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SHORT AND SWEET

Haptic choice blindness

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Abstract. Choice blindness is the failure to notice a mismatch between intention and outcome when making decisions. It is unknown whether choice blindness occurs when participants have extended interaction with real objects. Here, we examined the case when objects could be touched but not seen. Participants examined pairs of common, everyday objects inside a specially constructed box where a silent turntable was used to switch objects between initial choice and later justification. For similar pairs of objects, we found detection rates of around 22%, consistent with previous studies of choice blindness. For pairs consisting of more distinctive exemplars, the detection rate rose to 70%. Our results indicate that choice blindness does occur after haptic interaction with real objects, but is strongly modulated by similarity.

Keywords: choice blindness, haptic object recognition, decision-making, touch, similarity.

Choice blindness is a relatively new phenomenon that refers to the failure to notice a mismatch between intention and outcome when making decisions (Johansson, Hall, Sikström, & Olsson, 2005). In their original study, Johansson et al. (2005) presented participants with pairs of female faces and asked them to choose which they found more attractive. On a subset of trials, a magic trick was used to switch the preferred face for the non-preferred face and participants were asked to justify their choice. Only about 25% of such choice manipulations were detected. In more recent work, similar findings have been obtained with smell and taste tests (Hall, Johansson, Tärning, Sikström, & Deutgen, 2010) and moral decisions made as part of an opinion poll (Hall, Johansson, & Strandberg, 2012).

The main goal of the current work was to determine whether such detection failures also occur for decisions involving a previously unexplored modality, touch. We were also particularly interested in exploring a situation where participants had extended physical contact with real objects. Previous work has involved 2–6 s of brief exposure to 2D visual images or to a single taste/smell episode. Here, we gave participants 10 s to freely explore familiar 3D objects by hand. Haptic object recognition is known to be both fast and accurate (Klatzky, Lederman, & Metzger, 1985). It is also sensitive to viewpoint (Newell, Ernst, Tjan, & Bülthoff, 2001) and similarity (Gaißert, Wallraven, & Bülthoff, 2010; Lawson, 2009) variation, factors that might easily support the detection of choice manipulations. Our question, then, was whether choice blindness would still occur after extended haptic exploration.

Participants were asked to make preference decisions about common 3D objects that they could physically touch but not see. Examples of the objects are shown in Figure 1. We created similar and dissimilar pairs to follow the method used by Johansson et al. (2005). Participants placed their hands into a specially constructed box (Figure 2) in order to freely explore pairs of objects for 10 s and to verbally indicate a preference for one of the objects. On 6 out of 15 trials, participants were asked to justify their choice and were allowed to haptically re-examine their preferred object. On three of these trials, a switch was made before re-examination.

To implement the choice manipulation, a silent turntable was used to rotate the objects without the participant noticing. Twenty participants were randomly assigned to the low similarity group, 20 to the high similarity group. Note that the order of items and the left/right position that the objects were placed in the box was randomised on a participant-by-participant basis. In all respects except for the nature of the objects and the time allotted, our method followed that of Johansson et al. (2005).

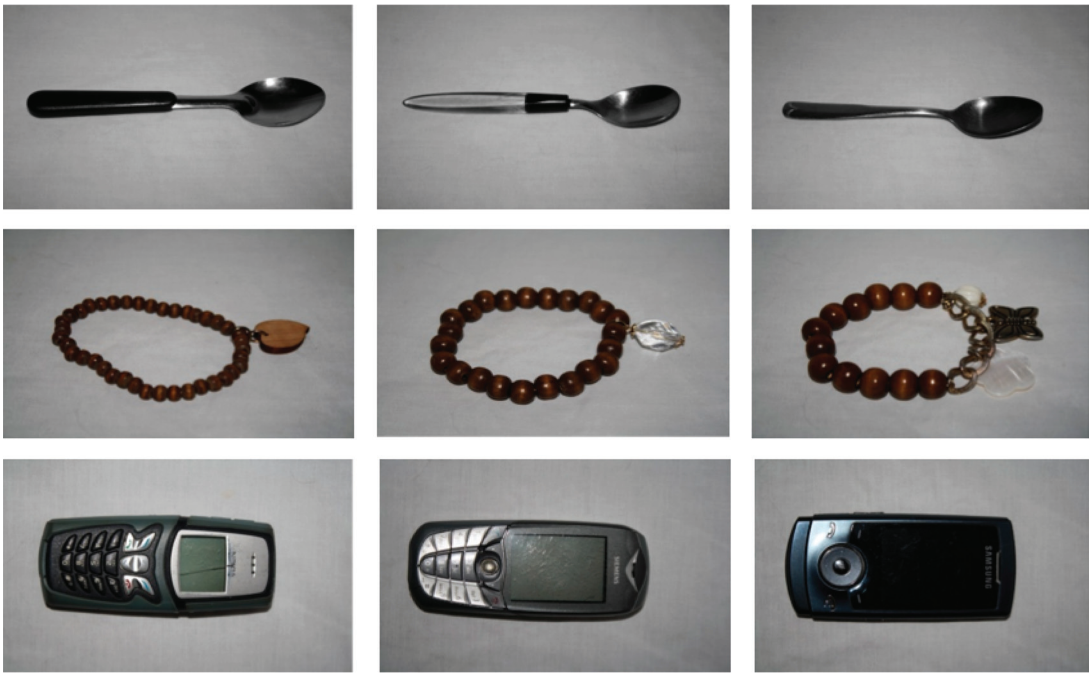

Figure 1. Stimuli consisted of pairs of objects from the following categories: nail files, earrings, padlocks, keys, mobile phones, sunglasses, bracelets, buttons, key rings, text highlighters, rings, doorknobs, spoons, nail varnish bottles, and fabric samples. Two categories—similar (columns 1 and 2) and dissimilar (columns 1 and 3)—were created based on ratings from a group of independent, blindfolded judges (n = 15). Using a scale of 1 (very dissimilar) to 10 (very similar), the categories had means 3.2 (SD = 0.3) and 7.0 (SD = 0.5), respectively.

Participants gave informed consent and the study was reviewed and approved by the Swansea psychology ethics committee.

Our findings are shown in Figure 3. Across all participants, a total of 60 switches were made in each condition, tree per participant. Thus, there were 60 possible opportunities to detect a manipulation in the similar condition, and 60 opportunities to detect a manipulation in the dissimilar condition.

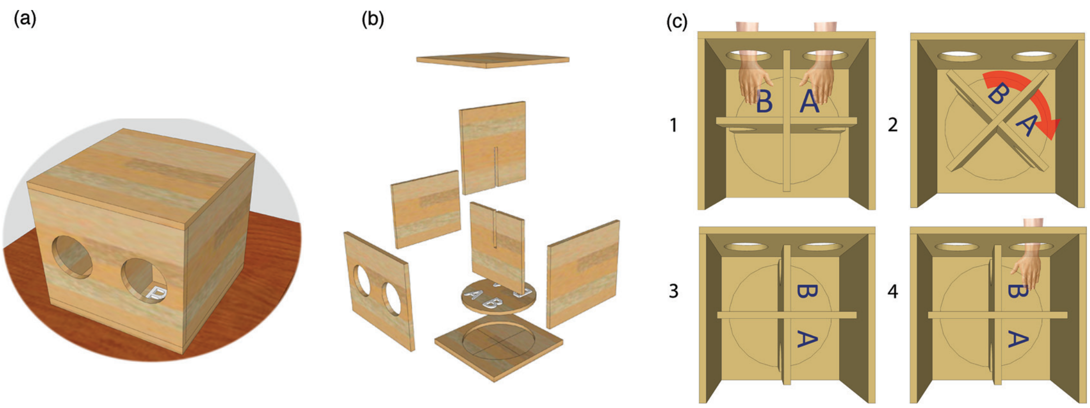

Figure 2. A customised box, shown intact (a) and in exploded views (b), was used to allow exploration of objects without vision and to facilitate choice manipulations via a silent turntable. The box dimensions were 2ft wide by 2ft deep by 1ft high; the turntable had a diameter of 22 inches; the dividers had a height of 10 inches. The dividers formed a cross on the turntable, splitting it into four compartments of equal size. Objects were placed in and removed from the two compartments (A and B) nearest to the participant through holes that had been cut out of one of the dividers (not shown). Two holes had also been cut out on the side of the participant to allow them to place their hands inside the box to feel the objects. (c) Example of a manipulated choice trial. (1) Both hands are placed inside the box to simultaneously feel two objects. When the participant removes their hands to verbally report a choice, the researcher rotates the turntable (2) so that the non-preferred item replaces the preferred item (3). Finally, the participant is asked to put their hand back into the preferred side while providing reasons for their choice (4).

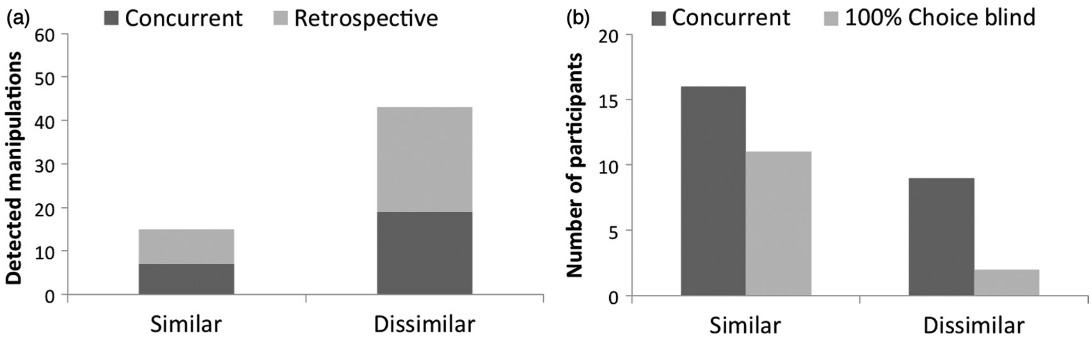

Figure 3. (a) Total number of manipulated trials detected concurrently and retrospectively, as a function of condition; (b) number of participants who remained choice blind both concurrently and in total, as a function of condition.

Concurrent detection refers to switches identified during the trial itself, retrospective detection to those occurring at any later period up to and including debriefing. For the similar condition, only 13 out of 60 of these switches were ever reported, 7 concurrently and 6 retrospectively, giving an overall detection rate of 22%. This is in contrast to the dissimilar condition where 42 out of 60 switches, 18 concurrent and 24 retrospective, were detected, a rate of just over 70%.

Probably the best way to quantify the strength of choice blindness, one that avoids cascade effects, where a participant's first detection leads to the increased likelihood of further detection, is to consider the number of participants who remain totally unaware of any switches. As shown in Figure 3(b), in the similar condition, 16 out of 20 participants failed to report even a single instance of concurrent detection, compared with only 8 out of 20 in the dissimilar group, $\chi^2 = 5.1$, $\phi = 0.41$, $p = <0.05$. Looking at those participants who were 100% choice blind, that is, failed to make any concurrent or retrospective reports, at any time during the experiment, the figures were 11 and 2 respectively for the similar and dissimilar conditions, $\chi^2 = 7.3$, $\phi = 0.48$, $p = <0.01$.

Our findings, then, seem quite clear. Choice blindness does occur when objects are explored by hand, but the level of awareness is strongly modified by object similarity. This latter finding is in contrast to the original description of choice blindness, where similarity between pairs of faces had no impact on performance (Johansson et al., 2005).

It is possible that this latter finding reflects a fundamental difference between vision and touch. However, there are clearly several other alternative explanations. The shift from 2D images to 3D objects, and the increase in exposure time, are just two possibilities. A clear limitation of the current study is the lack of a direct comparison with performance under vision-only or vision-touch conditions. The current stimuli set were designed specifically with touch in mind. Our use of familiar objects meant that, visually, a number of additional cues such as colour, visual texture, and identifying marks (e.g., labels and icons) would make direct comparisons between vision and touch problematic. Future studies would need to more carefully select common object and/or use more controlled computer-generated stimuli (e.g., Gaißert et al., 2010; Lawson, 2009).

A final, less interesting possibility that might account for the observed similarity effects would be if our pairs of similar objects were too close together in feature space. As we manipulated similarity by exchanging exemplars within the same category of objects, perhaps some pairs were simply indistinguishable? To objectively assess this we ran a small control experiment in which six object pairs replicated the similar condition of the main experiment and six contained physically identical items. Nine out of 12 of the participants had perfect hit rates for detecting the different pairs and there were only 9 false alarms (out of a possible 72) across the whole experiment (mean $A' = 0.93$, SE = 0.03).

In summary, the current findings appear to make two main contributions to the literature: First, we have shown that choice blindness generalises to a previously unexplored modality: touch. Second, our findings highlight the role of similarity and suggest that difference thresholds may provide important insights into the mechanisms that underlie choice blindness.

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References

Gaißert, N., Wallraven, C., & Bülthoff, H. H. (2010). Visual and haptic perceptual spaces show high similarity in humans. *Journal of Vision*, *10*(11), 1–20. doi:10.1167/10.11.2

Hall, L., Johansson, P., & Strandberg, T. (2012). Lifting the veil of morality: Choice blindness and attitude reversals on a self-transforming survey. *Plos ONE*, *7*(9), e45457. doi:10.1371/journal.pone.0045457

Hall, L., Johansson, P., Tärning, B., Sikström, S., & Deutgen, T. (2010). Magic at the marketplace: Choice blindness for the taste of jam and the smell of tea. *Cognition*, *17*, 54–61. doi:10.1016/j.cognition.2010.06.010

Johansson, P., Hall, L., Sikström, S., & Olsson, A. (2005). Failure to detect mismatches between intention and outcome in a simple decision task. *Science*, *310*, 116–119. doi:10.1126/science.1111709

Klatzky, R. L., Lederman, S. J., & Metzger, V. A. (1985). Identifying objects by touch: An "expert system." *Perception and Psychophysics*, *37*, 299–302. doi:10.3758/BF03211351

Lawson, R. (2009). A comparison of the effects of depth rotation on visual and haptic three-dimensional object recognition. *Journal of Experimental Psychology: Human Perception and Performance*, *35*, 911–930. doi:10.1037/a0015025

Newell, F. N., Ernst, M. O., Tjan, B. S., & Bülthoff, H. H. (2001). Viewpoint dependence in visual and haptic object recognition. *Psychological Science*, *12*, 37–42. doi:10.1111/1467-9280.00307

Catherine Steenfeldt-Kristensen studied Psychology at Swansea University, graduating in 2010. Her final year interests in change blindness and choice blindness evolved into the current project. Having obtained an MSc in Research Methods, also from Swansea University, she is now preparing to train as a Clinical Psychologist.

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