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Searching for triangles: An extension to food & packaging

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ABSTRACT

Two laboratory-based visual search experiments (Experiments 1 and 2) and an online survey (Experiment 3) were conducted in order to investigate the visual search for triangular foods. The results of Experiment 1 revealed that the visual search for a downward pointing triangular target was faster than when the same target pointed upward, regardless of whether the stimuli were simple geometric figures or photos of food. Experiment 2 replicated these results using images of both food and non-food packaging. Experiment 3 revealed that the same triangular stimuli were generally rated as less pleasant, less liked, and less familiar when they pointed downward than when they pointed upward. Taken together, these results therefore suggest that the cognitive processing of food images is influenced by incidental aspects of their visual appearance, and that such a pattern of results can also be extended to the case of food packaging.

1. Introduction

Foraging has played an important role in human evolution. An important step in successful foraging is the detection of foods from among the various distracting stimuli that are typically found in different natural settings. The visual search paradigm in cognitive psychology research is thought to capture something of this process (e.g., Wolfe, 1994, 2013). Previously, researchers have used large-scale three-dimensional set-ups in order to mimic the foraging process in natural settings. They have typically reported results that are consistent with those from visual search experiments that have been conducted on the computer monitors (e.g., Gilchrist, North, & Hood, 2001; Smith, Hood, & Gilchrist, 2008). Moreover, other studies have demonstrated that humans appear to retain some memory of the locations that they have searched previously while foraging.[1] That is, attention appears to be inhibited from returning to previously-attended locations (Thomas et al., 2006). This is similar to the Inhibition of Return (IOR) phenomenon (Posner, Rafal, Choate, & Vaughan, 1985) that has been documented in visual search experiments (Klein, 1988; Klein & MacInnes, 1999).

A majority of the research that has been published to date on people's food preferences has tended to focus on its olfactory and gustatory characteristics (e.g., Drewnowski, 1997; Koç, Vinyard, Essick, & Foegeding, 2013). Interestingly, though, the attentional resources that are devoted to a given food can be influenced by craving and the frequency of food consumption (e.g., Hardman, Rogers, Etchells, Houstoun, & Munafò, 2013; Hollitt, Kemps, Tiggemann, Smeets, & Mills, 2010; Werthmann, Field, Roefs, Nedekoorn, & Jansen, 2014). By contrast, far fewer studies have explored how visual appearance influences the cognitive processing of food images by humans. That said, researchers have demonstrated that attention toward specific kinds of food images might be based on the food's fat content (Harrar, Toepel, Murray, & Spence, 2011). An extensive body of research has shown that the visual search for food in nonhuman animals is influenced by its visual appearance (e.g., Bond, 1983; Foti, Spirito, Mandolesi, Aversano, & Petrosini, 2007; Spaethe, Tautz, & Chittka, 2001). However, there is, as yet, a lack of empirical evidence to support the claim that humans exhibit similar search behaviors.

The purpose of the present study was therefore to investigate whether, and if so, how, the appearance of food influences visual search in humans. Previous visual search studies have revealed that certain shapes are easier to find in a visual search task than others, for example, a circle with a straight line (i.e., a "Q") is easier to spot among regular circles than vice versa (Kristjánsson & Tse, 2001; Treisman & Gormican, 1988; Treisman & Souther, 1985). Currently, it is unclear how the visual appearance properties (specifically the shape and orientation) of a food influence visual

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[1] It should also be noted that there have been debates regarding whether or not visual search really has a memory, with different laboratory studies providing somewhat different answers (e.g., Horowitz & Wolfe, 1998; Peterson, Kramer, Wang, Irwin, & McCarley, 2001).

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attention in humans who are looking at the food. Specifically, are foods that have certain appearance properties easier to find than others? Due to the common appearance of triangular foods in everyday life, we were particularly interested in showing such foods in various orientations (e.g., downward- or upward-pointing) in order to determine whether our participants would find it easier to find them in one orientation rather than the other.

Laboratory research on visual search has revealed that the search for downward-pointing triangles is faster than for upward-pointing triangles or circles (Larson, Aronoff, & Stearns, 2007), which we refer to as the downward pointing triangle superiority (DPTS) effect in this article. In everyday life, foods presented in triangular shapes are undoubtedly a common feature of our supermarket shelves, just think of a slice of cake, pie, or pizza, sandwich triangles, cheese, Tortilla or Doritos chips, or even a slice of watermelon. Given the literature on the DPTS effect, we thought it possible that the visual search for triangular foods in a downward-pointing orientation might also be more efficient (i.e., faster and/or more accurate) than for the same food when oriented upward instead.

Interestingly, it should be noted that the DPTS effect has been interpreted in terms of the downward-pointing triangle being taken by the viewer to represent a potentially threatening shape (Larson, Aronoff, & Steuer, 2012; Larson et al., 2007; Watson, Blagrove, Evans, & Moore, 2012). According to this account, the fact that the visual search for downward-pointing triangles might be faster has been attributed to the possibility that they potentially convey threat-related information due to the resemblance of the form to an angry face in which the muscles are pulling down to form the "V" shape (Larson et al., 2012; Toet & Tak, 2013).

Elsewhere, threat-related information has been shown to attract more attention than neutral stimuli (Lundqvist & Ohman, 2005; Öhman, Flykt, & Esteves, 2001). However, one reason for thinking that the visual search for triangular food images might not show the DPTS effect relates to the presumably non-threatening nature of a downward-pointing triangular image if what happens to be depicted is a desirable food (think a slice of watermelon). Indeed, the visual search for threatening stimuli (i.e., guns) generally tends to be faster than for foods (pleasant stimuli), whereas searching for food has been shown to be faster than for neutral targets such as chairs (De Oca & Black, 2013).

In the present study, we examined whether the DPTS effect would be seen when participants were searching for pictures of food stimuli. Specifically, we addressed the following questions: First, is the visual search for downward-pointing triangular food images more efficient (i.e., faster and/or more accurate) than for upward-pointing triangular foods? Second, is the visual search for food images more efficient than for simple geometric figures, due to the general desirability of food stimuli? Third, how does the orientation of the triangular stimuli (downward- or upward-pointing) and the type of stimulus that is presented (food or simple geometric figure) interact? Last but not least, we also wanted to examine the visual search for food packages in order to understand consumers' choices when faced with alternatives in a shop, to investigate whether people attend to one item more quickly than to another when shopping, and whether that relates to their preference for the item.

2. Experiment 1

To answer the three questions outlined above, we conducted a first experiment in which the participants performed a visual search task on four different types of food images that were represented as either downward- or upward-pointing triangular shapes, including a slice of chocolate cake, a slice of cheese, a Doritos chip, and a sugar triangle (a traditional food in China). We also performed a between-participants analysis of the visual search results in order to compare the food stimuli with search results obtained when the participants were searching for simple geometric figures.

2.1. Methods

2.1.1. Participants

Undergraduate and graduate students from Tsinghua University took part in this and the following experiments. The participants were compensated with 20 Chinese Yuan or else given partial credit in order to fulfill the requirements of an introductory psychology course. All of the participants reported having normal or corrected-to-normal visual acuity. In this experiment, 40 participants (mean age = 19.79 years, ranging from 18 to 22 years; 23 women) were randomly assigned into one of two groups. Twenty of the participants were assigned to the food condition to perform the visual search task with triangular food stimuli; whereas the remainders were assigned to the other condition in which they had to perform the visual search task with simple geometric figures instead.

2.1.2. Apparatus and Stimuli

Pentium-based computers running E-prime 2.0 were used to present the stimuli and to record the data. The stimuli were presented on 17-inch monitors with a resolution of 1024 × 768 pixels, at a refresh rate of 60 Hz. The participants viewed the displays at a distance of approximately 50 cm, and their responses were recorded via keyboard presses.

The displays shown in the simple geometric figure condition were very similar to those used in the study reported by Larson et al. (2007). That is, a total of 16 downward or upward pointing triangles were presented in black against a white background in each display, and each triangle (3.19° × 3.19°) was placed at the center of each cell of an invisible 4 × 4 matrix (19.07° × 19.07°) centered on the screen. Thus, the whole search display subtended 17.49° horizontally and 17.11° vertically on the screen, and triangles were 3.19° (both horizontally and vertically) apart from each other. As shown in Fig. 1, the displays were classified into oddball-absent displays in which all of the items were the same, or oddball-present displays in which one item differed from the rest (i.e., a downward-pointing triangle among 15 upward-pointing triangle or vice versa).

The displays presented to the food group were similar to those presented to the simple geometric figure group with the exception that pictures of triangular-shaped food were presented instead. Four types of food were shown: a slice of chocolate cake which is a common desert in both Eastern and Western diets, a slice of cheese as a typical Western dairy product, a Doritos chip which is a popular snack in both the East and West, and a sugar triangle which is a traditional wheaten food served in Northern China with a white, soft surface and sugar stuffing inside. In this experiment, a single image was used to represent each type of food (see Fig. 2). Note, though, that only one type of food was presented in each trial/display. The food displays were also classified into oddball-absent displays in which all of the items were identical, and oddball-present displays in which one food was in a different orientation from the rest.

2.1.3. Design and procedure

The participant's task was to identify whether all the stimuli in each display were the same or not. All of the participants completed 4 blocks of 64 trials each. Equal numbers of oddball-absent and oddball-present trials were mixed and presented in a random order. Within each block of trials, downward-pointing triangles were presented in half of the oddball-absent trials, whereas upward-pointing triangles were presented in the remainder of the displays; the downward-pointing triangle was the oddball in