‘Show me the Goods’: Assessing the Effectiveness of Transparent Packaging vs. Product Imagery on Product Evaluation

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Abstract

Transparency in product packaging is appearing more frequently in the food/drink marketplace. That said, relatively little is known about the impact of seeing the food/drink within (as compared to more traditional opaque packaging designs) on product perception or consumer purchase intentions. The research reported here was specifically designed to address this important issue. Participants in an online experiment provided product evaluations of food packaging designs shown visually, as well as rated their willingness to purchase the product, across four product categories. This experiment compared packaging designs with: a transparent window, an image of the product on opaque packaging, or plain opaque packaging. Efforts were made to maximise ecological validity using 'mock-up' brands (that do not exist in real life) in order to avoid familiarity effects or bias from prior experience. The results highlighted the fact that transparent packaging increased willingness to purchase, expected freshness, and expected quality, as compared to packaging that used food imagery instead. In addition, people expected the products to be tastier, to be more innovative, and were more liked overall in several of the product categories that were assessed. Mediation analyses suggested that transparent windows on product packaging can lead to increased willingness to purchase through a variety of means differing by product category. The implications of this research for brand managers, marketers, and public health researchers are discussed.

Keywords: Packaging; Packaging design; Transparent packaging; Willingness to purchase; Food aesthetics.

1. Introduction

Over the past three decades, a growing body of empirical research has highlighted how food/drink packaging can inform, tempt, and bias the consumer, both at the point of sale, as well as during consumption (see Hine, 1995; Ordabayeva & Chandon, 2015; Spence, 2012, 2016; Vilnai-Yavetz & Koren, 2013, for reviews). Indeed, ongoing investigations suggest that even relatively minor adjustments to the visual design of the packaging – such as to the shapes, orientations, and positions of design elements – can significantly impact consumer's product evaluations and purchase intent either positively or negatively (e.g., Bar & Neta, 2006; Salgado-Montejo, Leon, Elliot, Salgado, & Spence, 2015; Spence, Ngo, Percival, & Smith, 2013; Velasco, Woods, & Spence, 2015; Westerman et al., 2012, 2013; see Spence, 2016, for a review).

However, with improvements in packaging technology come new opportunities for packaging design. One such trend is the ability to introduce transparency into a wide range of product packaging (Arthur, 2014; Mintel, 2014; Packaging Strategies, 2015). More than half of the consumers questioned in one study believed that it is important to be able to see the product through transparent packaging (Mintel News, 2014). Many brands now incorporate such features into their packaging designs (Nassauer, 2014; Oster, 2014). Indeed, the prevalence of transparency in food packaging has been estimated at between 20–77% (average: 40%) in the American market, depending on the category (Deng & Srinivasan, 2013), and industry experts predict that this trend is only going to increase (see Mintel, 2014, 2016a). However, that said, to date, relatively little research has attempted to investigate the effect of such packaging innovation on the consumer compared to more conventional

packaging designs. Indeed, industry leaders have suggested that more extensive research on this subject is urgently needed (e.g., Food Manufacture, 2014).

1.1. Prior research on transparent packaging

Previous research on products that incorporate transparent design elements into their packaging has highlighted a number of effects on consumer evaluations and purchase intentions (see Simmonds & Spence, 2016, for a comprehensive review). For example, experiments conducted by Billeter, Zhu, and Inman (2012) identified that those packages that had a transparent element (as compared to otherwise plain, opaque packaging) were judged to be more trustworthy, received higher consumer preference scores, and greater purchase intent. However, these effects were only found when the product contained within was visually attractive. If, however, the product was visually unattractive, it was rated as significantly less trustworthy when presented in transparent packaging. Meanwhile, Chandran, Batra, and Lawrence (2009) found that transparent packaging can lead to an increase in product trust, also identifying that increased product trust mediated an increase in expected product quality for those products that were presented within transparent packaging. However, in this case, the effect was only seen for those products (or brands) that the participant was unfamiliar with; that is, no such improvement was seen for familiar products/brands.

Under certain conditions, however, transparent packaging has also been identified as leading to negative product evaluations. For instance, Vilnai-Yavetz and Koren (2013) highlighted one case in which a move to transparent packaging from opaque for a boiled vegetable ready meal resulted in a 30% decline in sales. Mediation analysis identified that expected product quality and perceived aesthetics of the

packaging both had relatively strong effects on purchase intent. Both mediators were positively associated with the purchase intentions of consumers (i.e., as the score for either mediator was increased, so too was purchase likelihood). However, the presence of transparent packaging was negatively associated with these mediators (i.e., the presence of transparent elements in the packaging led to reduced scores for these mediators), thus explaining the overall reduction in purchase intent. This again suggests that the attractiveness of the product (and, as a result, the packaging itself) is an important consideration when it comes to transparent packaging, as well as suggesting that expected product quality also plays an important role in consumer purchase decision-making.

Furthermore, in a series of experiments reported by Deng and Srinivasan (2013), the effect of transparency was investigated with respect to the consumption of the product within. People were found to consume significantly more from transparent packaging (69%) when it contained a visually attractive snack food, as compared to when presented in opaque packaging instead. However, consumption levels for the visually unattractive foods were comparable for both the opaque and transparent packaging. The authors concluded that the transparent packages had the effect of making the attractive food within more visually salient, thus promoting consumption.

In summary, several variables have been implicated in affecting how consumers respond to products presented within transparent (as compared to opaque) packaging. It seems clear that the attractiveness of the product has a positive effect on purchase intentions when transparent packaging is used (Billeter et al., 2012; Deng & Srinivasan, 2013; Vilnai-Yavetz & Koren, 2013). Note here that this conclusion is also consistent with the results of research on inedible products, where it has been shown that the aesthetics of such a product are positively associated

with the desirability of owning it (e.g., Bloch, Brunel, & Arnold, 2003; Norman, 2005; Reimann, Zaichkowsky, Neuhaus, Bender, & Weber, 2010). Other important variables in the edible foods category, albeit with somewhat less empirical support to date, include brand trust (Chandran et al., 2009) and expected product quality (Vilnai-Yavetz & Koren, 2013).

1.2. Gaps in the knowledge base

However, an important variable may have been overlooked in the literature regarding transparency in product packaging. That is, the expected taste of a product is thought to be an important factor on purchase evaluations for edible products (Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; see also Food Processing, 2013), with expected taste being one of the most important sensory cues at the point of sale (Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013). Indeed, there seems to be a pathway by which transparent packaging could result in more favourable expected taste evaluations (see Simmonds & Spence, 2016, for a review). That is, images of food are known to robustly capture attention (e.g., di Pellegrino, Magarelli, & Mengarelli, 2011; Nijs, Muris, Euser, & Franken, 2010), and evoke feelings of hunger, salivation, and food cravings (Rogers & Hill, 1989; see also Spence, 2011; Wansink, 2004, for reviews). This is effect thought to be especially powerful for more visually attractive foods. Simply showing food visuals on product packaging has been found to give rise to expectations that the product tastes better than when no food visuals were displayed (Elliott, 2008; Underwood & Klein, 2002), although note that this effect has not been the subject of much research (see Piqueras-Fiszman & Spence, 2015, for a review). As such, one might predict that presenting food visuals (such as through a transparent element of the packaging

façade) would lead to increased purchase intentions by enhancing the expected taste of the product. Additionally, it would also seem likely that the increased levels of hunger, salivation, and food cravings (evoked by the food visuals on the packaging) would lead to increased perceptions of tastiness (Rolls, Rolls, & Rowe, 1983; this may perhaps also be linked to gustatory reward processing, see Cerf-Ducastel, Haase, & Murphy, 2012), and again also be likely to lead to increased likelihood of purchase (Pachauri, 2001; Wilcock, Pun, Khanona, & Aung, 2004). Here we suggest that being able to see the product directly (e.g., through a transparent window) would make the product more salient (as suggested by Deng & Srinivasan, 2013) as compared to a printed graphic of the product on the packaging. This effect would be expected to be especially strong if the food itself were reasonably attractive. The result of this increased salience would thus lead to a more pronounced increase in purchase likelihood for those products presented within transparent packaging.

1.3. Aims of the present research

In summary, the emerging literature provides some insights into the effects of transparent packaging on consumer evaluations and purchase decision-making. However, the mechanisms that give rise to such effects are still largely unknown, despite the increasing prevalence of this form of packaging in the marketplace. In addition, very little research regarding transparent packaging has compared these effects on consumer evaluations across different product categories. Previous research on this topic has typically only investigated one product category within each experiment. This approach precludes the possibility of generalising the findings to other product categories, should this be appropriate.

The experiment outlined here was designed to investigate whether the expected tastiness of a product would be improved in packaging designs that incorporated transparency, alongside other product evaluations that have previously been affected by transparent packaging (e.g., expected product quality, packaging attractiveness, etc.), across a diverse range of product categories. In addition, we also examined whether consumers' willingness to purchase would also be affected by transparency in packaging, and, if so, whether (and which) product evaluations mediated this effect.

2. Materials and Methods

2.1. Participants

One-hundred-and-nineteen individuals (57 males, 62 females), recruited from Prolific Academic (http://prolific.ac), took part in this experiment in return for a payment of 1.00 GB pound. The participants ranged in age from 18 to 58 years (M = 31.9 years, SD = 9.12). Prolific Academic's 'country of origin' filter was used, such that only individuals born in the United Kingdom could decide whether to take part. This was done in order to control for any international effects of packaging design, and to ensure participants had a broadly equivalent experience of a similar set of (available) products and their packaging designs. There were no other exclusion criteria. The experiment was conducted online on 12/02/2016 between 10:00 to 15:00 UST (see Woods, Velasco, Levitan, Wan, & Spence, 2015, for a methodological overview of internet-based psychological research). The participants took an average of 459s to complete the study (SD = 204s; average payment of £7.84/hr). This research was approved by Oxford University's Medical Sciences

Inter-Divisional Research Ethics Committee (approval # MS-IDREC-R43591/RE001). Each participant provided informed consent prior to taking part in the study.

2.2. Stimuli

To avoid effects related to brand sentiment, all stimuli used were mock-up brands (i.e., they were '*faux-brands*'). All of the stimuli were produced using Adobe Photoshop CS6 software. Four sets of faux-brands were created to represent a range of Fast Moving Consumer Goods (FMCG) product categories: cereal (granola), boxed chocolates, dried pasta, and fresh fish (salmon). These product categories were selected such that products varied along expected cost, purchase frequency, and respective shelf-lives (e.g., boxed chocolates being a 'premium' product not bought frequently, and fresh salmon being a 'staple' food which is perishable). Within each product category, three stimuli were created where the ability to see the product as part of the packaging design was manipulated. Specifically, the three stimuli were: (1) a design with a transparent window, such that the product could be seen through the packaging ('*window*'); (2) with a graphic showing an image of what the product might look like having been prepared for consumption ('*graphic*'); and (3) with a blank space with no graphic or window present ('*blank*'). Note that the comparisons between responses for the '*window*' and '*graphic*' stimuli were most meaningful in answering our research questions; comparisons to '*blank*', which was intended as a control, were used to give context to the results other stimuli, and so the results for these will only be summarily reported. All of the stimuli included product information, such as brand name and product weight, which was held constant between stimuli within the same product category. The size and the position of the manipulated design elements were held

constant wherever feasible. Note that in the case of boxed chocolates, matching the size of both the graphic and the window would have resulted in a packaging design that might have looked unrealistic as compared to the packaging design of boxed chocolate products available in the British marketplace, and an exception was made to preserve validity (i.e., the graphic utilised a smaller proportion of available space than the window). Careful attention was paid to ensure that each packaging design looked realistic, while controlling for extraneous variables where possible. Those packages that were wider than they were tall (i.e., chocolates, pasta and salmon) were resized to have a fixed width of 200-pixels, while those with packages taller than they were wide (i.e., granola) had a fixed width of 170-pixels (see Figure 1 for the set of stimuli used).

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Given the online nature of the study, viewing apparatus (i.e., computer or laptop monitor) varied between participants. In order for the participants to complete the study, their monitor had to have a resolution that was equal to, or larger than, 1024 x 768-pixels. The experiment was conducted full-screen, occupying the entirety of the participant's monitor. The experiment was displayed in a 1024 x 768 box in the centre of the screen, irrespective of the size of the monitor, with whatever remaining space on the boundaries of the screen being occupied by white space. The experiment was conducted online using the Haxe-based Xperiment 2 software compiled into JavaScript (http://www.xperiment.mobi/; https://haxe.org/).

2.3. Design

A 4x3 (product category x degree of transparency in stimuli) within-participants experimental design was used, with all stimuli in all product categories being shown to every participant during the course of the experiment. Eight questions were asked for each of the stimuli: overall product liking (‘*How much do you like the product shown overall?*’); willingness to purchase (WTP; ‘*How likely would you be to buy this product, assuming it was available and at a reasonable price?*’); expected tastiness (‘*How tasty would you expect this product to be?*’); expected freshness (‘*How fresh would you expect this product to be?*’); expected quality (‘*What quality would you expect this product to be?*’); perceived innovativeness (‘*How innovative do you think this product is?*’); perceived structural packaging integrity (‘*How strong and sturdy do you think the packaging is?*’); and perceived attractiveness of the design (‘*How attractive do you find this packaging design?*’). Here it should be noted that none of the products shown were actually tasted by the participants, thus it is important to bear in mind that our results relate to expected taste (based only on sensory inferences from the visual aspects of packaging design), not the actual, or perceived, taste. Single-item measures were used to reduce any participant fatigue that might have been caused by a larger number of questions (and thus trials). Single-item measures are thought to have comparable validity and reliability as multi-item scales, given that the underlying concept is unidimensional (as it is in this case; see Hays, Reise, & Calderón, 2012; Rossiter, 2002). Indeed, single-item scales are thought appropriate for exploratory research (Diamantopoulos, Sarstedt, Fuchs, Wilczynski, & Kaiser, 2012) and for use with VAS scales (e.g., Boer et al., 2004), with both of these conditions being present in the design of this research. In addition to these questions, information was recorded prior to experimentation on the participant’s age, sex, and whether they had bought a product from each of the four FMCGs

categories that the stimuli were created from in the past six months. This information was collected in order to help identify any different response patterns (across all independent variables) as a result of demographic or previous purchase status through hierarchical segmentation analysis. However, the results from such a segmentation analysis did not identify any significantly different response patterns by age, sex, or recent product purchase status; that is, the evidence for only one cluster across the dataset outweighed the evidence for multiple clusters.

2.4. Procedure

Responses were collected on a 1000 x 350-pixel 'box scale' (similar to that used in Van Doorn et al., 2017), on which maximal and minimal responses were anchored (e.g., for overall product liking: '*Like the product very much*' and '*Don't like the product at all*', respectively). The maximal response was always anchored on the far right-hand side of the scale, and the minimal on the far left-hand side. To indicate a response, the participants were instructed to drag the image of the relevant stimulus into the box, where the horizontal position matched how strongly they thought each stimulus matched the scale presented. The range of possible responses was between 0–100 for every measure. All three stimuli from the same product category were presented at the same time for each question, with responses being made on the same scale. The order in which these stimuli were presented was randomised on each trial, in order to reduce demand or familiarity biases. Stimuli could be placed so that they overlapped (e.g., the most recently moved stimulus would then occlude any stimuli that happened to be situated behind it). The height of the box allowed several stimuli to be 'stacked' vertically, such that they could be seen simultaneously. An example of the scale is shown in Figure 2.

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Thirty-two trials were presented in total: individual trials measured one of the eight questions, for one of the four product categories, with all stimuli in the category being assessed simultaneously in the trial (as shown in Figure 2). The order of the product categories for each question was randomised to reduce any order or priming effects; question order was not (questions were presented in the order described in *Section 2.3*). That is, all participants completed four 'overall product liking' trials first, each for a different product category (in a random order for each participant), then moved on to four 'WTP' trials, and so on until all the trials had been completed. The participants could not proceed to the next question until they had provided a response for all stimuli presented above the box scale. After completing the study, the participants were debriefed as to the nature of the study.

2.5. Data analysis

A Shapiro-Wilk test was used to identify whether the sample came from a normally distributed population. Since this test statistic for all measures was significant and, as confirmed by Q-Q plots, the sample was assumed to come from a non-normal distribution. Non-parametric tests were adopted, where appropriate, as a consequence. In addition, median scores were adopted as the measure of central tendency, with inter-quartile range (IQR) adopted as the measure of dispersion, to reduce the impact of outliers on these statistics. Two major types of statistical analyses were used to interpret the data: significance testing (using Friedman's and Wilcoxon Signed-Ranks tests), and mediation analyses.

Comparisons between scores for each stimulus were performed using Friedman's test separately for each product category and measure. Pairwise, post-hoc comparisons were then performed using a Wilcoxon Signed-Rank Test between '*window*', '*graphic*', and '*blank*' stimuli scores for each product category and measure. Note that the 'blank' stimuli were not designed to emulate available packaging designs in the British FMCG marketplace. Rather, they were included as a control set. Indeed, these stimuli lack many aspects of packaging design that consumers may well expect to find on product packaging, with such omissions expected to decrease the overall liking of these designs. As a result, post-hoc comparisons between these stimuli and the 'window' and 'graphic' stimuli will be outlined summarily, but not reported in greater detail in tables, for brevity.

The Hochberg procedure (Hochberg, 1988; see also Huang & Hsu, 2007, for a guide) was adopted to control for multiple comparisons (resulting from Friedman's test results) made across product categories for each measure. This procedure was chosen to adequately control both Type-I and Type-II errors arising from the relatively large number of comparisons made, and in which situation Bonferroni corrections would be unduly punitive (see Armstrong, 2014; Ludbrook, 1998). Note that the Hochberg procedure relies on the assumption of positive dependence between hypotheses (see Benjamini & Yekutieli, 2001), which is met throughout all comparisons presented here.

In addition, a series of mediation analyses were conducted to investigate whether WTP was significantly influenced by certain product evaluations as a result of having a transparent window included in the packaging design. Mediation analysis quantifies how an independent variable affects a dependent variable through one or more other intervening variables (i.e., potential mediators; see MacKinnon, Fairchild,

& Fritz, 2007). Such analysis has proven valuable in the transparent packaging literature that has been published to date, allowing researchers to make inferences about how certain product attributes influence purchase intentions (as in Billeter, Zhu, & Inman, 2012; Vilnai-Yavetz & Koren, 2013), or other product perceptions (as in Chandran, Batra, & Lawrence, 2009; for perceived product quality). Mediation analyses were run specific to each of the four product categories. Two-condition, within-participant mediation analyses were conducted using the MEMORE SPSS macro (see Montoya & Hayes, 2016). For each, bias-corrected bootstrapping was used to calculate confidence intervals for indirect effects, using 5,000 samples. Bias-corrected bootstrapping was preferred (compared to percentile bootstrapping) in this case due to its ability to adjust for non-normal distributions (see MacKinnon, Lockwood, & Williams, 2004). Each mediation analysis followed the same template: the presence of transparency was used as the independent variable (i.e., the '*window*' results were compared with the '*graphic*' results; the '*blank*' results were not used), with the dependent variable being WTP. Mediating variables were: expected tastiness, expected freshness, expected quality, perceived innovativeness, and perceived attractiveness. Overall liking and perceived structural integrity scores were not used: the former, because this measured a construct thought to be influenced heavily by other mediating variables; and the latter, because this was not expected to be a major influence in the purchase decision-making process. For partial mediation to be assumed, as per Baron and Kenny's (1986) guidelines, there needed to be a statistically significant relationship between the independent variable and the mediator, as well as between the mediator and the dependent variable. Percent mediation (PM) scores were used to estimate the effect size of mediating

variables: these were calculated as the product of the effect sizes for both indirect path effects (for the respective mediating variable) as a percent of the total effect.

3. Results

Due to an error in the software recording the responses, data for total study duration and perceived attractiveness of design was not saved for a small minority of the participants. Data was not lost for any other question or response. In total, 15 cases were lost for study duration, with the number of cases of data lost for perceived attractiveness varying by product category (7, 10, 8, and 4, for the pasta, chocolates, salmon, and granola categories, respectively).

3.1. Significance testing

The Friedman's tests (not displayed due to the number of comparisons made) revealed significant differences between stimuli in each product category for all measures ($p < .05$). Descriptively, the median scores of the '*window*' stimuli were higher than median scores of the '*graphic*' stimuli in every product category for the overall liking, WTP, tastiness, freshness, quality, innovativeness, and attractiveness measures. One exception to this trend was seen in the salmon category, where the median attractiveness score for the '*graphic*' stimulus was marginally higher than the same score for the '*window*' stimulus. In the case of packaging structural integrity, the median scores of '*graphic*' stimuli were higher than '*window*' stimuli for all product categories. Across all categories and measures, the '*blank*' stimuli had the lowest median scores of the three designs tested.

Pairwise comparisons in relation to the '*blank*' stimuli, with multiple comparisons controlled for with the Hochberg procedure, found that: (1) for all measures and in all

product categories, '*graphic*' stimuli received significantly higher scores as compared to their '*blank*' counterpart; and similarly, (2) '*window*' stimuli received significantly higher scores as compared to '*blank*' for all measures in all categories, with the exception of the perceived structural integrity of the packaging, where there was no significant difference between these stimuli in the granola, chocolate, and salmon product categories.

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Results from the '*window*'-'*graphic*' pairwise comparisons are displayed in Table 1 and, for brevity, are not all reported in the main body of the text. '*Window*' stimuli had significantly higher expected freshness, quality, and WTP scores across all four product categories, as compared to '*graphic*' stimuli ($Z \geq -2.84$, $p \leq .005$). In terms of overall liking, '*window*' scores were again significantly higher for the granola, chocolate and pasta categories ($Z \geq -3.67$, $p < .001$); and for expected tastiness, in the granola and chocolate categories ($Z \geq -4.35$, $p < .001$). Significantly higher '*window*' scores were also obtained for perceived innovativeness and attractiveness in both the granola and chocolate categories ($Z \geq -2.84$, $p \leq .004$). However, '*graphic*' designs had directionally higher scores than '*window*' for perceived structural integrity in all categories, with this difference reaching statistical significance in the salmon category ($Z = -3.09$, $p = .002$), but not in the three remaining categories ($Z \leq -2.75$, $p \geq .006$).

3.2. Mediation analysis

The results of the mediation analyses are displayed in Figure 3. The total effect of the presence of transparency on WTP scores was significant for all of the product categories, as also found in the post-hoc Wilcoxon Signed-Rank Test comparisons (as discussed above). The indirect effects of the mediation analysis (i.e., the effect of the independent variable, WTP, on each mediating variable) investigate similar hypotheses as the Wilcoxon Signed-Rank Tests between the same variables for 'window'–'graphic' comparisons. A very similar pattern of significant differences was identified between variables in both analyses, with this broad consensus of results between both tests helping to corroborate the validity of both analyses. In addition, as with the Wilcoxon Signed-Rank Tests, all significantly different indirect effects were directionally higher for the 'window' stimuli, showing again that '*window*' stimuli led to more positive consumer evaluations overall.

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A range of mediator variables were found to be significant for different product categories. In the granola stimuli set, expected tastiness (β = 0.34, CI = [0.15, 0.54], p < .001) and attractiveness (β = 0.40, CI = [0.24, 0.56], p < .001) were the only significant mediators. These indirect effects accounted for 27.3% and 38.1% of the total effect respectively, while 27.9% of the total effect could not be accounted for by indirect effects (i.e., is attributable to the direct effect, and not 'through' any mediating variables). For the chocolate stimuli set, only perceived attractiveness was found to be a significant mediator (β = 0.32, CI = [0.10, 0.54], p = .006), accounting for 19.5% of the total effect. 40.7% of the total effect could not be accounted for by indirect effects. In the pasta stimuli set, expected tastiness (β = 0.29, CI = [0.12,

0.47], p = .002) and freshness (β = 0.17, CI = [0.02, 0.33], p = .029) were both significant mediators, accounting for 12.0% and 12.9% of the total effect, respectively. However, 60.0% of the total effect could not be explained by any indirect effects. Finally, for the salmon stimuli set, only expected quality (β = 0.28, CI = [0.04, 0.52], p = .021) was a significant mediator, accounting for 30.7% of the total effect, with 73.6% not accounted for by any indirect effect. Note here that two other mediator variables, expected tastiness and attractiveness, had significant effects on WTP (the 'outgoing' or 'b' path), but without a significant effect between level of transparency and the mediators themselves (the 'ingoing' or 'a' path). As such, the indirect effect is not significant, and cannot be said to significantly mediate the outcome according to Baron and Kenny (1986; see also Preacher & Hayes, 2008). In addition, note also that these cumulative percentages exceed 100% due to subtractive (albeit non-significant) effect sizes of other mediators in the model.

4. Discussion

In sum, the results of the present study demonstrate that transparent windows in packaging design can be used to enhance evaluations of product freshness and quality, as well as to increase WTP, across several product categories. Indeed, perhaps the most striking finding to emerge from the present study was the consistent advantage afforded to packaging with transparent elements, as compared to packaging with an image of the product displayed instead, and the consistent disadvantage afforded to blank or undecorated packaging designs. While transparent packaging appears beneficial in a wide range of product categories, the explanation behind this benefit seems to differ by category.

Post-hoc comparisons between '*blank*' and both '*window*' and '*graphic*' stimuli suggest that consumers tend to prefer packages with a transparent window or image of the product on the pack compared to those with otherwise minimal design embellishment. Indeed, consumers also seem to judge products packaged within relatively spartan designs as (1) likely to be significantly less tasty, less fresh, and of lower quality, (2) being significantly less attractive and innovative, and (3) ultimately, would be significantly less willing to purchase them. Furthermore, '*window*'–'*graphic*' post-hoc comparisons indicated that, across a broad range of food product categories, consumers would be significantly more willing to purchase products that had been packaged within transparent designs, as well as rating the product within as significantly fresher and of better quality, compared to their graphics-only counterparts. Within individual product categories, the effect of transparent packaging on consumer evaluations was found to differ as a function of the product in question. For example, within both the granola and chocolate categories, transparent packaging led to significant increases in all of the variables measured. However, for salmon, significant increases (relative to the '*graphic*' stimulus) were only seen for ratings of WTP, and perceived freshness and quality when within transparent packaging (as well as a significant decrease for perceived packaging structural integrity).

The results of mediation analysis corroborated the findings of the post-hoc comparisons, also highlighting that the mechanisms behind the consistent advantage transparent packaging affords differed by product category. In the granola category, increased WTP caused by the presence of transparent packaging was mediated by increases in perceived tastiness and attractiveness; for chocolate, by increased perceived attractiveness alone; for pasta, by increased perceived tastiness and

freshness; and for salmon, by increased perceived quality. Such results corroborate findings from previous research (e.g., the identification of perceived attractiveness as a mediator of WTP in Billeter et al., 2012; Deng & Srinivasan, 2013; and perceived attractiveness and product quality as mediators of WTP in Vilnai-Yavetz & Koren, 2013). Furthermore, these results also demonstrate for the first time that transparency allows consumers to make important product inferences and evaluations which differ by category.

These findings lend tentative support for the 'salience' hypothesis mentioned previously. According to this hypothesis, the ability to see a food product directly through a transparent window would make it more salient in the mind of the consumer (compared to just a printed graphic of the product), thus eliciting greater levels of hunger and food cravings which, in turn, would lead to increased WTP for the product. The present experiment found that if the product was more immediately visible (i.e., through a window rather than as a rendered image), it would be significantly more likely to be considered for purchase. However, a number of caveats must also be considered: for example, no measure of visual or attentional salience was collected in this research, and hence it is not possible either to substantively support or reject the theory. Future research might benefit from including a measure of salience, such as through implicit measures (e.g., eye tracking; Piqueras-Fiszman, Velasco, Salgado-Montejo, & Spence, 2013), to understand whether the view of a product through a window is indeed more salient than a printed image. It might also be valuable to investigate whether consumers' trust in any printed imagery (i.e., whether they think the image accurately portrays what the product might look like outside of the packaging, or when cooked) attenuates the salience attached to it. Furthermore, manipulating the attractiveness

of such images may also elucidate these effects further: it seems possible that there may be situations where an especially attractive image may provide a more tempting, hunger-inducing view of the product than a transparent window could achieve (e.g., for frozen foods or some chilled ready meals, as in Vilnai-Yavetz & Koren, 2013). The content of the image could also be manipulated in such future research (e.g., showing a larger portion size may be seen as more 'tempting'; see Petit, Velasco, & Spence, submitted), as could comparisons to a design that includes both a window *and* an image of the product. Conversely, however, the use of overly-enhanced or manipulated images of the product may result in a compound negative effect, such as if consumers are led to feel the imagery is dishonest or misleading, and thus result in less favourable product evaluations (see Underwood & Ozanne, 1998). Future research investigating this, perhaps in collaboration with professional designers, would help provide further insight on the relationship between aesthetics and product evaluations. Considering recent findings regarding visual cognition and 'gastoporn' (see Spence et al., 2016; for a review), future research could also investigate such effects by manipulating the sugar/fat contents of the products that are shown behind a transparent window, given that the human brain preferentially processes images containing high- (vs. low-)energy content.

4.1. Guidance for industry

The methodology/findings presented here offers packaging designers and brand managers a tool by which to potentially encourage sales of their product(s), and perhaps also to evaluate how their products are perceived differently in the home environment.

The consistent advantage afforded to transparent packaging (as outlined here) indicates that transparency should at least be considered wherever feasible (e.g., where packaging formats would allow for transparent elements; for products that do not significantly degenerate when exposed to sunlight; and so on). More specifically, if a product can showcase itself as being tasty, fresh, of good quality, and as being attractive, then the present results suggest that such a product would be more likely to perform better in the marketplace within transparent packaging. However, it remains important to note that new packaging designs still need to be empirically tested using a representative sample of consumers: as this research shows, no single factor seems attributable to the success (or failure) of transparency increasing purchase likelihood, so each design and product category should, at this stage at least, be treated individually.

4.2. Limitations

While efforts were made throughout the design of the present research to minimise bias and maximise applicability, several considerations need to be kept in mind when interpreting these results. First, while this research suggests that ‘blank’ packaging designs should be avoided, it should be noted that ‘minimalistic’ designs are commonly used in the marketplace, and especially to differentiate premium, or modern and stylish products from other available brands. Additional research would be necessary to understand the efficacy of using minimally-embellished designs (compared to more graphical alternatives) in different circumstances, such as for premium or luxury products.

Second, it should be noted that the present research only tested one set of stimuli per category, with the underlying premise of the design not varying between

members of the set (e.g., all granola stimuli were on an orange background; all stimuli had the same brand name and tagline; etc.) Extrapolating these findings to apply to the broader product category of each stimulus would not be advisable, since (for example) variation in branding, price point, and packaging designs would likely all have an influence on consumer evaluations.

Third, the conclusions outlined here should be considered in the light of the fact that all of the research consisted of online experimentation. While online recruitment and experimentation is generally advantageous to researchers of visual stimuli – for example, enabling quick recruitment of a diverse and representative sample, as well as for easier manipulations and ratings of visual stimuli – there are certain limitations, including the level of comprehension of instructions and demand biases (for a more detailed analysis of the value of online visual research, see Woods et al., 2015). Furthermore, since the majority of purchases for packaged goods currently take place in-store, the stimuli used cannot be expected to be ecologically valid (in that consumers did not have the opportunity to interact with the physical packaging, or view any information not presented on the front façade). Further research, using physical stimuli (perhaps paired with product sales data) may be necessary to ensure the findings here are translatable into real-world environments. Note here, however, that as the proportion of online grocery purchases continues to grow (currently being 6% of all grocery sales in the UK, and forecast to grow to above 10% of all grocery sales by 2020; Mintel, 2016b), online research methods seem set to become increasingly relevant.

4.3. Concluding remarks

The present research helps clarify the effect of transparent packaging on consumer purchase decisions. Given that: (1) previous research has suggested that products in transparent packaging are consumed more quickly (Deng & Srinivasan, 2013); (2) attractive (and perhaps less healthy) products are both more likely to be visually salient and more likely to be purchased (Billeter et al., 2012; Chandran et al., 2009; Vilnai-Yavetz & Koren, 2013); (3) transparent packaging is prevalent in supermarkets, and is slated to become increasingly so; and (4) though many countries have strict advertising regulations for unhealthy foods (and especially for products aimed at children), these, critically, do not extend to regulate packaging (see also Hawkes, 2010); it seems remarkable that there is not a greater discourse about the ways in which packaging may be causing a deleterious effect upon public nutritional health. Indeed, perhaps it would be a timely discussion for public health officials to engage in.

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Author’s contributions

GS, AW, and CS all contributed to the writing of this paper. GS and AW programmed the experimental procedures, with GS running statistical analyses on the datasets. All authors read and approved the final version of the manuscript.

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Figure Legends

Figure 1. Stimuli used in the experiment. Headers denote the degree of transparency of each stimulus. Top row: stimuli in the granola category; second row: stimuli in the boxed chocolates category; third row: stimuli in the dried pasta category; bottom row: stimuli in the salmon category.

Figure 2. An example question from the experiment, showing the box scale in use (one trial, measuring overall liking of the product for the boxed chocolates category). All experimentation was conducted using the Xperiment software (http://xpt.mobi/).

Figure 3. Mediation analysis results for each product category (in the order of: granola, chocolate, pasta, salmon), exploring the impact of the level of transparency (i.e., 'window' or 'graphic' stimuli) on WTP scores through five mediator variables. *p*-values are displayed along each path.

Figure 1

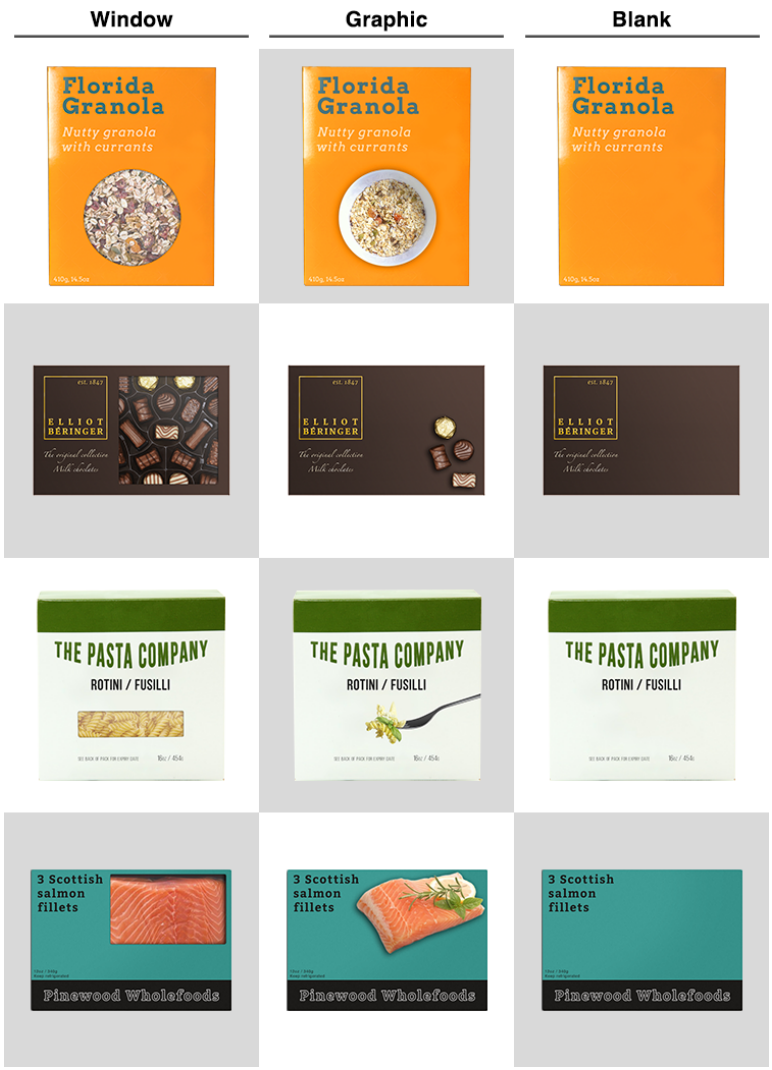
Window
Graphic
Blank
Florida Granola
Nutty granola with currants
ELLIOT BERINGER
THE PASTA COMPANY
ROTINI / FUSILLI
3 Scottish salmon fillets
Pinewood Wholefoods

Figure 2

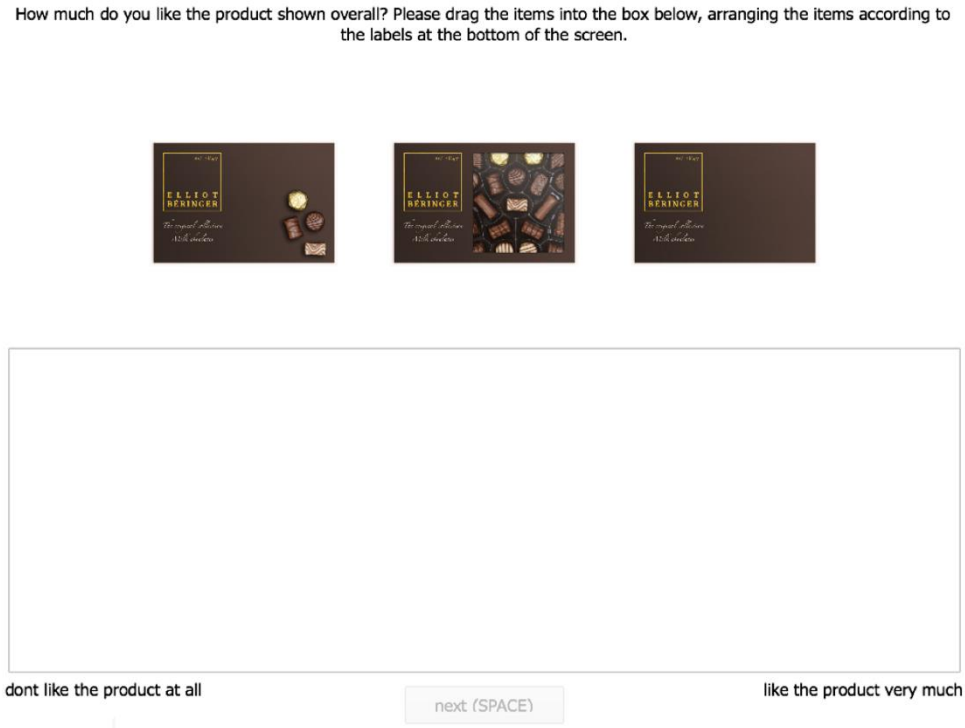
How much do you like the product shown overall? Please drag the items into the box below, arranging the items according to the labels at the bottom of the screen.
ELLIOT BERINGER
ELLIOT BERINGER
ELLIOT BERINGER
dont like the product at all
next (SPACE)
like the product very much

Figure 3

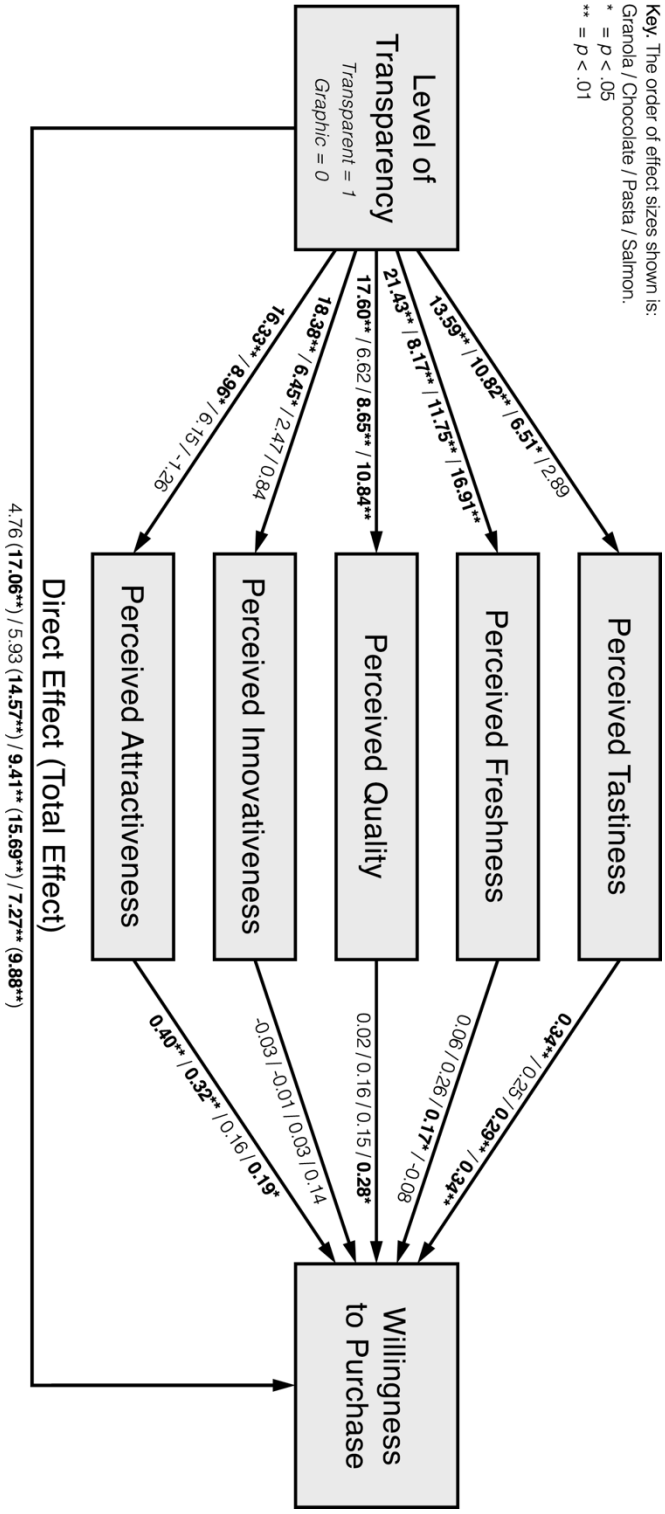
Key. The order of effect sizes shown is: Granola / Chocolate / Pasta / Salmon.
* = p < .05
** = p < .01
Level of Transparency
Transparent = 1
Graphic = 0
Perceived Tastiness
Perceived Freshness
Perceived Quality
Perceived Innovativeness
Perceived Attractiveness
Willingness to Purchase
Direct Effect (Total Effect)
13.59** / 10.82** / 6.51* / 2.89
21.43** / 8.17** / 11.75** / 16.91**
17.60** / 6.62 / 8.65** / 10.84**
18.38** / 6.45* / 2.47 / 0.84
19.33** / 8.96* / 6.15 / -1.26
0.34* / 0.23 / 0.29* / 0.34**
0.09 / 0.26 / 0.17* / -0.08
0.02 / 0.16 / 0.15 / 0.28*
-0.03 / -0.01 / 0.03 / 0.14
0.40** / 0.32** / 0.16 / 0.19*
4.76 (17.06**) / 5.93 (14.57**) / 9.41** (15.69**) / 7.27** (9.88**)

Table 1: Wilcoxon Signed-Rank Test results from the experiment for the presence of either a (a) transparent window, or (b) product graphic, by category.

	Window		Graphic				
	M	IQR	*M*	IQR	*z*	*r*	*p*
Granola							
Overall liking	84.24	41.82	53.86	26.18	-4.43	0.29	**< .0001**
WTP	84.60	44.67	51.96	25.59	-5.44	0.35	**< .0001**
Tastiness	77.37	38.98	53.02	35.90	-4.63	0.30	**< .0001**
Freshness	85.90	29.51	53.62	32.46	-6.38	0.41	**< .0001**
Quality	81.87	32.94	52.31	28.54	-5.32	0.34	**< .0001**
Innovativeness	69.20	44.08	46.98	29.61	-6.61	0.43	**< .0001**
Structural integrity	52.25	47.03	60.01	37.69	-1.67	0.11	.0961
Attractiveness	76.30	41.35	51.60	38.73	-4.68	0.31	**< .0001**
Chocolate							
Overall liking	86.36	43.12	52.45	34.77	-3.76	0.24	**.0002**
WTP	87.59	26.66	57.74	30.58	-4.65	0.30	**< .0001**
Tastiness	91.16	18.80	70.64	37.47	-4.35	0.28	**< .0001**
Freshness	77.89	36.00	59.58	31.45	-4.36	0.28	**< .0001**
Quality	83.78	29.11	72.23	38.45	-3.15	0.20	**.0016**
Innovativeness	57.61	51.47	51.23	31.44	-2.84	0.18	**.0044**
Structural integrity	51.59	54.92	64.25	35.38	-2.75	0.18	.0060
Attractiveness	86.86	41.58	67.33	36.36	-2.95	0.20	**.0032**
Pasta							
Overall liking	86.73	39.06	54.42	35.39	-3.67	0.24	**.0002**
WTP	85.75	20.02	63.52	35.38	-5.07	0.33	**< .0001**
Tastiness	80.09	35.86	71.86	39.19	-1.59	0.10	.1125
Freshness	78.75	42.26	56.75	37.97	-3.86	0.25	**.0001**
Quality	82.92	35.39	67.81	36.00	-2.99	0.19	**.0028**
Innovativeness	56.39	42.02	50.61	40.41	-1.65	0.11	.0981
Structural integrity	60.44	37.97	66.34	37.83	-2.28	0.15	.0229
Attractiveness	77.58	34.89	67.38	39.37	-1.83	0.12	.0677
Salmon							
Overall liking	69.28	40.05	59.83	44.84	-0.04	0.00	.9714
WTP	76.91	37.22	56.14	41.41	-2.84	0.18	**.0045**
Tastiness	78.13	39.44	73.58	43.37	-0.73	0.05	.4643
Freshness	88.08	25.67	59.09	37.10	-4.91	0.32	**< .0001**
Quality	83.66	34.89	60.08	38.83	-3.46	0.22	**.0005**
Innovativeness	52.70	39.80	51.11	46.92	-0.99	0.06	.3248
Structural integrity	51.23	48.78	68.42	35.75	-3.09	0.20	**.0020**
Attractiveness	69.28	36.25	73.83	41.64	-0.32	0.02	.7484

M = median; IQR = inter-quartile range; *r* = effect size (see Pallant, 2007, p. 225).
Note. *N* = 119, except where otherwise stated under '*Results*'; *p*-values are rounded and shown to four decimal places. Significant results, derived from the Hochberg Procedure, are shown in bold.