Objective and Subjective Measures of Change Blindness: Where Are the Real Pitfalls?

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Abstract

■ What is the observer's conscious experience in a change blindness task? Overgaard, Jensen, and Sandberg argue that subjective measures are required for any conclusions about conscious experience. We will lay out how the choice of subjective or objective measures depends on the given research question and that objective measures allow inferences on experience given plausible assumptions regarding the relation between task performance and experience. ■

Overgaard, Jensen, and Sandberg (2010) criticize our recent study of different types of change detection and change blindness (Busch, Fründ, & Herrmann, 2009) as "ending up in self-contradiction and methodological pitfalls." We will lay out that our study is not subject to such failures, given that our procedure was required by a specific research question and rests on very plausible assumptions regarding the relation between task performance and experience.

Change blindness has emerged as a central paradigm in the field of visual cognition (see Simons & Rensink, 2005), which has provided insights into the role of attention and visual memory in visual scene perception (Henderson, 2008; Hollingworth, 2008) by investigating subjects' ability to identify the changing object or simply to report whether or not a change occurred. Most studies have focused on the conditions under which change blindness occurs or the mechanisms of implicit representations under change blindness. A question rarely addressed is: what is it like (not) to see a change? This question is about the participant's subjective experience, rather than the stimulus. This type of question may seem to have an esoteric flavor, but it should be noted that similar questions have been fruitful in other fields of cognitive neuroscience. For instance, based on the phenomenology of long-term memory retrieval, studies have identified two different retrieval types: simply "knowing" that something is from the past and "remembering" detailed information about the study episode. Numerous studies have confirmed that familiarity and recollection are phenomenologically, behaviorally, and neurally distinct processes (Jäger, Mecklinger, & Kipp, 2006; Yonelinas, 2001). Likewise, studies of blindsight have not only investigated patients' performance in their "blind" fields but have also addressed the question of what it feels like (not) to see a stimulus in the blind field (Stoerig & Cowey, 1997), often by using confidence scales with labels corresponding to the patients' experience (Wessinger, Fendrich, & Gazzaniga, 1999; Overgaard et al., 2008). For instance, in a recent study by Overgaard, Fehl, Mouridsen, Bergholt, and Cleeremans (2008), a blindsight patient was asked to describe her experiences more systematically than the usual aware/unaware distinction allows (e.g., as "something was there but I had no idea what it was"). By using such reports, the authors found that preserved performance in blindsight does not reflect unconscious vision, but rather degraded, yet conscious vision.

Recently, Rensink (2004) investigated whether observers can "sense" the presence of a change in a change blindness paradigm before they clearly see the changing object. He concluded that "sensing" and "seeing" are not only phenomenologically distinct, but are also associated with distinct perceptual processes. This conclusion was criticized in a subsequent study by Simons, Nevarez, & Boot (2005), who suggested that "sensing" reports are either lucky guesses or cases in which subjects already saw the changing object, but do not yet "dare" to give a definite response about their "seeing." It is important to note that both studies relied on the relative timing and frequency of "now I sense" and "now I see" reports. It is widely accepted, however, that subjects' introspection about their perception or cognition is often not a good indication of what the brain actually represents. According to Henderson (2008), one might even say that the actual pitfall lies here: "it is … dangerous to draw any strong conclusions about internal visual representation or computation based solely on perceptual phenomenology" (p. 112). Thus, independent data are necessary to substantiate the

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claim of a distinct perceptual process, which allows people to "sense" the presence of a change without seeing the changing object.

Therefore, we employed a modified change blindness paradigm to study different types of change perception (Busch et al., 2009). Subjects were not queried directly about their experiences of "sensing" or "seeing" changes. However, it is important to acknowledge that the central question in this study was not whether or not subjects ever have such experiences.[1] This question has been answered positively in the studies by Rensink (2004) and Simons et al. (2005). The question was rather whether there is any sense in "sensing": Is "sensing" really a perceptual process and is it fundamentally different from "seeing"? And what is the nature of the visual representations underlying this "sensing"? These questions can be addressed only by assessing objective performance. Likewise, studies that measure subjective experiences directly, as in the blindsight study by Overgaard et al. (2008), need to measure objective performance as well in order to confirm that there is actually sight in the patient's blindsight. In our study, subjects were to report the presence or absence of a change (detection) and subsequently, to choose the changing object among a set of distractors (identification). Thus, although the connection between detection and identification performance and subjective experiences is indeed indirect and inferential (and is presented as such in the article), this connection rests on a simple and very plausible assumption: Consciously "sensing" that a change occurred should allow the observer to detect the presence of a change in the detection task and "seeing" a change should allow him to identify the changing object. Based on this simple assumption, we hypothesized that there should be detection without identification on a significant number of trials if "sensing," in fact, relies on a perceptual process rather than lucky guessing. Furthermore, if this perceptual process is really different from "seeing," the neural correlates of detection with and without subsequent identification should be substantially different. Both hypotheses were confirmed (Busch et al., 2009).

Overgaard et al. argue that by using this design, we "end up in self-contradiction and methodological pitfalls." What precisely is the pitfall in which we are supposed to end? According to Overgaard et al., the problem lies with our assumption that a visual experience is required to identify the changing object after correctly detecting the change. They argue that a subjective measure of conscious experience might actually reveal the opposite—that successful identification is due to implicit or subliminal perception. Accordingly, the large ERP effects that were found for identified changes compared to change blindness (selection negativity, N2pc, etc.) would be due to unconscious perception. However, it is hard to see how this could work. The scenario that Overgaard et al. have in mind goes like this: The subject had no conscious experience of the change whatsoever. Yet, she correctly guesses that a change occurred rather than responding "no change" or "don't know." Then, despite her unawareness, she picks the correct object due to some unconscious or implicit perceptual process. However, our data show that this is very unlikely. If subjects show implicit perception when they correctly guess the change, they should also show implicit perception when they do not guess. However, in the present study and in a follow-up study (Busch et al., in preparation), identification performance was at chance when subjects did not detect the change, and ERP components did not show any sign of implicit or residual processing, either. Thus, our assumption that the combination of correct detection and identification is associated with actually seeing the stimulus consciously is highly plausible.

In conclusion, we share Overgaard et al.'s fondness for subjective measures of conscious perception. As the authors correctly note: "Task performance is not a good guide to conscious experience." We would like to add that, conversely, subjective reports are not always a good indicator of perceptual processes and the nature of the underlying representations. Studies investigating perception without using subjective measures might miss part of the picture. However, by using solid experimental paradigms and relying on reasonable assumptions about the connection between experience and performance, pitfalls can be easily avoided.

Note

1. This is in contrast to the study on blindsight mentioned above (Overgaard et al., 2008), where the central question actually was: Do patients have conscious experience of a stimulus in the blind field?

REFERENCES

Busch, N. A., Dürschmid, S., & Herrmann, C. S. (in preparation). ERP effects of change localization, change identification and change blindness.

Busch, N. A., Fründ, I., & Herrmann, C. S. (2009). Electrophysiological evidence for different types of change detection and change blindness. *Journal of Cognitive Neuroscience, 22,* 1852–1869.

Henderson, J. M. (2008). Eye movements and scene memory. In S. J. Luck & A. Hollingworth (Eds.), *Visual memory* (Chap. 4, pp. 87–122). New York: Oxford University Press.

Hollingworth, A. (2008). Visual memory for natural scenes. In S. J. Luck & A. Hollingworth (Eds.), *Visual memory* (Chap. 5, pp. 123–162). New York: Oxford University Press.

Jäger, T., Mecklinger, A., & Kipp, K. H. (2006). Intra- and inter-item associations doubly dissociate the electrophysiological correlates of familiarity and recollection. *Neuron, 52,* 535–545.

Overgaard, M., Fehl, K., Mouridsen, K., Bergholt, B., & Cleeremans, A. (2008). Seeing without seeing? Degraded conscious vision in a blindsight patient. *PLoS One, 3,* e3028.

Overgaard, M., Jensen, M., & Sandberg, K. (2010). Methodological pitfalls in the "objective" approach to consciousness: Comments on Busch et al. (2009). *Journal of Cognitive Neuroscience, 22,* 1901–1902.
Rensink, R. A. (2004). Visual sensing without seeing. *Psychological Science, 15,* 27–32.
Simons, D. J., Nevarez, G., & Boot, W. R. (2005). Visual sensing is seeing: Why "mindsight," in hindsight, is blind. *Psychological Science, 16,* 520–524.
Simons, D. J., & Rensink, R. A. (2005). Change blindness: Past, present, and future. *Trends in Cognitive Sciences, 9,* 16–20.
Stoerig, P., & Cowey, A. (1997). Blindsight in man and monkey. *Brain, 120,* 535–559.
Wessinger, C. M., Fendrich, R., & Gazzaniga, M. S. (1999). Variability of residual vision in hemianopic subjects. *Restorative Neurology and Neuroscience, 15,* 243–253.
Yonelinas, A. P. (2001). Components of episodic memory: The contribution of recollection and familiarity. *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences, 356,* 1363–1374.