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Negative Information, Cognitive Load, and Taste Perceptions

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ABSTRACT

Previous research on consumer's evaluation of how good or bad a food product tastes have found that activating memory-based perceptions or presenting non-taste related product information influence the taste judgment. In this study, we extend this stream of research by introducing a cognitive load manipulation, and hypothesize that the effect of negative product information on taste evaluations is reversed under conditions of high cognitive load. A 3-cell between-subjects experimental design was employed to test this assumption, and the results show that cognitive load in fact reverses the previously found effect. In addition, an equal negative effect on purchase intentions and product popularity is also reversed. Theoretical implications for food marketing are offered based on the findings.

KEYWORDS
Taste judgments; cognitive load; negative product information; consumer decision making

Introduction

Like any other product evaluated by consumers prior to purchase, food products are also comprised of a variety of intrinsic and extrinsic attributes. But unlike a number of other consumer products, the purchasing decision, and especially for repurchases, largely depends on an evaluation of one dominating attribute: taste. While extrinsic cues like price level, health claims, package design, user convenience, etc. is also of significant importance, the major driver of liking is whether the food tastes good (Clark, 1998; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998). In this respect, food products differ from many other fast-moving consumer goods as the majority of product attributes are necessary but not sufficient for product choice. The one dominant diagnostic attribute is taste, and food products that do not satisfy a consumer´s taste preferences will have a tough job finding their way into the shopping basket. This further implies that the choice of food products typically does not follow a compensatory decision rule, where inferior performance on some attributes are out weighted by superior performance on others. Good taste is a go or no-go criteria, and serves as the

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gatekeeper to further comparison between product alternatives. However, while previous research suggests that consumer evaluations of food taste are influenced by both intrinsic and extrinsic food attributes, a unique facet of the research presented here is how negative information on *non-sensory* related attributes influences the evaluation of taste. Specifically, we study how taste evaluations are 1) affected by negative product information unrelated to the senses, and most importantly 2) how the effect of negative information disappears with higher levels of cognitive load. The paper departs with a brief introduction to the theoretical basis for the study, before an experimental study testing our hypotheses is described. Finally, results are presented and discussed, and implications for theory and practice offered.

Consumer taste evaluations

Physiologically speaking, taste is one of several specialized but interacting sensory pathways that operates within the oral cavity and refers specifically to the sensation derived when chemical molecules stimulate taste receptor cells. The stimuli perceived by the sensory receptors are transported to the brain, where the good-bad evaluation is performed. This is often considered an automatic process, as can be seen from the uncontrolled facial expressions often displayed when people taste something extremely bitter or sour (Steiner, 1979). However, previous research suggest that the evaluation of taste can follow both a top-down or bottom-up process. For example, Hersleth, Mevik, Næs, and Guinard (2003) found that context differences, like tasting wine in different rooms, influenced how well consumers liked it, while others have found that water tastes differently when consumed from different glasses (Krishna & Morrin, 2008). These differences result from bottom-up processes, since the stimuli received are integrated rather automatically and unconsciously to form a perception of how the liquid tastes.

In contrast, top-down processing "holds that external information provided about the food is processed more deliberately, and that it affects taste perception in a cognitive manner" (Elder & Krishna, 2010, p. 749). For example, Hansen (2014) found that how consumers liked a product's taste was influenced by the reported evaluation of others, and that this effect depended on the food-related status of the reference group. Similarly, Lee, Frederick, and Ariely (2006) found that negative information about a beer influenced consumer judgments when the information was presented before consumers tasted the product, which suggests that the negative information both introduces a cognitive element to the evaluation of sensory stimuli, and that taste evaluations are influenced by this. However, a distinction between the studies of Hansen (2014) and Lee et al. (2006) is that the prior offered non-product related information while the latter focused on intrinsic, sensory-related attributes. This is important, as previous research has also shown that both intrinsic and extrinsic cues affect our perceptions of taste. Intrinsic product cues like smell, texture, temperature, sound, and visual appearance are all related to how we evaluate the taste of a food product (De Araujo et al., 2005; Cruz & Green, 2000; DuBose, Cardello, & Maller, 1980; Hertz, 2007; Zampini & Spence, 2004), which supports the idea that taste evaluation does not rely solely on the sensory stimuli perceived by the taste buds (Elder & Krishna, 2010). As for the more extrinsic cues, previous research has shown that food products considered unhealthy are associated with better taste than healthy ones (Raghunatan, Naylor, & Hoyer, 2006), and as mentioned, that information about reference group evaluation of a food product influences our perception of how it tastes.

In the present study, we focus on how top-down, cognitive processing of intrinsic, non-sensory related product information is related to taste evaluations. Based on the general idea that cognitively processed information about a food product will influence consumer perceptions of how it tastes, and the support for this assumption in previous research, our baseline hypothesis suggests that:

H1:Negative product information will have a negative effect on taste perceptions.

Hypothesis 1 largely serves to establish, or replicate, the same effect of product information on food taste evaluations found in previous studies. As this effect is argued to result from a cognitive evaluation of the negative information presented, any mechanism that interrupts or prevents this cognitive process should intuitively also limit the effect of the information, or remove it completely. Thus, the effect of cognitively based stimuli requires that these stimuli get the necessary attention, and that they are actively processed. An interesting question then, is what will happen if the cognitive resources are occupied with other tasks that require the consumer´s attention and reduces working memory? Drawing on Shiv and Fedorikhin (1999, 2002), we argue that top-down processing of food-related information is closely aligned with the higher order processes described in their Affective-Cognitive model of decision-making. Following further from this, Shiv and Fedorikhin describe how such processes require available cognitive resources, and that cognitive load is a factor inversely related to available cognitive capacity; the higher the cognitive load, the less cognitive resources available. In the current study, we test whether these predictions also hold if constraints on the cognitive capacity are introduced to evaluations of food taste, and if the effects assumed by these affective-cognitive models also hold for evaluations that should intuitively be dominated by sensory stimuli.

In their study on the effects of single vs. multiple sense ads on taste evaluations, Elder and Krishna (2010) found that ads that mentioned multiple senses had a greater effect on food taste than ads that mentioned taste only, and that his effect disappeared when a cognitive load was introduced. The multiple sense ad portrayed in positive terms the smell, looks, texture, and sound of the advertised popcorn brand, and thus appealed to important intrinsic product attributes. As described earlier in this paper, these are all previously found to affect taste perceptions. While this supports our arguments for the role of cognitive load in food evaluations and taste judgments, it is also important to note that Elder and Krishna´s ads centered around affective, sensory thoughts, so "a distraction from the ad is a distraction from affective consequences" (2010, p. 753). Following from this, we will argue that Elder and Krishna first activated the receptiveness to multiple, taste related stimuli, and found that this affected taste evaluations. They then constrained this activation by introducing cognitive load, and the effects on taste disappeared. However, there is an important difference between product information portraying taste-related sensory characteristics, and extrinsic information on product attributes unrelated to sensory features. In this research, we extend the previous studies on how information on intrinsic cues influence taste, and the role of cognitive load, by focusing on secondary information unrelated to taste. By so doing, we extend current knowledge in two important ways; firstly, we complement and add additional support to previous studies on the effect of external cues on taste perceptions (eg. Hansen, 2014; Hersleth et al., 2003; Krishna & Morrin, 2008). Secondly, and most importantly, we extend current knowledge on the role of cognitive load by focusing on food product information totally unrelated to senses in general, and taste in particular. In summary, our study focus on 1) whether negative product information unrelated to the senses negatively impacts taste perceptions, and 2) whether cognitive load reduces this effect. Formally, our second hypothesis can then be formulated as:

H2:The effect of negative product information on taste will decrease with increasing cognitive load.

Methods

A three-group between-subjects design was applied to test our hypotheses. The first group received neutral product information and a low cognitive load. The second group received negative product information and a low cognitive load, while the third group received negative product information and a high cognitive load. Group 1 (neutral information/low cognitive load) and 2 (negative information/low cognitive load) were compared to look for the effect of negative product information on taste, while group 2 (negative information/low cognitive load) and 3 (negative information/high cognitive load) were compared to test the effect of negative product information on the same variables at different levels (low/high) of cognitive load.

Participants and procedure

We recruited 75 students from the University of Stavanger, Norway, to take part in the experiment. The mean age was 23.7 years and 64.5% were female. The experiment took place in a lab setting, and subjects were invited in one at the time. When recruited, they were not told what the study was about or what we wanted them to do, only that participation would take no more than 15 minutes. On arrival at the lab, participants were randomly assigned to three experimental conditions, leaving 25 in each group. The subjects in each of the three experimental groups were given a pamphlet with instructions to the experiment on the first page. On the following page, they were given the cognitive load manipulation (low or high) consisting of a sequence of letters that the subjects were asked to remember throughout the entire experimental session. This is a procedure widely used in previous cognitive load studies, and our particular design was identical to the one used by Kessler and Meier (2014), where low cognitive load was represented by a sequence of three random letters (GXN) and high cognitive load was represented by a random nine letter sequence (GXNTDPRLW). The subjects were given 30 seconds to memorize the letters before they moved on to the next phase, which involved answering socio-demographic questions. Following that, they were presented with a cover story that described how a new brand of chocolate was about to enter the domestic market. This story included the neutral/negative information manipulation. After reading the story, subjects were asked to taste a piece of dark chocolate placed in front of them, and then to rate it according to taste. After each sub-task in the experimental process, subjects were reminded of the letter sequence memory task, thereby constantly being pushed to allocate cognitive resources to this task (they were reminded of the memory task – not the letters themselves). Finally, they were asked to report the letter sequence presented to them at the beginning of the session. This was important to check the cognitive load manipulation. If the subjects in the high cognitive load condition remembered the entire sequence correctly, this would indicate that the load might have been too low. If they remembered very little, this might be an indication of them not allocating attention to this task, and also imply a too low allocation of cognitive resources. The results showed two trends that assure us that the load was heavy enough, and that participants had allocated attention to the task: they either remembered many, but not all letters, or they remembered close to all letters, but not in the right order. The group with a three-letter sequence had no problems remembering the letters. Based on this, we concluded that the cognitive load manipulation influenced the task at hand in the way it was designed to.

To test the strength of our negative information manipulation, a pretest was performed on 32 university students not taking part in the experiment. Sixteen subjects were given the neutral product information, and 16 the negative product information. The neutral story consisted of neutral information about the chocolate, including the percentage of cocoa and the producer´s brand name (a fictitious brand). The negative story included negatively loaded information about the product, such as the use of some controversial ingredients – among them a widely criticized, genetically modified palm oil. Related to this, an important detail is that the story did not describe this ingredient in negative terms, it just stated that the chocolate contained it. The choice of this attribute as the negative information was due to Norwegian consumers being very negative toward palm oil (Alfsen, 2018), and also genetically modified food (Rickertsen, Gustavsen, & Nayga, 2017). For example, a consumer action campaign in 2012 resulted in domestic food producers cutting the use of palm oil as an ingredient by two-thirds within a year (Rainforest Foundation Norway, 2013). In fact, the negative attitudes toward palm oil reached a level where the Norwegian Government Pension Fund Global, the world´s second largest investment fund, decided to not invest in companies that produced palm oil, and between 2012 and 2015 it sold all shares in 29 palm oil companies (Alfsen, 2018). After reading the cover stories, the subjects in each of the test groups were asked to rate their impression on a scale ranging from 1 (very bad impression) to 7 (very good impression). An independent samples t-test showed a significant difference between the groups, with the ones presented to the neutral story having a mean score of 4.19 and the ones presented to the negative story having a mean score of 1.94 ($t = 6.03$, $p = .000$). Thus, the strength of our information manipulation was considered sufficient for use in the subsequent experiment. The information manipulation is presented in the Appendix.

Measures for dependent variables

We chose a dark chocolate for the tasting part of our experiment. This was done to obtain sufficient variations in this measure, as some people seem to like dark chocolate very much, while others are not fond of it at all. Variations in dependent variables (here: taste evaluation, purchase intention, and perceived popularity and competitiveness) are necessary to be able to find potential effects of experimental manipulations. Measures of the dependent variables were adapted from similar studies by Elder and Krishna (2010) and Hansen (2014). Taste was measured by one item: "How good did this chocolate taste?" Response alternatives were given on a scale ranging from 1 (very bad) to 7 (very good).

To test the concurrent validity of our results, we also asked participants whether they were likely to purchase this new chocolate, and if they thought it would be popular among consumers. The argument behind this is that if an effect of negative information on taste results from the aforementioned cognitive top-down process, it should also affect other consumer judgments resulting from cognitive processing. Both purchase intentions and respondents′ thoughts about a product gaining popularity in the market are based on such cognitive processes. We can therefore assume that negative information will also reduce purchase intentions and beliefs in the product's market performance, and that the process leading to this reduction will be constrained by the cognitive load manipulation. Purchase intention was measured by one item: "If I were to buy dark chocolate today, I would buy this product." Perceived popularity was measured by two items: "This product will not be widely accepted in Norwegian households" (reverse coded) and "Only a marginal number of consumers will like this chocolate" (reverse coded). Response alternatives for these items were given on a scale ranging from 1 (totally disagree) to 7 (totally agree).

Data analyses and results

We first checked the mean scores and standard deviations for the dependent variables, and these are reported in Table 1. To test our hypotheses we then ran a One-way ANOVA with taste as the dependent variable and experimental group as the factor. The results show a significant difference between groups, with F = 3.16 (p = .032). Further t-tests between the groups show that subjects given negative information scored significantly lower on taste perception (4.20), than subjects given neutral information (5.16) (t = 2.36, p = .02). Thus, the hypothesis that negative product information influences taste perception in a negative direction (H1) was supported by our data. Next, group 2 (negative information/low cognitive load) and 3 (negative information/high cognitive load) were compared to explore whether the effect of negative product information on taste perception was reversed under the condition of high cognitive load. The results showed that subjects assigned to the high cognitive load condition scored significantly higher on taste perception (5.08) than subjects assigned to the low cognitive load condition (4.20) (t = 2.30, p = .03). In other words, the effect of negative product information on taste perception was practically zeroed out at a high level of cognitive load. Thus, the hypothesis that the effect of negative product information will depend on the magnitude of an additional cognitive load (H2) was supported in our study. There was no significant difference in taste evaluation between groups 1 and 3, that is the neutral info/low load and negative info/high load groups (t = 0.201, p = .842).

Table 1. Means and standard deviations across the three experimental cells.

Condition	Taste	Purchase intention	Perceived popularity
Neutral info/low cogn. load	5.16 (1.49)	3.80 (2.10)	4.68 (1.37)
Negative info/low cogn. load	4.20 (1.38)	2.68 (1.49)	3.67 (1.37)
Negavtive info/high cogn. load	5.08 (1.32)	4.12 (1.76)	4.72 (1.13)

We then ran the same procedure for our two validation variables – purchase intentions and perceived product popularity. Again the results of the ANOVA were significant, with $F = 4.39$ ($p = .016$) and 5.16 ($p = .008$), respectively. Running t-tests for the effect on purchase intentions and product popularity between groups yielded similar results as for taste. There are significant differences between groups 1 and 2, and between 2 and 3, but not between 1 and 3. See Figures 1, 2 and 3 for a clear picture of group differences.

Discussion

The overall results of our study show that 1) taste evaluations are influenced by product information offered prior to taste, with less positive taste ratings for subjects given the negative information, and 2) that cognitive load

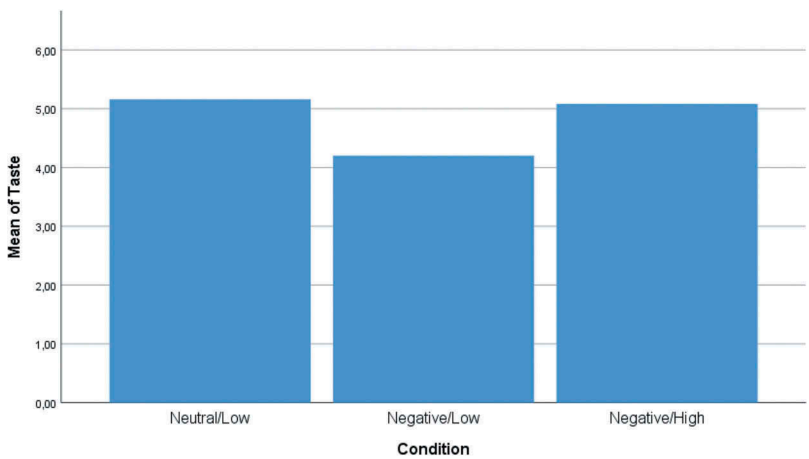

Figure 1. Taste evaluations across three experimental conditions.

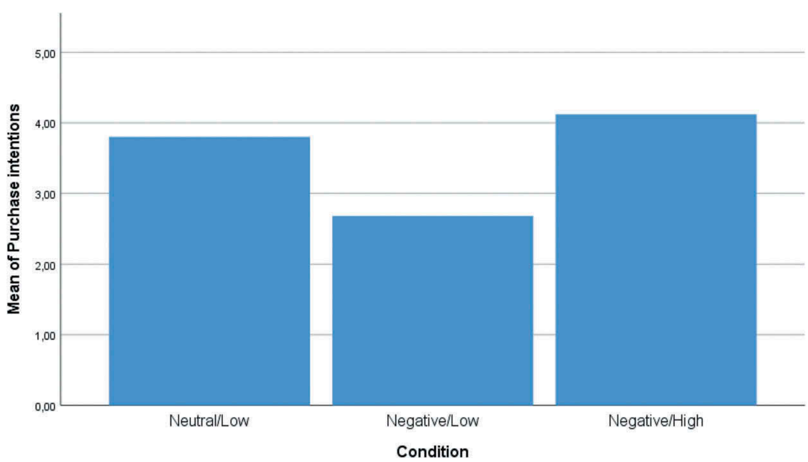

Figure 2. Purchase intentions across three experimental conditions.

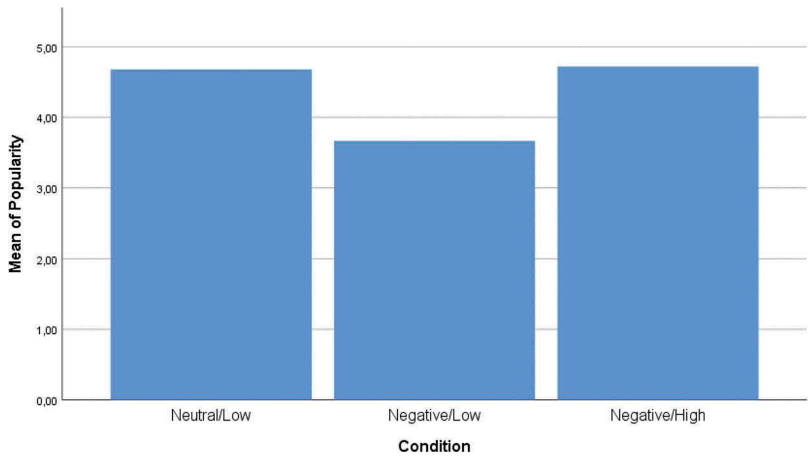

Figure 3. Perceived product popularity between experimental conditions.

reduces (removes) the effect of negative information on taste. There are three major contributions to be highlighted from these findings. Firstly, we replicate previous studies that have established the effect of product information on taste (e.g. Hansen, 2014; Hersleth et al., 2003; Lee et al., 2006). We also extend current knowledge by showing that negative, non-sensory-related information both decrease the perception of whether the product tastes good, and that a similar effect is found for purchase intentions and beliefs in the products popularity in the market. In other words, we find a negative effect on dependent variables that should intuitively be affected by negative information. To our knowledge, this is a contribution in itself, as no study we have seen have simultaneously scrutinized how non-taste related product information affects cognitive first-person (purchase intentions) and third-person (product popularity) variables, and sensory variables (taste). This, we argue, strengthens the validity of our results.

Secondly, and more important, our results indicate that for taste evaluations that follow a top-down process, the evaluative output is hampered when cognitive capacity is constrained. The cognitive load given at the beginning of the experimental session limits the available capacity in the subjects' working memory, thereby limiting the processing of negative information presented to them at a later stage. Consequently, the negative information is "lost," and its negative effect on taste evaluation is practically removed. These results support the notion that when taste perception not merely results from a physiological sensory experience based on chemical stimuli affecting lingual taste receptors, the process is prone to be de-railed by the same mechanisms as other cognitive evaluation processes (Elder & Krishna, 2010; Shiv & Fedorikhin, 1999). Again, we will point out that when higher cognitive load both limits the effect on the outcome of typical higher order processes (purchase intentions and product popularity), *and* taste evaluation, this is an indication that taste perception is often the result of a more deliberate evaluation than an automatic bottom-up process.

Finally, the negative information employed in this study was unrelated to taste or consumption situation. Where previous studies have found information related to ingredients (Lee et al., 2006), consumption context (Hersleth et al., 2003), number of senses activated by ads (Elder & Krishna, 2010), healthy/unhealthy labeling (Raghunatan et al., 2006), or drinking glass (Krishna & Morrin, 2008) to influence taste perceptions, this study presented participants with negative information of a more secondary type. The negativity manipulation was based on the chocolate containing a genetically modified palm oil. While this might be argued to concern product ingredients, the negative element here is primarily related to 1) GMO´s having a negative image in Norway, and 2) the extremely negative attitude Norwegians hold toward the devastation of forests resulting from palm oil production. In this respect, it is not the palm oil itself that is negative, it is how the palm oil is produced, and how the industry is believed to devastate forests half-way across the globe that annoys people. Recall also that our information manipulation did contain any negative descriptions about palm oil, but just mentioned that the chocolate contained it. Hence, activating a negative, already held association that started a top-down process influenced taste even when this information was of a more secondary type. We believe this also merits to be mentioned as an interesting aspect of this study.

As argued in the introduction section, taste is the cardinal attribute in terms of consumer choice between alternative food products. In that respect, marketers can be tempted to think that "as long as it tastes good, people will buy my product." Our study indicate that this is an attitude prone to surprise food marketers. If food products attract negative attention, and consumers are exposed to negative information about the product itself, the producer, or the production methods, our results indicate that this will also influence their perception of taste. And – their purchase intentions and how they believe others will like it. In that respect, the managerial implications of our study are several. Firstly, managers need to pay close attention even to secondary, non-taste related product information, and how consumers evaluate and emphasize this information. This is especially important for multinationals, where a production method, marketing activity, HR-policy or operational procedure that is acceptable for consumers in one market, may be viewed completely different in others. Secondly, and more positive, is that consumers whose cognitive capacities are occupied with other tasks are less influenced by negative information.

Our study, and the results of it, also make way for suggestions for future research. One is based on the fact that we have only tested three variations of two variables. To get a full 2 × 2 factorial design, we could have included also a fourth cell where subjects were given neutral information under a condition of high cognitive load. In retrospect, our study would have benefited from such a design. However, in the study by Elder and Krishna (2010), they found that when exposed to an ad that focused on multiple senses, respondents rated the taste of popcorn given to them as better than when the ad focused on one sense only (taste). Under a condition of cognitive load, there was no such difference, and there was no main effect of cognitive load. While this suggests that including a fourth cell to check the main effect of cognitive load would leave us with a cleaner design, we are not convinced that the results would be different. However, future research would benefit from adopting such a 2 × 2 design.[1] In line with our hypothesis, we find that the effect of negative information is not present under high cognitive load. This, we argue is caused by the cognitive resources needed to process the negative information being constrained. However, an alternative explanation can be that the cognitive load hinders the negative information from even entering working memory, and there is no information to process. While the result on taste evaluations is the same, no effect of negative information, the underlying process would be different. We could have included a memory test to check this in our study, and suggest that future studies extend our research by following up on this note and thereby assessing the degree to which the negative information enters memory at all in conditions of high cognitive load[1]. Next, we have focused on negative information only, and while there are other studies on the effect of positive information on taste perceptions, we believe future research would offer interesting nuances to current knowledge by studying both negative and positive information, and make comparisons as to both effects and the degree to which cognitive load limits the effect of different kinds of information on taste. While research on how cognitive product information influence taste perceptions is continuously growing, there are still fruitful paths to be pursued.

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[1]We thank one of the reviewers for pointing this out.

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