Food Attractiveness and Gazing Behaviour

Martin Haindl
martin-haindl@gmx.at

Klaus Dürrschmid
klaus.duerrschmid@boku.ac.at

Department of Food Sciences and Technology,
University of Natural Resources and Applied Life Sciences
Vienna, Austria

ABSTRACT

The aim of this work was to verify whether the u-shaped curve of attention concerning canceling and recall versus attractiveness, published by Brunner et al. [1], was valid for the observation of food stuff, too. It was assumed, that both visual attractive and objects with little visual attractiveness get more attention than objects, which are characterized by mediocre visual quality. Two series of five pictures of foodstuff out of three product classes (fresh fruit, vegetables and sausages) were presented to the test persons. These series contained one of five objects in different stages of decay, both ascending and descending compared to the four residual objects. Using a Tobii® T60 eye tracking device, the gazing behaviour of the participants was analyzed and statistically evaluated. The pre-assumed u-shaped curve of attention was verified in general, but it was figured out, that foodstuffs of bad appearance attract attention much more than foodstuffs of good visual quality.

Author Keywords

Eye-tracking, gazing bahaviour, visual attractiveness, curve of attention.

MATERIALS AND METHODS

Inspired by Brunner, Reimer & Opwis' [1] paper "Cancellation and Focus: The Impact of Feature Attractiveness on Recall" we set out to ascertain the applicability of this model in a food science context by utilizing an eye-tracking device; that is, whether images of foodstuffs in various states of decay result in a U-shaped curve (with maxima in either the most appetizing and most disgusting image element) for certain eye tracking parameters. The work by Brunner et al. is, in itself based on Houston, Sherman & Baker's [2] model of "Cancellation and Focus", which is in turn an extension of a previously established feature-matching model by Tversky [3]. While previous research on these models was mostly based on textual information, the subject matter in our case dictated an alternative approach based on visual attractiveness (since food choice is largely an instinctual process, and "appetizing" and "disgusting" concepts are greatly reduced in emotional impact when we attempt to put them into words). Furthermore, previous research by this department suggested gender differences in the time necessary to detect food spoilage, which we hoped to confirm statistically due to a larger number of participants and product categories in this study.

While Brunner et al. [1] sought to extrapolate the attractiveness of certain features from their persistence in the test subjects' individual memory, eye tracking technology allows a more direct means of verification for the mental models mentioned above. By utilizing a current-generation Tobii® T60 eye tracking device, we were able to gain detailed insights into the impact of visual attractiveness (and, conversely, visual repulsiveness) on human gaze patterns. More specifically, we created 3 parallel lines of experiments, each representing a single major subgroup of food products (vegetables, fresh fruit and sausages). Each of these was further divided into two sub-experiments: One where a single food object was shown in various stages of spoilage over time while four others stayed unchanged, and another where we began by showing all 5 food objects in an advanced state of decomposition while one of them continuously gains attractiveness (i.e. the photos are shown in a time-reversed order). The advantages of the Tobii® eye tracking technology for this line of experiments are manifold: Unlike previous generations of eye trackers where precision usually came at the cost of greater intrusiveness and set-up time (for example by necessitating specialized contact lenses, head-mounted cameras or a fixed head position), the Tobii® system allows the participant to maintain a relatively relaxed and natural posture in front of the combined sensor/screen unit, also allowing a single operator to screen a large number of participants (183 recordings of females, 186 recordings of males) in a comparatively short amount of time (less than three weeks); the eye tracker comes pre-quipped with software for scheduling, managing and classifying participants and recordings and performing a

Proceedings of Measuring Behavior 2010 (Eindhoven, The Netherlands, August 24-27, 2010)
Eds. A.J. Spink, F. Grieco, O.E. Krips, L.W.S. Loijens, L.P.J.J. Noldus, and P.H. Zimmerman

419

basic analysis of the experimental data, which we exported for a more in-depth analysis in Statgraphics and Senstools. Lastly, its easy use of operation and general intuitiveness of the graphical user interface allowed us to familiarize new operators with the basic functions of the device in less than an hour.

It should be noted that as in previous works on this topic, in this paper the term "attractiveness" was used in a sense of "visually pleasing/appealing". In an eye tracking context, "attractiveness" might also be interpreted to mean "attracting the eye's attention", under which definition both appetizing and disgusting items would be considered "attractive". For this reason, we tried to avoid this potentially ambiguous term and replace it with "spoiled" and "unspoiled" when applicable. We also suggest using the term "attention-grabbing", commonly found in literature concerning the theory of incentive salience, as a neutral term for the tendency of an object to captivate a person's attention, regardless of that person's emotional response to it.

	tomato ↓	bell pepper ↑	peach ↓	banana ↑	spicy sausage ↓	turkey sausage ↑
First fixation duration	b=0.135 ** r²=8.79	b=0.010 r²=0.36	b=-0.002 r²=0.03	b=0.009 r²=0.32	b=0.002 r²=0.02	b=0.008 r²=0.53
Fixations before	b=-1.337 ** r²=15.26	b=-0.186 r²=0.29	b=-1.43 ** r²=17.14	b=-0.356 r²=0.43	b=-1.037 ** r²=5.93	b=0.540 r²=1.14
Fixation count	b=0.562 ** r²=6.90	b=0.905 ** r²=12.26	b=2.018 ** r²=29.67	b=0.593 ** r²=4.14	b=1.843 ** r²=21.63	b=0.126 r²=0.41
Fixation length	b=0.608 ** r²=23.97	b=0.460 ** r²=16.19	b=0.803 ** r²=31.31	b=0.276 ** r²=5.08	b=0.673 ** r²=25.17	b=0.062 r²=0.83
Observation count	b=0.29 ** r²=5.65	b=0.208 ** r²=3.41	b=0.263 ** r²=5.40	b=0.138 * r²=1.70	b=0.288 ** r²=6.26	b=0.035 r²=0.11
Observation length	b=0.609 ** r²=21.21	b=0.492 ** r²=17.17	b=0.879 ** r²=32.43	b=0.300 ** r²=5.68	b=0.709 ** r²=25.19	b=0.081 * r²=1.26
Time to first fixation	b=-0.527 ** r²=17.92	b=-0.059 r²=0.20	b=-0.519 ** r²=20.16	b=-0.100 r²=0.32	b=-0.391 ** r²=7.13	b=0.204 * r²=1.65

**… 99% confidence interval

*… 95% confidence interval

b…slope of the regression line

r²…coefficient of determination

↑...image presented progresses from „spoiled" to „unspoiled"

↓... image presented progresses from „unspoiled" to „spoiled"

Table 1. Eye tracking parameters vs. objects. Fields marked in light grey show values that increase with greater attention, while fields in dark grey show values that decrease as the object becomes more attention-grabbing.
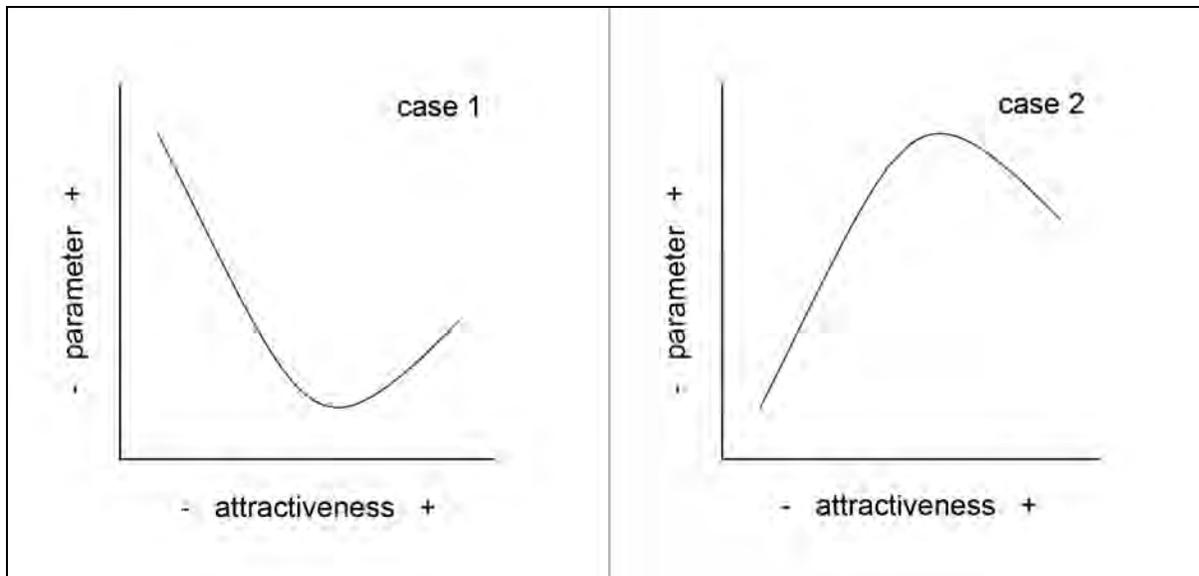
Figure 1. Symbolic representation of the curve shapes for the measured parameters. Case 1: Fixation count", "fixation length", "observation count" and "observation length"; Case 2: "fixations before" and "time to first fixation".

RESULTS

Our analysis of the experimental data confirmed the strong attention-grabbing properties of a single visually repulsive food item surrounded by four unspoiled ones, while those of a single unspoiled item surrounded by four spoiled ones seem to be significantly less pronounced. The results are summarized in Table 1. The visual attention curve is thus more accurately described as a "half ready U-curve" than a "U-curve" for the parameters "fixation count", "fixation length", "observation count" and "observation length" (see Figure 1, case 1). For "fixations before" and "time to first fixation", this curve is inverted (see Figure 1, case 1).

It should also be noted that different forms of spoilage generate different amounts of visual attention. The bell pepper consistently shows a significantly higher coefficient of determination than the banana and turkey sausage, the latter only having a coefficient determination of 1.65 percent. While the banana undergoes a massive change in colour (almost completely yellow to almost completely brown) over the course of the pictures, the bell pepper retains its general coloration, instead undergoing a visible change in texture. The reason for the banana not producing as much visual attention is likely that a certain amount of brown spots on the peel are acceptable for the inside still to be considered edible; on the other hand, visible shriveling of a bell pepper indicates a loss of crispness and thus significantly reduced palatability. The turkey sausage showed only mild discoloration even in later stages of spoilage; furthermore, another sausage in the picture set drew significantly more visual attention due to being visibly overgrown with white-colored mould.

In contrast to the findings from previous experiments of our department suggesting gender differences in visual spoilage detection, we could not demonstrate a statistically significant difference in the gaze patterns of male and female participants in this study.

REFERENCES

1. Brunner, T.A., Opwis, K. & Reimer, T. Cancellation and focus: The impact of feature attractiveness on recall in *Proceedings of KogWis05: The German Cognitive Science Conference 2005*, eds. Klaus Opwis & Iris-Katharina Penner, (2005), 27-32.

2. Houston, D.A., Sherman, S.J. & Baker, S.M. The influence of unique features and direction of comparison on preferences, *Journal of experimental Social Psychology*, 25 (1989), 121-141.

3. Tversky, A. Features of similarity. *Psychological Review*, *84* (1977), 327-352.

Proceedings of Measuring Behavior 2010 (Eindhoven, The Netherlands, August 24-27, 2010)
Eds. A.J. Spink, F. Grieco, O.E. Krips, L.W.S. Loijens, L.P.J.J. Noldus, and P.H. Zimmerman

421