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## Assessing Visual Semantics Experimentally

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Viktor Smith\*, Daniel Barratt and Henrik Selsøe Sørensen

# Do natural pictures mean natural tastes? Assessing visual semantics experimentally

**Abstract:** A widespread assumption in Danish consumer law is that if the package of a food product carries a picture of a potentially taste-giving ingredient (say, a strawberry), then consumers will expect the corresponding taste to stem primarily from that ingredient rather than from artificial flavouring. However, this is not expected to be the case if the packaging carries only a verbal indication of the potential ingredient (say, the word *strawberry*). We put these assumptions to experimental test. Our goal was to contribute firmer evidence to the legal decision-making in the present field while at the same time providing new perspectives and data to the general theoretical debate on the communicative potential of pictures versus words. Our findings showed that pictures did have an effect on assessments of naturalness that was however marginal compared to that of product type. Moreover, participants' general level of food knowledge had a significant influence on their expectations about naturalness.

**Keywords:** pictures, words, visual semantics, propositional indeterminacy, relevance theory, conceptual combination, food labelling, consumer law

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## 1 Introduction

### 1.1 Background and aims

While both pictures and words are used extensively as vehicles of human communication, the perceptual and cognitive mechanisms by which they

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operate and the sorts of messages they are capable of conveying differ profoundly. The differences and interaction between pictures and words have been subject to much investigation and debate in research paradigms spanning from Peircean semiotics and (post-)structural semasiology (Peirce 1867–1893/1992; Bartes 1968; Sonesson 1989) through visual rhetoric (Scott 1994; Kress and van Leeuwen 2006) to models of online language and image processing (e.g., Hartsuiker et al. 2008; Chen and Spence 2010; Andersson 2012) and neural computation (e.g., Kircher et al. 2009; Tylén, Wallentin, and Roepstorff 2009). At the same time, in many real-life communicative domains where pictures and words interact, these issues are dealt with by professionals who rely on their practical experience and common sense rather than on explicit cognitive, semiotic, or other generalized theorizing or systematic empirical evidence.

In the present study, we address one such field of real-life activity, namely the labelling<sup>1</sup> of commercial food products and, specifically, the assessments made by lawyers, government officials, and ultimately courts as to whether the symphonies of words, texts, figures, and pictures found on food packages are likely to inform or mislead consumers about the product inside. We rely primarily on an extensive quantitative and qualitative review of Danish administrative and legal practices in this field (Smith et al. 2009; Møgelvang-Hansen 2010). Among other findings, the review showed that more advanced forms of visual persuasion (such as pictures of healthy-looking people on not-so-healthy products) tend to escape legal evaluation for lack of explicit propositional arguments (see Bone and France 2001 for similar observations for US consumer law). Nevertheless, certain rather specific assumptions have crystallized in the authorities' daily practices on seemingly more "trivial" ways of using pictures on food packages. This includes an alleged difference in consumers' understanding of pictures of potentially taste-giving ingredients (say, strawberries or sour cream and onions) compared to verbal indications to the same effect (say, the words *strawberry* or *sour cream and onions*) with regards to the expected naturalness of the corresponding taste; for details, see Section 1.3.

In this study, we shall transpose the above-mentioned pre-theoretical assumptions into more exact theoretical terms and put them to experimental test. Our aim is twofold. On the one hand, we wish to contribute new insights and empirical evidence for supporting future legal decision-making and the self-regulation of the food industry on these issues. On the other hand, we wish to introduce a new type of data to the general debate on the communicative

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<sup>1</sup> In accordance with EU Directive 1169/2011, Article 2,2(i), we will refer to all information on food packages as *food labelling* (consisting of various *labelling elements*), thus using these terms in a somewhat broader sense than in ordinary language.

potential of pictures versus words in cognitive science research, comparing alternative paths of theoretical explanation for the findings and identifying issues in need of further investigation.

## 1.2 Pictures versus words: Iconicity, indexicality, and propositional indeterminacy

To pinpoint the cognitive phenomena at stake in the pre-theoretical legal considerations to be presented below, let us first consider three widely acknowledged properties that distinguish pictures from words, following Messaris' elaboration (Messaris 1994; 1997) on the classic trichotomy of communicative signs suggested by Peirce (1867–1893/1992).

(a) *Iconicity*. Unlike words, most pictures bear some degree of immediate visual resemblance to the objects depicted. This property holds true of both photographs and drawings, assuming that we are dealing with non-abstract representations. The main implication of iconicity is that the processing of pictures will involve the visual system, which we also use to detect actual objects and events. In turn, this system is related to a variety of additional systems via associative connections (Damasio and Damasio 1994; Beauchamp et al. 2002; Vermeulen, Corneille, and Niedenthal 2008) including the systems underlying taste and reward (Simmons, Martin, and Barsalou 2005). This means that seeing a picture of a strawberry involves a more direct and complete experience of the object type in question than merely reading the word *strawberry*.

(b) *Indexicality*.<sup>2</sup> Some pictures, namely, celluloid and digital photographs, are caused by the objects they represent in brute physical terms. That is, patterns of light reflected from the strawberry's surface trigger chemical changes in the case of celluloid-based photographs and electrical changes in the case of digital photographs. In contrast, a drawing of a strawberry is produced by the hand of an artist who is working with a certain degree of creative freedom. One of the potential implications is that the viewer will tend to regard photographs as possessing a higher level of evidential, or documentary, status (see Currie 1991 and Plantinga 1997 on the evidential status of photographs and documentary film).

(c) *Propositional (syntactic) indeterminacy*. Like words, pictures may *refer* to objects and events (by resembling them), but they lack the symbolic and syntactic devices necessary for making explicit propositional arguments about

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<sup>2</sup> Following Messaris (1994; 1997), we use the term *indexicality* in the narrow sense of *photographic indexicality*. The broader sense of the term includes other causal relationships such as smoke as an index of fire, and sneeze as an index of a head cold.

them. Take the utterance *contains 10% strawberry concentrate* as compared to a picture of a strawberry on the packaging. Nothing about the picture itself tells us whether it “means” that the product contains strawberries, tastes of strawberries, is shaped like strawberries, may be eaten with strawberries, and so on.

To make sense of the picture, the viewer will need to fill in the symbolic and syntactic gaps relying on general cognitive procedures such as the assumption of optimal communicative relevance (Sperber and Wilson 1987; 1995). Several theorists have attempted to show that the interpretation of pictures is subject to certain rules and conventions in its own right presented under such headings as “visual literacy” (Debes 1969; Messaris 1994), “visual rhetoric” (Scott 1997), “visual grammar” (Kress and van Leeuwen 2006), “pictorial semiotics” (Sonesson 1989), and “pictorial metaphors” (Forceville 1996). However, it is also widely recognized that such conventions display a higher degree of flexibility and variation across time, media, cultures, and genres than those underlying, say, British English spelling or Russian verb aspect.

The paradox addressed in this study, then, is that in some real-life domains rather specific “rules” have nevertheless been postulated for how people are likely to understand pictorial messages, in turn, implying that there is a “correct” way to understand those messages. Indeed, the Danish food authorities tend to treat pictures as less propositionally indeterminate than words; i.e., as being capable of conveying a more specific semantic content as further described in Sections 1.3 and 4.1.1.

Rather than looking for any further theoretical support for or against such assumptions *a priori*, in the following we transpose them into a set of explicit hypotheses and put them to experimental test. To our mind, this ensures a more solid ecological basis for identifying questions of genuine importance to understanding the interplay between pictures and words in real-life situations than taking a theory-driven top-down approach from the outset (see Andersson 2012 for a similar view). Instead of asking “How can the real-life concerns just introduced contribute to promoting and refining our favourite theoretical or methodological paradigm(s)?”, in this study we ask “How can the theoretical and methodological paradigms presently available in cognitive and semiotic research contribute to handling a widely recognized societal challenge in a more informed and consistent manner – while possibly refining the paradigms themselves in the process?”

### 1.3 Legal practices and the need for firmer evidence

In the European Union (EU), the general legal provisions against misleading labelling of food products are stipulated by Article 16 of the EU Food Regulation

(2002/178), the Food Information for Consumers Regulation (1169/2011), and the *Unfair Commercial Practices Directive* (2005/29). Many of these provisions are stated in highly general terms and require further interpretation.<sup>3</sup> The gaps are filled on a case-by-case basis by the relevant national administrative bodies and, ultimately, by courts across the EU with the European Court of Justice as the final instance. Such decisions are not based primarily on theoretical considerations or empirical evidence, but rather on lawyers' and government officials' common-sense judgements as to the likelihood that someone might in fact be misled, with the "average consumer" serving as a key benchmark.<sup>4</sup>

Despite the common rules, national administrative practices within the EU tend to vary in several essential respects. Following the total harmonization of the written rules, there is however also an increasing call for more consistency in the application of the rules across national borders. In turn, this has fostered a call in the legal literature for harder evidence to underpin the legal decision-making with input also from other areas of research than strictly legal ones, notably those subsumed under the heading of cognitive science (Legrand 1996; Incardona and Poncibò 2007; Micklitz, Smith, and Rørdam 2010).

Taking up this call, we address a set of assumptions that have been canonized by the Danish authorities and courts over several years but are now being increasingly challenged from outside. We rely on a quantitative and qualitative review of a sample of 821 Danish cases on misleading food naming and labelling processes by the Danish food authorities during the period 2002 to 2007 (Smith et al. 2009; Møgelvang-Hansen 2010). A key observation is that among those instances where a labelling element is pointed out as potentially misleading, only 8% concerned purely non-verbal elements (all of them pictures), rising to 13% if we include hybrids such as logos and signpost labels. The remaining 87% concerned purely verbal elements such as product names, verbal claims, and

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<sup>3</sup> Regulation 178/2002/EU offers no explicit definition of misleading food labelling; it merely stipulates the prohibition. The *Unfair Commercial Practices Directive* 2005/29/EC, Article 6, offers some criteria on misleading commercial practices in general. These criteria cover both untruthful information and factually correct information that is nevertheless "likely" to deceive an average consumer. In either case, the information must cause or be likely to cause the average consumer to make a transactional decision that (s)he would not otherwise have made. It is judgements of likelihood that completely dominate in current practices; reliance on empirical evidence is a rare exception. For overviews and further discussion, see Howells, Micklitz, and Wilhelmsson 2006; MacMaoláin 2007; Trzaskowski 2011.

<sup>4</sup> The average consumer is defined in the Preamble of the Directive, Item 18, as "reasonably well informed and reasonably observant and circumspect, taking into account social, cultural and linguistic factors," a definition that has been subject to severe criticism for its vagueness and lack of differentiation between people's different way of acting in actual purchase situations (for discussion, see e.g., Incardona and Poncibò 2007; Trzaskowski 2011).

nutrition facts. A possible explanation for this asymmetry is that verbal elements are capable of presenting explicit propositional arguments that are assessable in terms of truth and falsity and are hence easier to complain about in an unambiguous manner (Smith, Møgelvang-Hansen, and Hyldig 2010; also see Messaris 1994; 1997; Bone and France 2001).

Nevertheless, for some seemingly “trivial” conflict scenarios involving pictures, certain rules-of-thumb have been developed. One such rule-of-thumb is that if the food packaging depicts a potentially taste-giving ingredient then the taste in question should originate primarily from that ingredient and not from artificial flavouring (even if artificial flavouring was used to “adjust” the taste). That is, if a soda pop carries a picture of a strawberry, then it should owe most of its taste to real strawberries, but otherwise not.<sup>5</sup> By contrast, verbal indications are generally exempted from this principle. Notably, this is true not only for precise formulations such as *with artificial strawberry flavour*, but also when the taste is indicated by a single word such as *strawberry* placed in isolation on the packaging or in immediate connection with the generic product name (e.g., *strawberry tea*). In effect, the Danish authorities thus treat pictures as more propositionally determinate than words, despite the fact that a noun without an explicit clause surrounding it does not say any more about the intended propositional content than a picture.

Yet no rules are without exceptions, especially when the final judgment comes down to common sense.<sup>6</sup> In one case, for example, the authorities deemed pictures of bananas and other fruits on a pack of cream biscuits as being misleading in their own right, but ultimately accepted that the pictures could be retained, provided that the manufacturer added a clear verbal indication on the front of the packaging saying that the product did not contain any fruit but only artificial flavouring. In another case, the central national authorities eventually overruled the decision of a regional office and accepted a highly stylized drawing resembling fruits on a pack of chewing gum. This was motivated by the very fact that the picture was so stylized and sketchy that it could hardly be taken as an indication of real fruit, but simply of a taste variety, given also the product type. While the first example mainly concerns the strength of

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<sup>5</sup> Examples: Case No 2007-S7-274-00392 (beef-flavoured sausage made of pork); Case No 2005-09-274-00173 (raspberry and melon-flavoured soft drink); Case No 05-274-00419 (hazelnut-flavoured syrup); Case No 2005-05-274-00474 (fruit-flavoured tea and candy); Case No 2005-10-712-11053 (fruit-flavoured toffees); and several others. The case numbers refer to the filing system of the Danish Veterinary and Food Administration (DVFA) and its Regional Offices.

<sup>6</sup> The following two examples refer to Case No: 2002-05-274-00006 (biscuits with fruit pictures) and DVFA appeal case 1150-1387/01 (chewing gum with fruit flavour).



verbal disambiguation, the second entails a rather subtle assumption concerning “pure” visual semantics: that the constellation *realistic picture* + *artificial taste* is potentially misleading, whereas *artificial picture* + *artificial taste* is not. If true, this might offer a means for manufacturers to graduate the scope of their visual messages. However, if the initial assumption of a greater “literality” of pictures compared to words is valid in the first place, can it be graduated at all? The bottom line is that today we have no hard evidence pointing in any of these directions, only intuitive wisdom.

## 1.4 Hypotheses

In the experimental study, we put the tentative hypotheses emerging from the real-life legal considerations summarized above to experimental test. The hypotheses can be summarized as follows:

H1: For commercial food products featuring a characteristic taste that may stem from a natural ingredient, consumers will expect a relatively larger proportion (or all) of that taste to stem from the ingredient in question rather than from artificial flavouring if the package carries a picture of it, and a relatively smaller proportion (or none) if the packaging carries only a verbal indication of it.

H2: The effect will be stronger for naturalistic pictures (i.e., photographs) and weaker for artificial pictures (i.e., stylized drawings).

Furthermore, as indicated above, legal judgments on these issues do not necessarily need to be valid for all consumers, only for the benchmark “average consumer.” This notion has been strongly criticized for bringing together too many dimensions such as knowledge levels, attitudes, current shopping purpose, age, etc., under one heading without offering strict measures of any of them (e.g., Incardona and Poncibò 2007; Trzaskowski 2011; Selsø Sørensen et al. 2013; see also footnote 4). Nevertheless, there is a wide consensus that the individual consumer’s level of all-around knowledge on food and food-related issues is an essential and relatively stable factor. We therefore supplemented the main experimental task with a questionnaire developed as a generic tool for measuring food knowledge levels (Selsø Sørensen et al. 2013) to see if consumers clearly above and below average would respond differently to our current task. Considering that this notion is rarely referred to directly in the case material analysed but merely presupposed as a general basis for the decision-making in this field, we decided to take an explorative approach rather than setting up specific hypotheses in advance. However, we were bearing in

mind the universal wisdom that “those who know less are easier to fool.” This might imply that consumers below average would be easier to persuade about naturalness in general and possibly also more sensitive to pictures, and vice versa for those above average.

## 2 Materials and methods

### 2.1 Materials

#### 2.1.1 Target stimuli

The target stimuli were bitmaps of the packaging fronts for real food products manipulated using Corel Paint Shop Pro Photo XI (see Figures 1 and 2). A total of 12 food products were selected from less common brands on the Danish market in order to reduce the likelihood of the participants recognizing the designs and having pre-established opinions. The packages were manipulated and anonymized further by changing the brand names into fictional ones. The products were intended to represent such product types (a) which come in different taste variants out of which one was selected for each product for the purpose of the experiment, ensuring a systematic variation of taste variants across products and (b) for which the taste in question could be expected to stem from anything from “all natural” to “all artificial” ingredients. Each product was matched with one taste related to a (potential) ingredient from the categories of fruit, vegetables, meat, or alcohol,

	Key ingredient	Stimulus set 1	Stimulus set 2	Stimulus set 3
Avocado Guacamole Dip	Avocado	No picture	Drawing	Photograph
Fruit Candy	Fruit	No picture	Drawing	Photograph
Sour Cream & Onion Chips	Sour cream and onion	No picture	Drawing	Photograph
Beef Bouillon Cubes	Beef	No picture	Drawing	Photograph
Peach Ice Tea	Peach	Drawing	Photograph	No picture
Raspberry Soda	Raspberry	Drawing	Photograph	No picture
Strawberry Mazarins	Strawberry	Drawing	Photograph	No picture
Chicken Noodles	Chicken	Drawing	Photograph	No picture
Brandy Beans	Brandy	Photograph	No picture	Drawing
Vanilla Wafers	Vanilla	Photograph	No picture	Drawing
Blackcurrant Tea	Blackcurrant	Photograph	No picture	Drawing
Cherry Yoghurt	Cherry	Photograph	No picture	Drawing

**Figure 1:** List of stimuli, key ingredients, and stimulus sets.

A: No picture	B: Drawing	C: Photograph
		
		

Figure 2: Examples of target stimuli.

with no repetitions: for example, *ice tea* was matched with the taste variant *peach*, and *bouillon cubes* was matched with the taste variant *beef*.

For each of the 12 food products, three different conditions (i.e., packaging designs) were constructed, yielding a total of 36 stimuli. In condition A, there was no picture of the potentially taste-giving ingredient, only a verbal indication in the shape of an isolated word such as *hindbær* (raspberry) or as a part of the product name such as *frugt-* (fruit/fruits) in *frugtbolcher* (fruit candy). In two cases, the English name of the ingredient(s) was used because it was just as commonly used on the Danish food market, i.e., *sour cream and onion* on potato chips and *chicken* on instant noodles. In condition B, a stylized drawing of the potentially taste-giving ingredient was added, but otherwise the design was the same. In condition C, a photograph of the potentially taste-giving ingredient was added instead of the drawing. The drawings and photographs were found on the internet through the use of search engines such as Google Images. If the product’s package already carried either a drawing or a photograph of the relevant ingredient, then this picture was retained and the remaining two versions were constructed. The drawings and the photographs were equivalent in size and prominence.

### 2.1.2 Control stimuli

The 12 control stimuli were bitmaps of the packaging fronts for real Danish food products (common brands) using the original brand names such as *Carletti*, *Rynkeby*, and *Toms*. We selected six products for which we believed that the taste indicated verbally on the package would be expected by most Danish consumers to actually stem from natural ingredients (e.g., apple juice) and six products for which we believed that the taste indicated verbally on the package would be expected by most consumers to stem from artificial flavouring only (e.g., strawberry-flavoured chewing gum). The packages either carried no picture at all or a picture that could not be associated with taste-giving ingredient(s) and was hence irrelevant to the task. For two products, a picture of the key ingredient(s) had to be replaced/removed through digital manipulation.

The controls served four functions: first, to distract attention away from the fact that the targets were being varied with respect to the picture of potentially taste-giving ingredients; second, to present some clear-cut cases of either “obviously natural” or “obviously artificial” products in order to encourage the participants to feel more confident about their choices with respect to the targets; third, to present some familiar brands in order to set a realistic scene; and fourth, to check if the product types selected by us as targets were indeed representing intermediate cases between the extreme points of “all natural ingredients” and “all artificial ingredients” and thus likely to be sufficiently sensitive to the absence/presence of pictures. In other words, in the naturalness-rating task described below, we expected the mean scores of the six expectedly natural controls to be significantly higher and of the six expectedly artificial controls to be significantly lower than the mean scores of the targets across the three conditions.

### 2.1.3 Stimulus sets

Three stimulus sets were constructed. Each stimulus set contained 12 targets and 12 controls, so that each participant was presented with a total of 24 stimuli. In a given stimulus set, each of the 12 targets was represented only once (Figure 1). There were four instances of the no-picture condition (A), four instances of the drawing condition (B), and four instances of the photograph condition (C). For each target, the picture manipulation was varied across the three stimulus sets, so that all three possibilities were covered. The 12 controls were identical across the three stimulus sets.

### 2.1.4 Questionnaire

In addition to performing a rating task involving the above stimuli, the participants were asked to fill out a questionnaire in order to test their general knowledge of food and food-related issues. This questionnaire was developed as a generic tool for assessing consumer knowledge levels in combination with a series of experimental investigations into the potential misleadingness of individual food labelling solutions, among which the present study is one (Selsøe Sørensen et al. 2013).

The questionnaire contained 45 factual questions and 15 questions relating to the recognition of signpost labels. The 45 factual questions were selected using four criteria: they represented a broad range of common food products and categories; they represented types of information corresponding to that conveyed by such types of labelling elements that are commonly accused of causing consumers to be misled; they did not assume expert knowledge about such matters as nutrition science and food law; they lent themselves to creating three possible answers which would all seem plausible to participants who did not know the correct answer beforehand.

The multiple choice model was chosen so that the analysis of the participants' answers would not rely too much on the experimenter's interpretations of individual answers, setting the scope of possible answers and the correct one in advance. The 15 signpost labels were selected from those labels most commonly found on Danish food packages: for example, the organic farming logo and the recycling logo. For the questions on 15 signpost labels, a free response model was chosen, as otherwise it would have been too easy for the participants to guess the correct answers. There were three options to choose from: *I do not know the label*, *I know the label but I cannot say what it stands for*, and *I know the label and it stands for [insert answer]*. Correct and reasonably correct answers counted.

## 2.2 Method

### 2.2.1 Participants

The participants were 148 Danish consumers (87 female, 61 male; age range 18–76 years; mean age 47.8 years) recruited in a Danish supermarket. The supermarket was SuperBest in the town of Viby Sjælland (population < 20,000), close to Copenhagen, Denmark. The participants received a gift (a bottle of wine, a box of chocolates, or a package of coffee) with a monetary value of about 40

Danish kroner. All of the participants were native Danish speakers and all had either normal or corrected-to-normal vision.

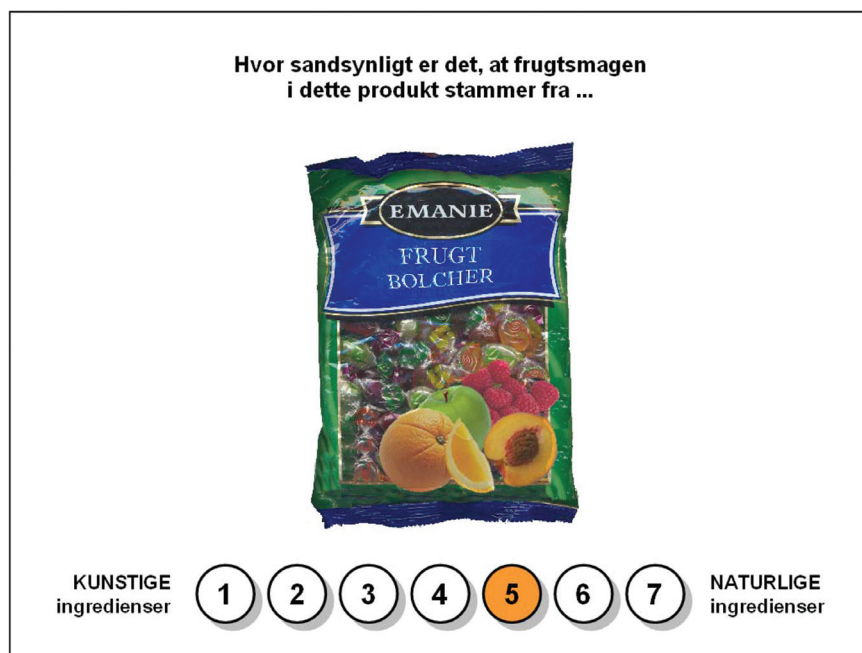
The location was chosen in order to obtain a good mix of demographic groups. An effort was made to recruit a roughly equal number of participants from both genders and from different age groups (18 to 19 years, 20 to 29 years, 30 to 39 years, and so forth). It was easier, however, to recruit certain demographic groups than others. For example, female customers were generally more frequent and more willing to participate than male customers, while elderly customers generally had more time to spare than young working parents who were shopping to a deadline. Both of these points are reflected in the relatively high proportion of female participants and the relatively high mean age. The participants were divided into three roughly equal groups and each group was presented with one of the three stimulus sets described above: 49 participants were presented with stimulus set 1, 51 participants were presented with stimulus set 2, and 48 participants were presented with stimulus set 3. Thus, each participant only saw one version of each target, reducing the chances of their becoming suspicious about the picture manipulation.

### 2.2.2 Apparatus

The data collection was conducted in a separate area in the supermarket. The experiment was run on three IBM-compatible laptop computers, one for each of the stimulus sets and participant groups. The presentation of stimuli and the recording of responses were controlled by E-Prime software (Psychology Software Testing, Pittsburgh, PA). The stimuli were displayed on an LCD monitor: the display size was approximately 15 inches (38.1 cm) measured diagonally, the aspect ratio was 5:3, and the resolution was 1280 × 768 pixels. The viewing distance was approximately 60 cm. Responses were entered on the keyboard.

### 2.2.3 Procedure

The experiment was divided into two parts. The first part involved the main rating task. The rating task began with a practice session of three examples. For the active session, the 24 food packaging fronts were presented in random order. For each package, the stimulus/response display followed the same template (see Figure 3). The main question was presented at the top of the display: *How likely do you think it is that the product owes its taste of [name of potentially taste-giving ingredient also indicated verbally on the package front] to ...* + response



**Figure 3:** Example of stimulus/response display.

scale (see Figure 3).<sup>7</sup> The bitmap of the food package was presented in the middle of the display. The size of the bitmap was standardized in the following way. If the height exceeded the width, then the height was set at 460 pixels (60 % of the display height on a monitor with a standard aspect ratio of 4:3). If the width exceeded the height, then the width was set at 922 pixels (90 % of the display width on the same monitor).

The response scale was presented at the bottom of the display. The participants were instructed to rate the likeliness that the taste indicated verbally on the package (and repeated in the question on a scale) would stem from 1 *ARTIFICIAL ingredients* to 7 *NATURAL ingredients* or something in between by pressing the corresponding key on the keyboard. When the participants entered their response, the corresponding number on the scale was highlighted in orange. The participant was free to change their response until they were satisfied. The participants were instructed to press the “enter” key to finalize their response and proceed to the next stimulus.

<sup>7</sup> All original instructions and questions were given in Danish but are here translated into English.

In the second part of the experiment, the participants were asked to fill out the questionnaire designed to test their general knowledge of food and food-related issues. The participants filled out the questionnaire at a separate table, while new participants were performing the rating task. The participants had no access to the Internet or reference books, and were not able to consult anyone orally.

## 3 Results

### 3.1 Analysis of rating scores

We broke down our analysis of the participants' rating scores into two parts. The aim of the first analysis was to determine the status of the target products in terms of their general level of perceived naturalness with respect to the main taste-giving ingredient, irrespective of the picture manipulation (see Figure 4, upper bar chart). To begin with, we compared the overall mean score for the 12 target products with the overall mean scores for the six control products that we expected to be perceived as having a high level of naturalness regarding the taste in question and the six control products that we expected to be perceived as having a low level of naturalness in this respect. A one-way repeated measures ANOVA revealed that the relationship between the target and control products was significant,  $F(1.49, 219.22) = 323.60, p < 0.001$ .<sup>8</sup> On average, the "natural" controls were given the highest scores (mean 4.39) and the "artificial" controls were given the lowest scores (mean 2.13), with the scores for the target products coming halfway between the two (mean 3.01). This analysis confirmed that the target products belonged to a "middle zone" where naturalness would be more open to verbo-visual negotiation. In addition, we examined the relationship between the 12 target products (see Figure 4, lower bar chart). A one-way repeated measures ANOVA revealed that this relationship was also significant,  $F(8.93, 1312.44) = 26.45, p < 0.001$ . For example, the participants' general belief in the naturalness of Beef Bouillon (with or without picture; mean 2.16) was much higher than their general belief in the naturalness of Fruit Candy (with or without picture; mean 4.08).

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<sup>8</sup> For the one-way ANOVAs, Mauchly's test indicated that the assumption of sphericity had been violated. Therefore, degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity.



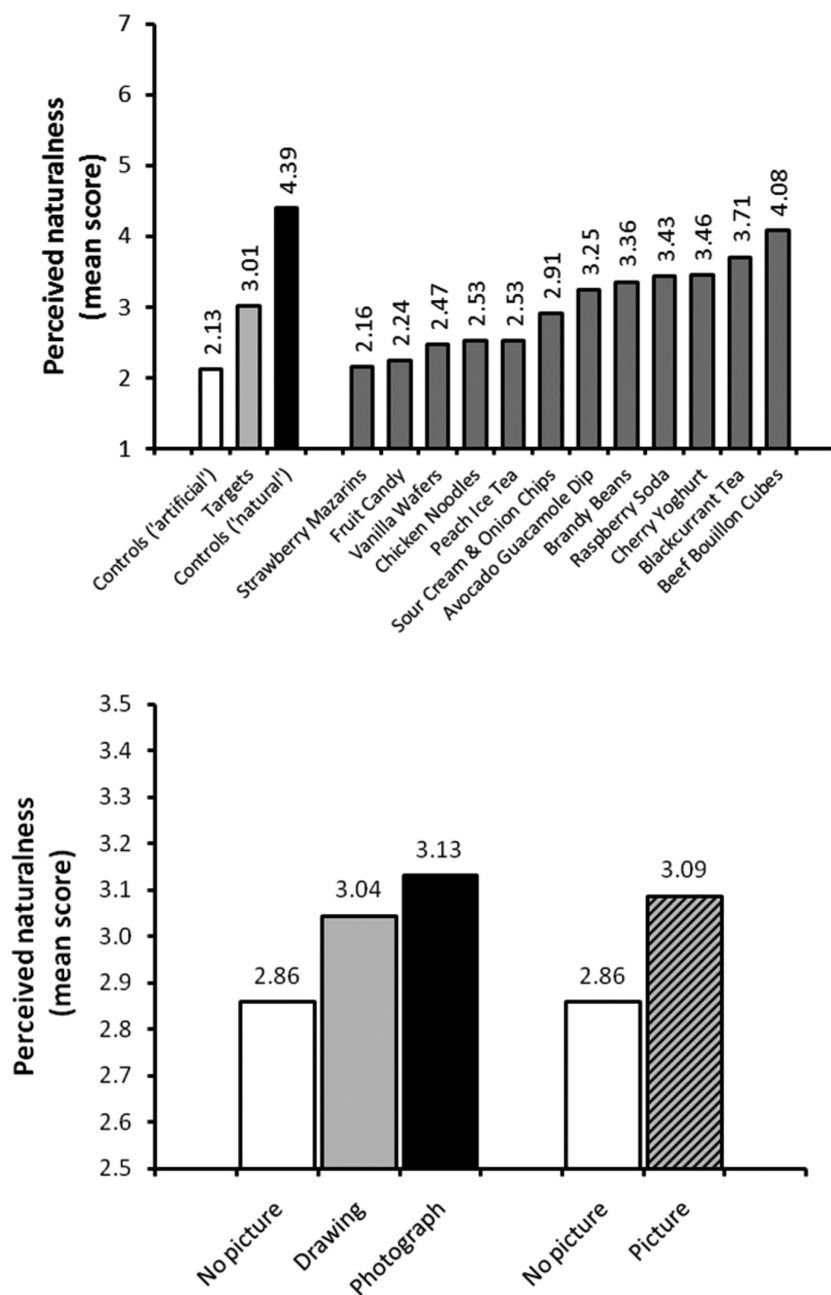


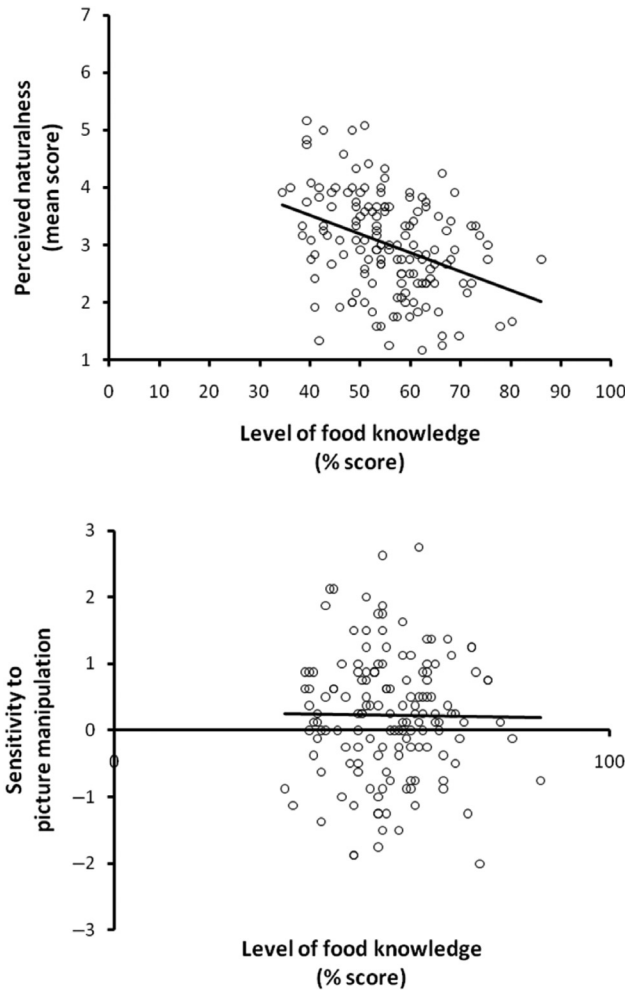
Figure 4: Analysis of rating scores.

The aim of the second analysis was to investigate the relationship between the three key conditions: the no-picture, drawing, and photograph conditions (see Figure 4, lower bar chart). For each participant, the mean score for each of the three conditions was calculated. A one-way repeated measures ANOVA revealed that there was a significant difference between the three conditions,  $F(1.89, 278.20) = 4.63$ ,  $p < 0.05$ . Planned comparisons using Fisher's LSD revealed that there was a significant difference between the no-picture condition and the drawing condition (2.86 vs 3.04),  $p < 0.05$ , and a significant difference between the no-picture condition and the photograph condition (2.86 vs 3.13),  $p < 0.01$ . However, the difference between the drawing condition and the photograph condition did not reach significance (3.04 vs 3.13),  $p = 0.36$ . In light of this, we decided to merge the drawing condition and the photograph condition to form a more general picture condition. A paired-samples  $t$ -test confirmed that the difference between the no-picture condition and the picture condition was significant (2.86 vs 3.09),  $t(147) = 3.04$ ,  $p < 0.01$ . Thus, Hypothesis 1 (pictures in general have an effect) was supported, but Hypothesis 2 (the effect is more pronounced for photographs than drawings) was not supported. It should be noted that the difference between the picture conditions (+0.23) was small in comparison with the difference between the lowest and highest ranked products (+1.92).

### 3.2 Comparison of rating scores with food knowledge level

In addition to analysing the participants' performance in the rating task, we were interested in ascertaining whether this performance was related in any way to the participants' general level of knowledge about food and food-related issues, as measured by the questionnaire. For the questionnaire, each participant was given a score out of 120. Each of the 45 factual questions was awarded 2 points for a correct answer and 0 points for an incorrect answer. Each of the 15 label questions was awarded 2 points for complete identification (the label was recognized and could be named), 1 point for partial identification (the label was recognized but could not be named), and 0 points for no identification. The total scores were then converted into percentages.

The comparison of rating scores with food knowledge level was broken down into two analyses. The aim of the first analysis was to ascertain whether or not there was any relationship between the participants' level of food knowledge and their mean rating scores for the target products, irrespective of the picture manipulation (see Figure 5, upper scatter plot). A Pearson's correlation revealed that the level of food knowledge was significantly related to the mean rating scores,



**Figure 5:** Comparison of rating scores with food knowledge level.

$r = -.368$ ,  $p < 0.01$ . The participants with a low level of food knowledge tended to rate the products higher on the perceived naturalness scale than the participants with a high level of food knowledge – to use an alternative formulation, the less knowledgeable participants were less conservative (more liberal) in their judgements of perceived naturalness than the more knowledgeable participants.

The aim of the second analysis was to ascertain whether or not there was any relationship between the participants' level of food knowledge and their sensitivity to the picture manipulation (see Figure 5, lower scatter plot). Sensitivity scores were obtained by subtracting the mean scores for the

no-picture condition from the mean scores for the picture condition. Thus, a positive score indicated a change in the expected direction whereas a negative score indicated a change in the opposite direction. In this case, a Pearson's correlation showed that there was no significant relationship,  $r = -0.012$ ,  $p = 0.888$ . The less knowledgeable participants were not more susceptible/sensitive to the picture manipulation than the more knowledgeable participants or vice versa. Regarding the linear regression line ( $y = -0.0011x + 0.2885$ ), the intercept on the y-axis ( $+0.2885$ ) is an indication of the fact that the pictures had a positive, albeit small, influence on the participants' perception of naturalness, whereas the zero-slope ( $-0.0011$ ) is an indication that this influence did not covary with respect to the level of food knowledge.

## 4 Discussion

The study reported above provides previously non-existent empirical support for the common-sense assumption held by legal decision-makers in Denmark and in some other (but not in all) EU countries that a picture of a potentially taste-giving ingredient on a food package will enhance consumers' expectations that the corresponding taste stems from that ingredient in its natural form (Hypothesis 1). However, it failed to provide support for the additional hypothesis that photographs have a stronger impact than drawings (Hypothesis 2). Another key finding is that the effect of pictures turned out to be marginal in comparison with the participants' expectations regarding the naturalness of different product types, with or without pictures. For example, the participants had significantly more faith in finding real beef in the beef bouillon cubes than real fruit in the fruit candy.<sup>9</sup> Data from the follow-up questionnaire showed that the level of consumer's general knowledge about food and food-related issues had an impact on their performance on the main rating task: in particular, the less knowledgeable participants were less conservative (more liberal) in their judgements of perceived naturalness than the more knowledgeable participants, pictures or not.

With respect to Hypothesis 1, the findings contribute new insights and potential research questions to the general theoretical debate on multimodal communication involving both pictures and words (e.g., Forceville and Urios-

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<sup>9</sup> Apart from the product type, idiosyncrasies of the specific product packages that served as targets for the experiment may have played a role. For example, the non-familiarity of the brand names of the target stimuli (which were all fictitious, unlike the controls) may have led some participants to be more sceptical about product quality (and possibly naturalness) than would a well-known high-end brand. Yet this remains to be demonstrated. See also note 13.

Aparisi 2008; Zlatev 2009; Andersson 2012). At the same time, the findings add new leads to the continued development of administrative and legal practices regarding potentially misleading food labelling, and, at best, to the voluntary self-regulation of the food industry. We will consider both of these perspectives in more detail in Sections 4.1 and 4.2.

Regarding Hypothesis 2, there are two possible explanations for our failure to find a difference in effect between drawings and photographs. The first and most simple explanation is that the failure was due to specifics of the experimental design. For example, given that the general effect of pictures observed was marginal compared to the effect of product type (and that our results did display the expected “staircase” pattern between the three conditions, yet without reaching statistical significance for the drawing versus photograph conditions, see Figure 4, lower bar chart), a more fine-grained response measure such as a 9-point scale might have influenced the result. Another possible factor may lay in idiosyncrasies of the pictures selected and/or idiosyncrasies of the digital manipulations. In light of this, future studies could be conducted with more tightly controlled stimuli. For example, the basic outlines of each photograph could be traced to produce the corresponding drawing, and greater care could be taken to ensure that the drawings are stylistically comparable in terms of lines and colours. The second possible explanation is that the stylized drawings were actually more salient than the corresponding photographs. From an ethological perspective, stylized drawings can be regarded as examples of “superstimuli” or “supernormal stimuli” on the grounds that they are capable of isolating and accentuating certain key features (for discussion, see Tinbergen 1951; Lorenz 1970; Barrett 2010). Thus, it is possible that the lower reality-status of the drawings was compensated by a higher level of perceptual salience, whereas the higher reality-status of the photographs was hindered by a lower level of perceptual salience.

## 4.1 Theoretical perspectives

### 4.1.1 Relevance processing and conceptual combination

First of all, how do we explain that despite the propositional indeterminacy of pictures as such, they tend to become “somewhat” determinate after all when placed on food packages, leading consumers’ factual expectations in some directions more than in others?

A suitable framework for further analysis seems to be offered by *relevance theory* (Sperber and Wilson 1987; 1995) that expands upon and operationalizes earlier theorizing on *implicit communication* (Austin 1962; Grice 1975; Cummings 2005). In

brief, it is assumed that any information that the sender brings to the communicative scene will be expected by the recipient to be situationally relevant. If the relevance is not clear from what is uttered explicitly, the recipient will go through a subconscious process of step-by-step relevance processing where the explicit information is matched with the knowledge already accessible to him or her. On that background, alternative candidates for possible inferences that might establish a meaningful connection between the two are checked for situational relevance. The process stops when the cognitive cost of additional relevance processing exceeds the expected cognitive benefits in terms of new knowledge that can be used efficiently in the situation. For food packages, this is tantamount to having a sufficient enough idea of the product so one may decide whether to buy, consume it, or (in the present case) to make judgments about its taste and naturalness.

Although the theory is meant to apply to human communication in general, it has so far mostly been applied to verbal communication on the sentence and text levels where the need for additional inference-making is not necessarily caused by propositional indeterminacy. For example, the statement *It's cold in here!* is not indeterminate, yet to grasp the sender's communicative intention, the recipient may, depending on the circumstances, need to infer additional statements spanning from <I would like you to close the window> to <hold me tight and kiss me>.<sup>10</sup>

In the case of isolated pictures, on the other hand, the inference-making is needed to ascribe any propositionally determined message to them whatsoever, regardless of which further inferences that may trigger. This renders pictorial communication “weak” by definition (Sperber and Wilson 1995: 175). What tends to be forgotten in the pictures versus words debate, however, is that exactly the same point extends to single-word (or noun-phrase) *verbal* utterances such as *strawberry* or *sour cream and onion*. For lack of a surrounding predicative clause, there is nothing to specify the (restrictive but otherwise completely vague) link between the conceptual content conveyed by such words and that pertaining to the overall product as conveyed by the generic product name. This is also true when both verbal elements in play merge (ortho)graphically into a single unit, a noun-noun compound (NNC), such as *frugtbolcher* (fruit candy). Thus, as observed already by Jespersen (1942: 137), “compounds express a relation between two objects or notions, but they say nothing of the way in which the relation is to be understood. That must be inferred from the

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**10** Likewise, in the case of food products the packaging may carry short, visually prominent verbal statements such as *No sugar added* or *Only 3% fat* (so-called claims) which are quite transparent semantically, but may give rise to both due and undue additional (pragmatic) inferences during consumers' search for situational relevance (for examples and discussion, see Roe, Levy, and Derby 1999; Williams 2005; Wansink and Chandon 2006; Chandon and Wansink, 2011). As we shall see soon, however, our present case is different and less well described.

context or otherwise” (for some theoretical implications, see e.g., Bundgaard, Ostergaard, and Stjernfelt 2006; Benczes 2006; Zlatev et al. 2010).

In sum, to make situational (or any) sense, the relation needs to be further specified across the conditions mentioned. For fruit candy, for example, the relation of the product itself (as represented by the name *bolcher* ‘candy’) to the drawing/photograph of mixed fruits and/or to the word *frugt* ‘fruit(s)’ could be interpreted in a number of different ways including:

- (1) This candy contains fruits
- (2) This candy tastes of fruits
- (3) This candy is shaped like fruits
- (4) This candy can be served with fruits

Which interpretation will the viewer arrive at first and, furthermore, accept as sufficiently situationally relevant to abstain from further relevance processing? Put differently, is there a *default* interpretation (Jaszczolt 2005) for the conceptual combination as such, i.e., the one that is likely to be preferred in our present situational setting if nothing suggests otherwise? The degree to which such default interpretations can be predicted has been a major concern in the psycholinguistic and cognitive linguistic literature with a primary focus on conceptual combinations and blends established by verbal means, in particular through novel noun-noun compounds such as *train juice* and *land yacht* (for critical reviews and discussion, see Fauconnier and Turner, 2002; Bundgaard, Ostergaard, and Stjernfelt 2006; Benczes 2006; Libben and Jarema 2006; Ran and Duimering 2010). However, related lines of analysis have been suggested for concepts conveyed visually (e.g., Jones 2007; Kress and van Leeuwen 2006: 79ff; Kuramori, Iwaki, and Kusumi 2009). Let us therefore consider to what extent these paradigms can contribute to our present inquiry.

One group of relevant studies could be subsumed as the *slot/filler* approach: it is assumed that if the modifying concept could naturally serve as a value (filler) for a salient attribute (slot) in the concept modified, then the corresponding interpretation will be preferred (Smith et al. 1988; Murphy 1988; 1990; Ryder 1994; Wisniewski 1996; Estes and Glucksberg 2000; Gill and Dubé 2007; Veale and Hao 2008; Lynott and Connell 2010). Another relevant line of analysis could be subsumed as the *analogy* approach: it is assumed that the frequency with which a given interpretation has been actualized earlier in other, well-established combinations involving similar constituents will influence the recipient’s interpretation of novel ones (e.g., van Jaarsveld, Coolen and Schreuder 1994; Gagné and Shoben 1997; Tagalakakis and Keane 2005; Gagné and Spalding 2006; Estes and Jones 2006; Krott 2009). We will first consider the implications of the slot/filler approach and then see what the analogy approach may add to the picture (in Section 4.1.2).

In most above-mentioned studies, human concepts are not understood as linear samples of isolated distinctive features (as in earlier, pre-cognitive accounts), but as complex graded structures that form a hierarchy of categorization criteria (conceptual components) spanning from (a) *essential (defining) components* (say, the expectation that candy has a sweet taste), over (b) *prototypical components* that correspond to properties that are essential to our understanding of the category as a whole, but do not need to be manifest in each exemplar (say, the expectation that candy contains lots of sugar even if some variants are sugar free), to (c) encyclopaedic and/or personal *background knowledge* relevant for dealing with the objects in question but not decisive to their categorization (say, knowing that one's girlfriend loves fresh fruits but hates fruit candy). For different terminological and theoretical statements of these basic assumptions rooted in the work of Rosch (1975), see Barsalou (1987); Taylor (1989); Cohen and Lefebvre (2005). Applied to food, then, it seems fair to assume that ingredients and taste will correspond to conceptual components that are more salient and closer to the core of the concept modified than, say, the exact shape or context of eating.<sup>11</sup> If so, this would render inferences (and potential fillers) of type (1) and (2) in the list of possible inferences given above more readily available for relevance processing (i.e., demanding less cognitive effort) than inferences of type (3) and (4). Moreover, the most straightforward way to establish a meaningful connection between (1) and (2) would be to understand (2) as being caused by (1) in which case these inferences are likely to co-occur.

Now, what might potentially interfere with such apparent defaults? According to relevance theory, the inferences ultimately accepted should also be consistent with the hearer's general world knowledge. Thus, most adult consumers in the industrialized world are aware that some types of commercial food products owe their characteristic taste of, say, fruits, brandy, or sour cream and onion to artificial flavourings. Moreover, the more well-informed among them may likewise be aware that even if a product does contain some proportion of "the real thing" (justifying its inclusion in the ingredients list), the corresponding taste may still be due, primarily or entirely, to artificial flavouring. Individual consumers' expectations in this regard are likely to vary both with the product type and their general level of knowledge on food and food-related issues. Both assumptions find support in the findings of our experiment.

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<sup>11</sup> Any further hypothesizing and experimenting along these lines would require a more systematic, empirically founded modelling of larger clusters of food concepts as performed by, e.g., Ross and Murphy (1999) though for a somewhat different purpose.



In terms of inference-making, the above implies that for some products and recipients, respectively, an additional inference such as the following is expectable (here again illustrated by the fruit candy):

(1') This candy contains artificial fruit flavouring.

Some consumers may then see (1') as the only plausible cause for (2), i.e., for the alleged presence of fruit taste, while others may see (2) as a combined effect of (1) and (1') in some relative proportion. Moreover, even for candy, it cannot be entirely excluded that some consumers (say, young children) will take the “direct route” and understand (2) as an effect of (1) only. Transposed to the 7-point scale used in the experiment, the higher end-point of the scale corresponds to expecting (2) to be caused by (1) only, while the lower end-point of the scale corresponds to expecting (2) to be caused by (1') only. The intermediate points correspond to different estimations of the relative role of (1) and (1') in causing the effect ( $50/50 = 4$ ). The rating scores actually gained in the experiment for the “natural” and the “artificial” controls – and the difference in scores between the individual targets across conditions – provide evidence for an effect of product type on perceived naturalness (see Figure 4, upper bar chart). In turn, the comparison of rating scores with participants' performance on the questionnaire provides evidence for a correlation between perceived naturalness and consumers' level of general food knowledge (see Figure 5, upper scatter plot).

#### 4.1.2 Propositional knowledge versus sensory experience

An important insight following from the discussion so far is that propositional indeterminacy is not only a key feature of visual communication but also of verbal communication when based on simple word-product and word-picture juxtapositions rather than verb clauses. Moreover, both decoding procedures are – at least up to a certain point – susceptible to similar lines of analysis in terms of relevance processing and conceptual combination models. However, it remains to be explained why the target stimuli that were carrying a picture of the potentially taste-giving ingredient(s) still tended to receive proportionally higher naturalness scores than those which carried only a verbal indication of that ingredient, let alone the effects of knowledge level and product type.

A number of partially overlapping paths of explanation offer themselves. The decisive factor seems to be the iconicity and (for photographs) indexicality of pictures as opposed to the complete arbitrariness of words as well as the influence of these properties on the speed and strength with which the respective entities are capable of activating different types of conceptual content (see

also Section 1.2). Taking the conceptual analysis suggested in Section 4.1.1 a step further, conceptual components (on any of the levels of typicality mentioned) may be further subdivided into what we shall here call (i) *propositional components*, which consist of (often second-order) knowledge susceptible to truth-conditional evaluation (say, knowing that strawberries contain flavonoids), and (ii) *sensory components*, which rely on the immediate recall of first-order sensory-motor experiences with category members (such as the look, smell, taste, and feel of real strawberries). For further theorizing along similar lines, see Barsalou 1999;<sup>12</sup> Moskowitz et al. 2006; Smith, Møgelvang-Hansen, and Hyldig 2010; Conell and Lynott 2012; Smith et al. 2013. Alternatively, concepts can be thought of in terms of *connectionist networks* (e.g., Rumelhart et al. 1986; Marcus 2001), where the relevant propositional and sensory information is represented by nodes (roughly analogous to neurons, or groups of neurons) that are connected to each other by either excitatory or inhibitory connections (roughly analogous to synapses).

Regardless of what approach is preferred, the point is that a picture of a strawberry is likely to activate information relating to the immediate visual properties of real strawberries more directly and more strongly than the word *strawberry*. This, in turn, may result in an enhanced priming of sensory information relating also to the tactile and gustatory properties of natural strawberries, thereby making such information more accessible to relevance processing.<sup>13</sup> Indeed, some recipients may interpret the sender's decision to offer them an immediate visual experience of natural strawberries as a message in its own right that calls for additional relevance processing and inference-making, possibly in direction of enhanced naturalness of the product in the package.

An alternative yet complementary line of explanation seems to lie in the *analogy* approach to conceptual combinations mentioned in Section 4.1.2. If we

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<sup>12</sup> Barsalou (1999) has argued that even highly abstract conceptual knowledge ultimately relies on simulations grounded in sensory-motor experiences. Here, however, we restrict the term *sensory components* to such components that it would be hard to adequately model and describe at all on any level *beyond* immediate sensory experience and which therefore tend to escape truth-conditional evaluation.

<sup>13</sup> In continuation of Conell & Lynott (2012), this could be taken as an example of how immediate perceptual stimuli interfere with conceptual processing relying on propositional knowledge. On the other hand, our results indicate that – regardless of which exact mechanisms are seen as explaining it – a picture on the package must be considered as rather a weak piece of evidence for actually finding the corresponding ingredient in the product, at least by experienced consumers. Fernbach, Darlow, and Sloman (2011) have shown that such weak evidence can sometimes have a negative effect on peoples' willingness to believe in a given assertion compared to no evidence at all. The degree of interaction between these seemingly opposing mechanisms clearly calls for additional research.

assume that the Danish authorities up till now have been successful in keeping pictures of potentially taste-giving natural ingredients off the most synthetic products on the market (see Section 1.3), then some consumers may have noticed a correlation between absence of pictures and absence of natural taste-giving ingredients revealed, say, while scrutinizing the ingredients lists of the backside of the packages once in a while. In other words, such repeated usages may lead to the recognition of certain conventions in Danish food labelling practices (though not as stable as the linguistic conventions allowing us to decode an explicit claim like *all natural flavours*) or a “grammar” of visual communication adopted in Danish supermarkets to follow Kress and van Leeuwen (2006). A major question, then, is whether or not consumers in those EU countries where practices have so far been more liberal (allowing vivid symphonies of naturalistic ingredient pictures even on very unnatural products) will understand the message in the same way. That is, to what degree is the “grammar” sensitive to societal factors operating on top of universal cognitive ones? This remains to be tested.

Finally, it seems fair to ask if the recipient will always expect the sender to be fully communicatively cooperative (also in Grice’s 1975 specific sense) when presenting him or her with stimuli that require for additional inference-making. Stated differently, will the inferences that recipients make to grasp the *intended* message of the sender automatically be accepted by that very same inference-maker as *true*? Non-systematic observations during the experiment would seem to indicate the opposite. Thus, participants could spontaneously exclaim things like “They even put pictures of fruits on the package! Come on, there are no real fruits in that product.”<sup>14</sup> Both from a communicative and a legal position, that aspect too deserves further attention and systematic experimental investigation in future work.

## 4.2 Implications for legal and commercial practices

In terms of wider societal implications, the study provides clear evidence that the Danish authorities are right in assuming that pictures of potentially taste-giving ingredients may lead some consumers to be more optimistic about finding the “real thing” in the package than if the package had carried a verbal indication only. If the product in question contains no more of the “real thing”

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<sup>14</sup> The possibility of such “double standards” of communication has been demonstrated even for non-verbal communication and for other primates than humans (e.g., Woodruff and Premack 1979).

than a competing product without pictures, these consumers will indeed have been misled.

On the other hand, we also found that the effect of product type was far more prominent than the effect of pictures. With or without pictures, our participants had very little faith in finding real fruits in fruit candy, whereas they had considerably more faith in finding real beef in the beef bouillon cubes – and more faith yet in finding real garlic in garlic paté even if that product did not carry ingredient pictures in any conditions in serving as a control; see Section 2.1.2. On this background, some actors on the market might argue that the problem is not nearly as serious as claimed by consumer organizations and, indeed, that in some cases, the use of vivid pictures on the packaging is not only justified, but vital from a competitive viewpoint to overcome the consumers' prejudices. Thus, judging from our results, it would take more than just nice pictures (probably, some semantically very explicit *and* visually prominent text on the front) to convince consumers that a new brand of fruit candy was indeed based on natural fruits. For products not containing fruits at all, on the other hand, it could be argued that the pictures' role is merely to serve as eye-catchers and taste-indicators, and that most consumers would not expect otherwise.

What also needs to be taken into account, however, is that our present setup may have biased a higher level of conscious reflection on specific product properties than what is reached in many real-life food choice situations because we directly asked the participants about their expectations on selected properties among several other possible ones (the same is true of previous studies such as Bone and France 2001). While there are no grounds to fully reject consumers' ability to display a degree of preference consciousness during everyday shopping (for discussion, see Smith et al. 2011), it is well documented in the marketing and consumer behaviour literature that time pressure, spontaneous emotional responses, and insufficient motivation and/or capability to retrieve and compare relevant information on the spot tend to interfere with good consumer intentions (e.g., Hoyer 1984; Iyengar and Lepper 2000; Hansen 2005; Khan, Dhar, and Wertenbroch 2005; Frewer and van Trijp, 2007; Sheehan 2010; Gidlöf et al. 2013). On that background, two key properties of visually prominent design elements deserve attention, both of which are well documented in the empirical literature: on the one hand, their potential for automatically attracting stimulus-driven visual attention, interfering with goal-driven search, and on the other, their capability of bringing about a variety of affective states, including positive emotions, via associative connections (for details on both aspects, see Pilditch 1973; Messaris 1997; Wolfe 1999; Chun and Wolfe 2001; Pieters and Warlop 1999; Underwood and Klein 2002; Kauppinen 2004).

In the context of a shopping environment with numerous competing products, this may give a package carrying an appealing picture of a potentially taste-giving ingredient an advantage over a package with the ingredient name only in at least two ways. First, the package may distract attention away from neighbouring products (and/or from detailed textual information on the back of the very same product, see Roe, Levy, and Derby 1999), thus counteracting comparisons of textual information on the respective packages (Selsøe Sørensen, Clement, and Gabrielsen 2012; Smith, Barratt, and Zlatev 2014). Second, the consumer may not experience any need for additional factual information in being driven by hedonic impulses that involve seeing and “almost touching,” say, a juicy peach or a freshly cut avocado rather than by more rational utilitarian considerations (e.g., Khan, Dhar, and Wertenbroch 2005; Hansen 2005). The further implications of these circumstances for communicational fairness are beyond the scope of the present study but clearly deserve systematic consideration in future work.

What requires a brief comment at this point, however, is that while the above circumstances hardly fall under the EU legal provisions against *misleading* commercial practices (Article 6 and 7 of the Unfair Commercial Practices Directive 2005/29/EC), the provisions against *aggressive* practices (Article 8) might, in principle, become applicable to the most obvious cases. On the other hand, the reverse argument – that consumers are ultimately buying experiences and hedonic pleasure rather than merely the physical products – could be used in support of a more liberal interpretation of all three articles mentioned. For further discussion along these lines, see Trzakowski (2011). The bottom line is that more research is required on both the semantic (propositional) aspect and on other possible cognitive and emotional effects of using pictures on product packages which combines the sales-oriented marketing perspective with a fairness perspective and links these issues more directly to relevant theorizing in cognitive science and cognitive semiotics.

### 4.3 Methodology development

As for methodology, we have achieved a higher degree of ecological validity compared to much existing experimental research into the language-vision interface in terms of the questions investigated (relating them to real-life disputes on the potential misleadingness of product-to-consumer communication) and the materials used (words and pictures presented on realistic food packages). However, there is clearly room for further improvement of the experimental setup itself to increase the generalizability of the results gained. Specifically, follow-up studies should combine measures of preferences with

measures of actual choices, and measures of factual beliefs with measures of emotional responses. Moreover, the experimental setups should simulate more realistically the purchase environment where the choices are made. This includes allowing all sides of the package to be examined and, to the extent possible, monitored by, for example, eye-tracking techniques. Experimental work along these lines is presently in progress in our laboratory.

## 5 Concluding remarks

In the present study, we have accepted a long-standing invitation to cognitive researchers from EU politicians and legislators to do precisely that (see Section 1.3). Taking a bottom-up approach, we have first addressed a set of assumptions regarding how consumers understand pictures of potential ingredients on food packages as opposed to words to the same effect. Rather than relying on intuitive wisdom, we have put them to experimental test. We have then considered possible theoretical explanations for our findings, combining key aspects of relevance theory with current research into conceptual combination and empirical insights into the online processing of verbal versus visual stimuli, suggesting certain new possible paths for continued theorizing and empirical research. At the same time, we hope to have contributed at least some new leads to the daily efforts of food authorities and courts throughout the industrialized world to distinguish between justifiable sales promotion and food-labelling solutions which may potentially mislead consumers about essential properties of the food inside the packaging.

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