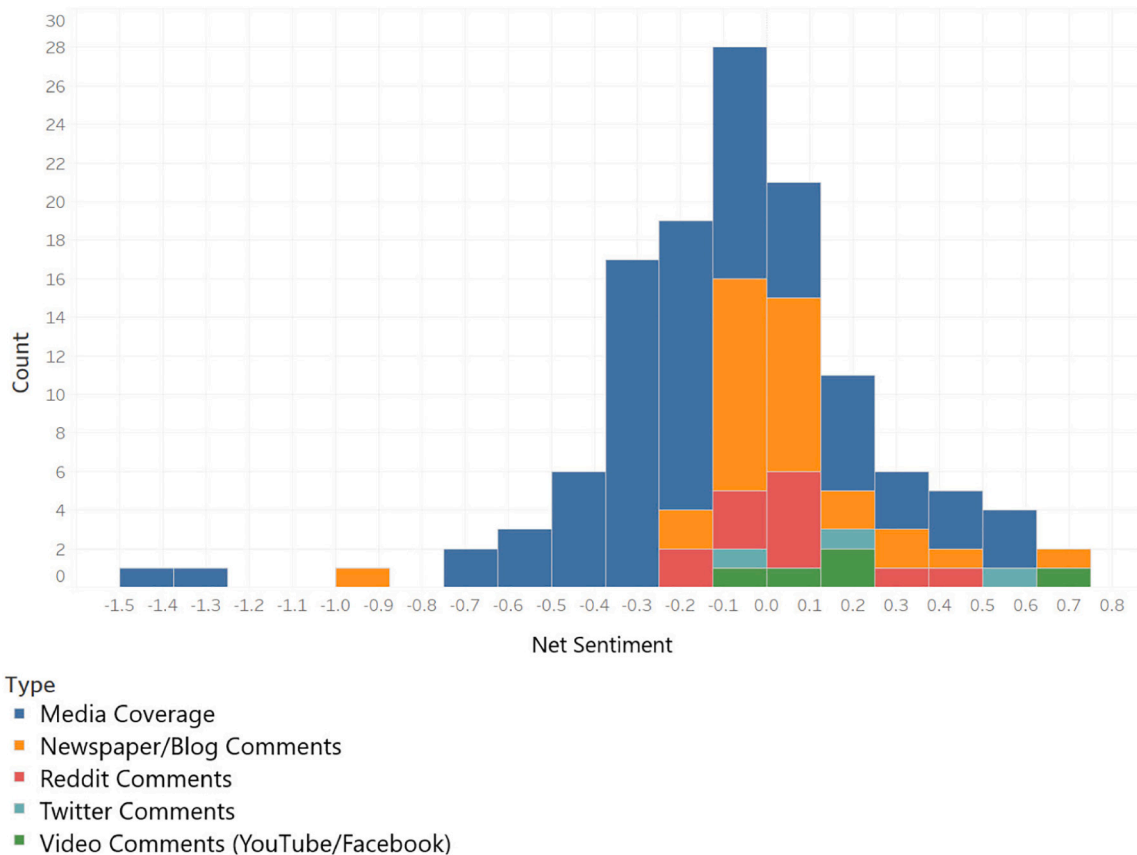


Fig. 6. Net sentiment.

If only we'd had these in high school. ([RT.com](#))

Inherent throughout the above is how autonomous vehicles are made meaningful by imagining them as juxtaposed between daily practices (i.e. commuting) and sexualised acts. This functions to reinforce an imagination that the future will be different and better and thus helps position autonomous vehicles as potentially desirable.

However, it was not just possible sexual benefits that captured the public's positive imagination, but also the broader potential travel and tourism advantages, despite these often being ignored in the media coverage. As the following Reddit reader comments:

This has been my life goal since I found out self-driving RVs could be a thing. Imagine gassing up, going to sleep, and waking up parked in an entirely new and different place. I would travel every single night.

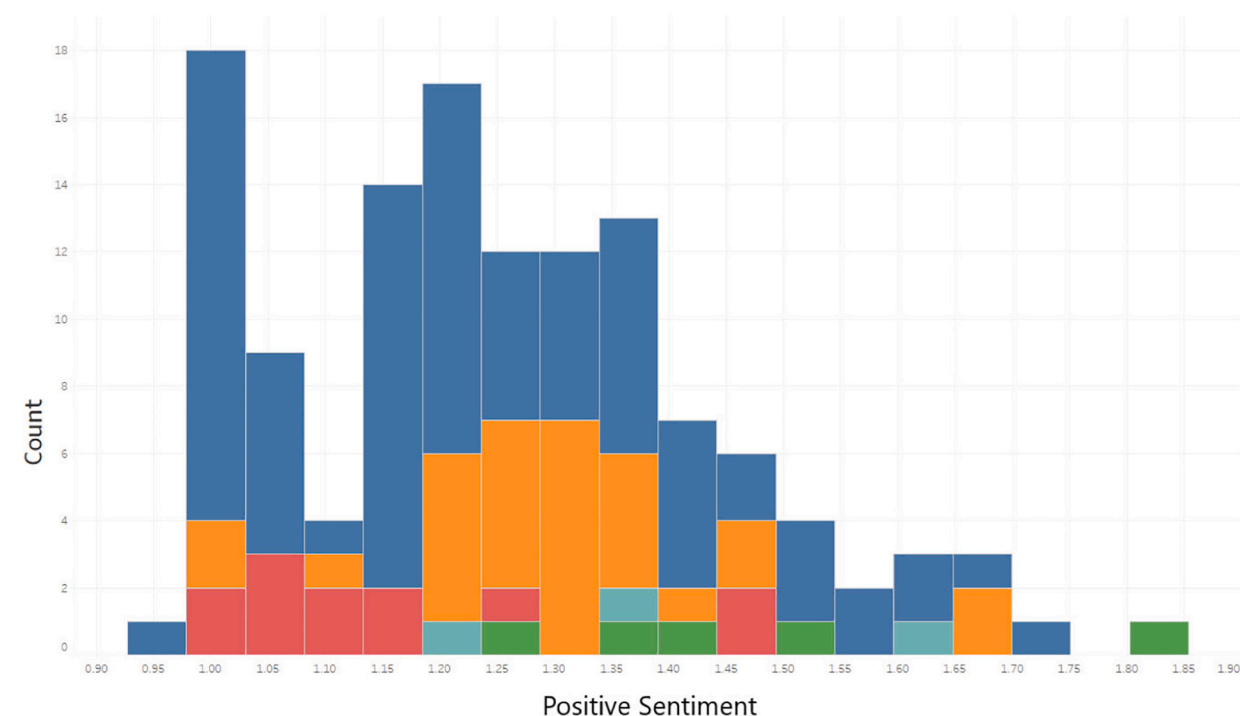
Here autonomous vehicles are constructed in the future as an innovation that will be radically different and better and not, for instance, a development that would suggest simply a new stage in the evolution of the car (i.e. incremental innovation).

There was a considerable amount of negative sentiment throughout the data (Fig. 8). While this was more prominent in the media coverage, it featured across the different data mediums. Although there were some examples of the negative impacts of autonomous vehicles on urban tourism raised in the original scientific article, negative sentiment predominately functioned through the following themes: negative constructions of sex work, potential for terrorism and an anti-academic position.

Negative constructions of sex work

Prostitution, brothels, pornography and the sex trade more generally have been socially constructed in a negative light across societies throughout modern history. However, this understanding of sexual acts as negative has not always been the dominant construction with various sexual relationships and acts understood positively in antiquity (Foucault, 1992). Prominent in the data was the construction that sex in driverless vehicles per se was not the issue, but rather it was the construction of sex *work* that enabled the negative connotations of prostitution as an illegitimate form of employment. As the following media articles and user comment highlight:

A new study claims that driverless cars will lead to a higher rate of prostitution.



Type

- Media Coverage
- Newspaper/Blog Comments
- Reddit Comments
- Twitter Comments
- Video Comments (YouTube/Facebook)

Fig. 7. Positive sentiment.

The rise of driverless cars is expected to displace workers, slash cab fares and give people a new place to have sex. Possibly for money. ([Thespec.com](#))

Still in their infancy, self-driving cars are expected to flood roads in less than a decade. And when they do, luxurious cabs (featuring room enough for bedding, perhaps a massage chair) will chase out traditional taxis, with their glass partition and sticky seats. Enter brothels on wheels. ([geek.com](#))

Then the self driving car crashes killing you and the hooker your balls deep in. (Facebook)

In these statements the public positions autonomous vehicles as creating a future that will bring a series of disruptive threats that while uncertain to materialise will certainly offer a different future from the current present. While sex in cars is familiar and there are brothels in the present, the mobilisation of sex work represents a new kind of threat to social life.

Potential for terrorism

Of the negative sentiment expressed in relation to autonomous vehicles was the potential that a driverless car might offer to possible acts of terrorism. As with sex work, this potential issue was only mentioned briefly in the original scientific article but appeared to capture the imagination of the media articles and also some of the comments in response to these, along with comments on social media:

They will also increase terrorism, once Muslims get their hands on them. Fill the boot with explosives, set the GPS to Westminster then retreat to the local mosque to await the newflash

(User comment, Yahoo News)

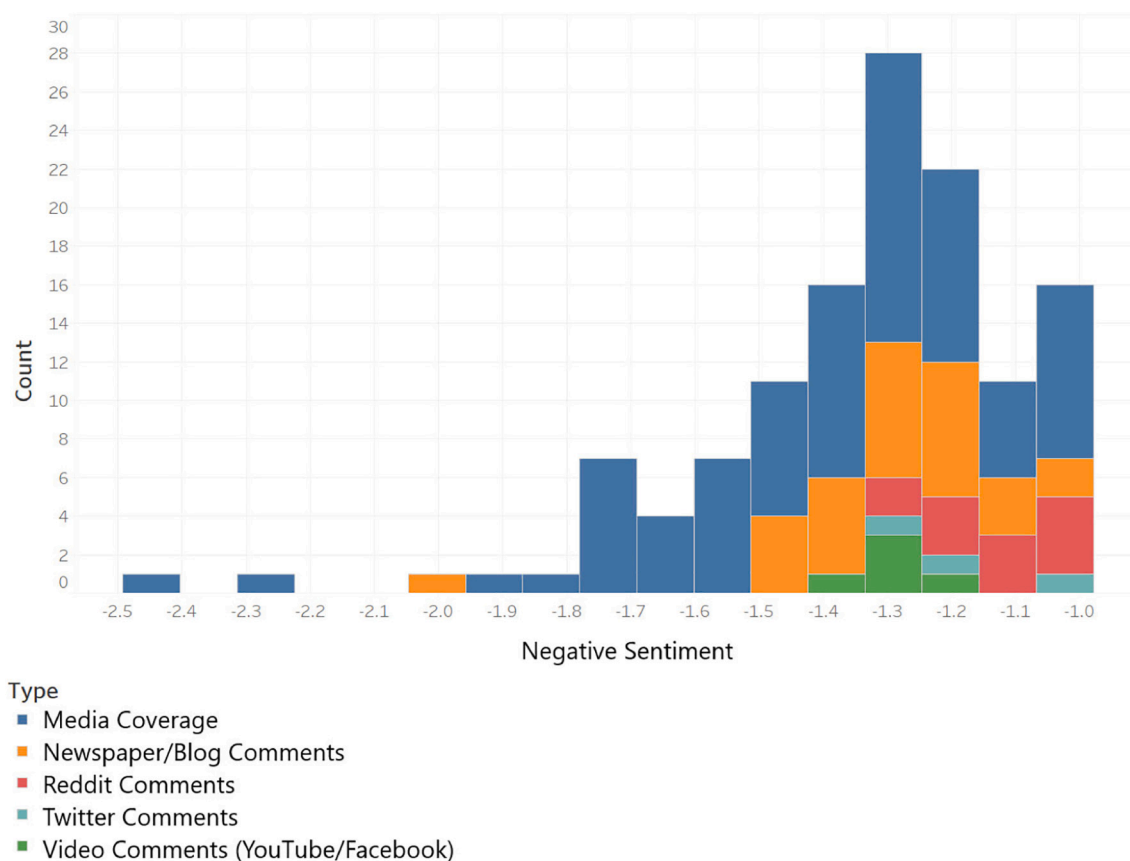


Fig. 8. Negative sentiment.

They also pose a major security risk if terrorists choose to plough unoccupied vehicles into crowded urban areas, a new report has warned

(Article, The Daily Mail)

In a similar light to the negative future presented through sex work above, here the potential for terrorism, when compared to positive sentiments above, suggests the future can be understood through a different set of interdependencies, in this case terrorism and tourism. Such an imagined future both threatens and offers opportunities for liberal democracies. In addition, through reference to 'Muslims', 'mosque[s]', 'Westminster' and 'terrorists' there is also an element of Othering here that links the imagined future of autonomous vehicles to security regimes in the present, including racist tropes and Islamophobia.

Anti-academia

As is often the case when analysing comments made by the public towards research conducted by academics (e.g. Cohen et al., 2018) there was a strong anti-academic rhetoric throughout the data. Such negativity has been argued to function as a strategy for denial within the broader context of 'fake news' and recent high profile political discrediting of the value of academic research in relation to climate change (e.g. De Pryck & Gemenne, 2017). As the following comments highlight:

I remember being a child in the seventies stuck on a coach in Blackpool for the lights. So I don't believe these academics have been thorough in their research. i.e. they are thick. The methodology is described as an "imaginings" approach whereby the authors "imagine" things. I am not making this up. But I am one of many paying for these clowns.

(User comment, The Telegraph)

This is literally the stupidest thing I've ever seen! Who even thought of this dum [sic] shit (Facebook)

That tells me all I need to know about this "research." Once you start "imagining," all scientific meaning goes out the window. Just because some sexually frustrated academics can't get their minds out of the gutter and choose to project their own thoughts and desires on to the rest of the population, it doesn't make them prophets. (User comment, The Washington Post)

This final extract can be understood through notions of shadowcasting in that the individual commenting is actively attempting to cast doubt on the 'research' presented through the questioning of its 'scientific meaning'. Here the public is not the passive recipient of knowledge but is engaging in the uncertain and contested landscape of the emergence of autonomous vehicles to suggest that the 'sexually frustrated academics...choose to project their own thoughts and desires' as opposed to engaging in what might have constituted a traditionally 'scientific' endeavour.

While anti-academic rhetoric is disconcerting, the findings cast shadows back onto the original paper that enriches understanding beyond framing the future for publics. A media agenda-setting approach to sensationalisation, for instance, would offer a binary nuance to regime narratives of certainty and technological progress by demonstrating that autonomous vehicles may bring some uncertain negative moral consequences like prostitution. This suggests that certainty is valued in innovation while uncertainty is negative and to be avoided through governance, and perhaps research needs to expand beyond technical progress to look at the actual potential for moral regressions to reassure the public.

Instead, by analysing the future as a de-naturalised category from which diverse actors construct their own meaning and often paradoxical associations with practices in everyday life, shadowcasting demonstrates how uncertain futures are understood as both a source of creativity for new forms of consumption and a threat. In constructing the future as a disruption, publics imagine innovation happening in relation to a multiplicity of emerging, interdependent connections and unforeseeable events like terrorist attacks, but also for example, the current Covid-19 pandemic. Thus, by questioning media and academic discourse, publics can contribute to the research process by pointing to new anticipatory questions, in this case, how can innovation be open to and create the possibility for sex in cars, and new tourism experiences, while preventing prostitution and terrorism without diminishing either? In addition, because the future is imagined as different from the past, shadowcasting reveals that researchers may not wish to rely on analysing the past to know the future of autonomous vehicles but will require a constant readiness to identify other possible ways in which significantly different futures are emerging in relation to new events (Anderson, 2010).

Conclusion

This paper contributed an understanding of the nexus between tourism research and its media dissemination that has been lacking in tourism scholarship. Moving away from the dominant focus on the implications of media reporting for destination image and how the tourism sector is framed, we instead revealed how tourism research itself can be bound up in the act of future-making through media reporting. To do so, we developed the concept of shadowcasting, a post-structuralist methodological orientation that shows how academic research dissemination through the media, and public comments on that media reporting, are co-constitutive actors in processes of imagining possible futures. This is akin to how when shadows are cast upon objects, they create a sense of presence on the objects they encounter, as well as altering our perception of the objects as they contact them, while simultaneously making other ideas less apparent.

In this paper, we empirically demonstrated the multiple ways that media reporting, and public comments on this reporting – of one specific academic paper on autonomous vehicles and tourism – emerged and diverged from the original paper. In doing so, we revealed the ways that media reporting, in its various manifestations, might contribute to the construction and perpetuation of hype and/or disappointment, underpinned by various logics and discourses. The media, various publics, scientific research, and university communication teams thus become key actors in the innovation process, offering layers of interpretation and frames of potential futures which connect between the niche, existing regime and landscape, across a variety of temporal and spatial scales. We showed how sensationalist discourse is operationalised (in this context related to sex work), with the potential to affect heterogeneous expectations of what autonomous vehicles might do – and what futures they might be bound up within. The role of the media within sociotechnical transitions is complex, occurring across the three levels of the multi-level perspective (Geels, 2002). Future research could productively examine the dynamics of these interactions across the niche, regime and landscape levels. The media in this sense communicates multiple versions of scientific research, which may support or reject transition processes across the niche, regime and landscape. Our analysis however did not consider the extent to which these are embedded within particular geographical contexts, a vantage point which may be taken in future studies.

Our findings demonstrated that far from being linear and predictive, the potential impacts of autonomous vehicles on urban tourism that captured media reporting and the public's imagination instead related to possibilities and anxieties linked to interdependent flows implicit to the complexity of globalisation, such as sex as leisure and illegal work and terrorism and tourism. This suggests that the media and publics (as reported through the media reporting comments) anticipate autonomous vehicles not necessarily through a lens of inevitability and desire for transport efficiency, but uncertainties that construct good and bad circulations whose effects potentially advance but also impede neoliberal economic life (Anderson, 2010).

This paper also helped to elucidate how somewhat minor aspects of academic research – in this case sex and sex work – can be magnified through media reporting. This is perhaps more relevant for topics and themes that are apt to sensationalisation. Having sex in cars has long been associated with the car's capacity to engender a sense of freedom and emotional expressivity as a mobile yet private space (Featherstone et al., 2005), and these sentiments are repeated with reference to the emergence of autonomous vehicles. It thus came with little surprise that shortly after the media reporting on Cohen and Hopkins' (2019) paper, motor companies began to leverage upon ideas of intimacy in autonomous vehicles. In late November 2019, Tesla Motors introduced a 'Romance Mode' to their vehicles, shortly before their aspirational timeline to become fully self-driving. As Elon Musk tweeted: "After safety, our goal is to make a Tesla the most fun you could possibly have in a car" (Lucchessi, 2018, n.p.). Inverse magazine (29/11/18) reported on a possible link between Tesla's 'Romance Mode' and the original academic research:

The joke about the physical act of love in self-driving cars was the subject of actual academic research earlier this year: A paper in the journal *Annals of Tourism Research*...examined just how urban tourism, a hallmark of which is prostitution, would be changed by the self-driving car.

While we cannot be certain of the link between the research dissemination and the emergence of 'Romance Mode', this anecdote illustrates the difficulty of evidencing the non-academic impact of research, wherein public engagement more often than not does not lead to linear impacts. Rather shadows are cast that co-constitute an imagined politics of the future, which informs anticipatory action and forms of governance in the present.

This brings us back to the original question this paper's title posed: Self-driving sex cars? Yes, indeed.

Our analysis in this paper has been limited to one particular case, an innovation still in development that may disrupt social life in the future. However, there are general dimensions from our case study that indicate other tourism research contexts prone to sensationalisation. These will include not just studies that disrupt dominant regimes or envision radical innovations, but also ones that threaten societal perceptions of tourism as a remedy for the ills of late-modern capitalism. Globalisation heightened the promise that tourism can be a remedy to social issues. To this end, we anticipate future studies that threaten the relationship between tourism and society, articulate key tensions in late-modern life and/or cast light on disruptive futures, will cast particularly strong shadows. This may include for instance studies of last-chance tourism, overtourism, flight shame, technological tourism unemployment and the darker sides of social media and technology use in tourist behaviour.

Tourism research in at least these areas may be vulnerable to shadowcasting, even without actively reaching out to the media. In contrast, researchers can pro-actively leverage shadowcasting through press releases and media engagement, which is a positive prospect for empowering more impactful research. However, as other actors can cherry-pick, hype and distort findings, as shadowcasting is a co-constitutive process, tourism researchers are advised to proceed with caution.

Declaration of competing interest

None.

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