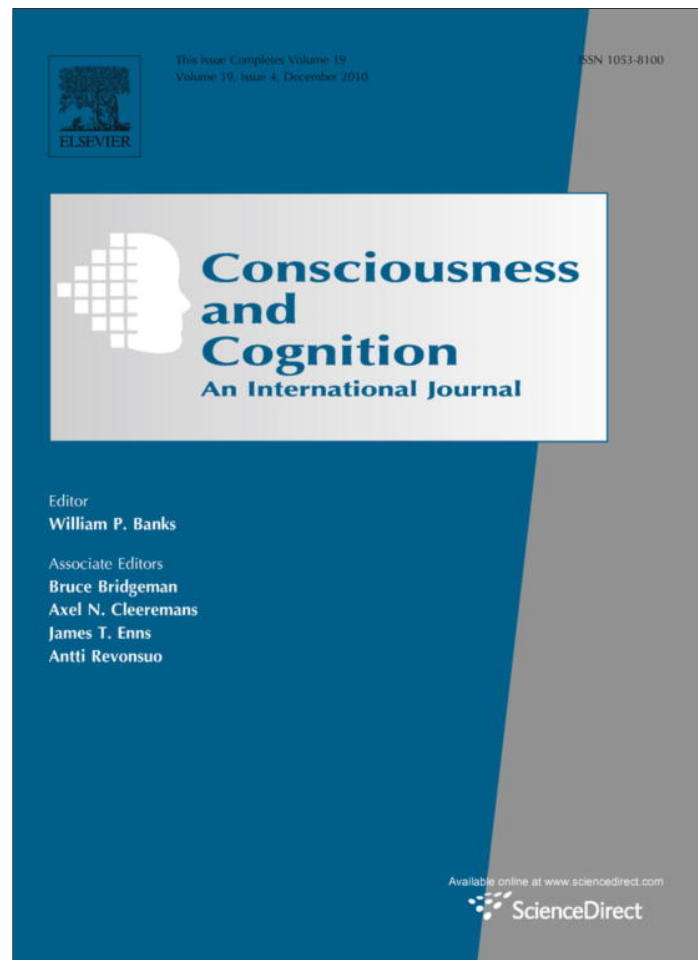


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Reply

Partial awareness distinguishes between measuring conscious perception and conscious content: Reply to Dienes and Seth [☆]Bert Timmermans ^{a,c,*}, Kristian Sandberg ^b, Axel Cleeremans ^a, Morten Overgaard ^b^a *Consciousness, Cognition, and Computation Group, Université Libre de Bruxelles, Belgium*^b *Cognitive Neuroscience Research Unit, Hammel Neurorehabilitation and Research Center, Aarhus University, Denmark*^c *Neuroimaging Group, Department of Psychiatry, University Hospital of Cologne, Germany*

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ABSTRACT

In their comment on Sandberg, Timmermans, Overgaard, and Cleeremans (2010), Dienes and Seth argue that increased sensitivity of the Perceptual Awareness Scale (PAS) is a consequence of the scale being less exclusive rather than more exhaustive. According to Dienes and Seth, this is because PAS may measure some conscious content, though not necessarily relevant conscious content, “If one saw a square but was only aware of seeing a flash of something, then one has not consciously seen a square.” In this reply, we claim that there is a difference between conscious visual experience, which may be partial, and the resulting conscious content, which is conceptual. Whereas PAS measures the first, confidence judgments and post-decision wagering measure the second.

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When evaluating a measure of awareness, two parameters are of key importance: exhaustiveness and exclusiveness (Reingold & Merikle, 1988). A measure is maximally exhaustive when it detects all conscious knowledge, and it is maximally exclusive when no unconscious knowledge is misclassified as conscious knowledge. In the study of Sandberg, Timmermans, Overgaard, and Cleeremans (2010), we tested three measures of awareness and concluded that since the Perceptual Awareness Scale (PAS) was the most sensitive measure, it was also the most exhaustive one, based on the fact that all three measures were equally exclusive. In their comment on the study, Dienes and Seth (2010) dispute the paper's conclusion, arguing that asking participants to report on their visual experience in general instead of on their confidence in having responded correctly incurs the risk of misclassifying unconscious information as conscious. In other words, the higher sensitivity of PAS that Sandberg et al. (2010) observed is a consequence of the scale's weak exclusiveness rather than of its better exhaustiveness. According to Dienes and Seth, this is because PAS may reflect conscious contents that are irrelevant to performing the task. They write, “according to higher order thought theory, the content *p* of a mental state is conscious only if the participant is aware of the mental state as having content *p* (cf. Rosenthal, 2005). If one saw a square but was only aware of seeing a flash of something, then one has not consciously seen a square.” In this reply, we claim that there is a difference between conscious visual experience, which may be partial, and the resulting conscious content, which is conceptual and, at least in the sort of experimental paradigm we have used, dichotomous. Whereas PAS measures the first, confidence judgments and post-decision wagering measure the second, as such content forms the basis of participants' judgment knowledge.

[☆] Reply to Commentaries on Dienes, Z., & Seth, A. (2010). Measuring any conscious content versus measuring the relevant conscious content. *Consciousness and Cognition*, 19, 1079–1080.

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Dienes and Seth build their argument around a study by Perrig and Eckstein (2005), in which 750 ms-presentations of vertically mirrored words, such as shown in Fig. 1, fail to be consciously identified, but nevertheless produce reliable semantic priming effects in word stem completion. However, let us assume that the stimulus in Fig. 1 is presented to a person who has no knowledge of English. Obviously, there will be no semantic priming effect. But one would be hard-pressed to say that this person had less conscious visual experience of the actual stimulus.

By this simple example we aim to highlight the difference between the occurrence of a conscious visual experience (one's experience of the stimulus) and the resulting conscious content (one's awareness of the word). Kouider and Dupoux (2004) clearly demonstrated that there is a difference between being conscious at the letter level and at the word level, by showing that, for instance, with only partial awareness of certain letters, both the word BLUE and the non-word BELU, are identified and treated as real words, both in a Stroop task and in subjective reports. Recently, de Gardelle, Sackur, and Kouider (2009) went even further: using the Sperling letter-grid, they showed that, when non-letters were presented in the grid, participants still identified them as letters, based on what they have coined "partial awareness" (Kouider, de Gardelle, Sackur, & Dupoux, *in press*; see also Kouider, de Gardelle, & Dupoux, 2007), that is, partial perception that activates a concept, such as the word BLUE or a letter. Both findings suggest that our mind, rather than consciously experiencing a rich reality, constructs a conscious reality based on partial experience modulated by context and expectations. This "illusory" conscious perception, constructed from parts, might be termed "conscious content", whereas the "conscious perception" is what participants actually observed, which may be just the parts. It may be impossible, and even futile, to try and disentangle conscious perception from conscious content, but it may help clarify why Dienes and Seth (2010) believe the increased sensitivity of PAS compared to confidence ratings and post-decision wagering to be a sign that PAS is not as exclusive.

In their 2010 paper, Dienes and Seth indicate that they are interested in judgment knowledge – do people know that they know? However, the answer to this question critically hinges on what one considers relevant knowledge (see also Overgaard, Timmermans, Sandberg, & Cleeremans, 2010). In implicit learning tasks, as those used in Dienes and Seth's experiments, one is interested in what knowledge, or what conscious content people have about properties of material that was presented consciously. This is similar to asking English-speakers whether they have identified a word in the shape in Fig. 1. Both properties are not part of the material as such, but are consequential to the context – whether this is the repeated presentation of different instances of the same artificial grammar, or semantic content. If we take Kouider and Dupoux and de Gardelle et al.'s results into account, this would similarly hold for geometric shapes as used in Sandberg et al., in the sense that perception of partial information may not necessarily give rise to a full-blown conscious representation, but may nevertheless be diagnostic in terms of discrimination.

When giving confidence ratings or placing wagers, participants are, as Dienes and Seth state in their comment, reporting relative to their judgment, that is, the degree to which they saw a "square" for instance. Such judgment knowledge reflects whether the conscious content "square" is activated or not. However, since the conscious content of a square is very probably created based on partial information, this does not necessarily inform us about what participants actually experienced. Moreover, this makes these subjective measures very vulnerable to what part of their conscious content participants *think* contributed to their answer. With PAS, there is no explicit reference to participants' judgment; instead, participants are just asked about their visual experience. So it is possible, and very probable, that participants, especially when reporting a "weak glimpse", saw something that they were not able to identify. Nevertheless, this "something", which may not yield any confidence in, or wager increase on the response at all, may be diagnostic and therefore enough to influence behavior.

If a perceived part of the stimulus fails to be diagnostic, one expects performance to be at chance level, and ratings on both PAS and the other two measures to be dissociated from accuracy. Conversely, when the perceived part is diagnostic, one expects above chance discrimination, and PAS awareness ratings to increase and correlate accordingly. However, for confidence ratings and wagers, this diagnostic part can only yield a change in awareness rating when it has activated the conceptual content pertaining to the judgment. The results of Sandberg et al. show that it is in any case more efficient to see something, rather than seeing absolutely nothing. Crucially, when using PAS subjects are clearly able to distinguish situations in which (practically) no information is available (ratings of "1") from those situations in which some amount of information is present (ratings of "2"). Confidence ratings and post-decision wagers do not pick up on this, not only because (as suggested by Sandberg et al.) it takes a sufficiently clear experience before one can be confident about one's answer, but also because there may simply not be any conscious content about a "square". This gap between seeing something (conscious perception) and knowing what it is (conscious content) might explain the difference between the sensitivity of PAS and confidence ratings or wagers.

Interestingly, in this explanation may also lay the reason why PAS indicates a subjective threshold that coincides with the objective threshold for the most difficult stimuli, while the other two measures do not. A hypothesis could be that in terms of actual perception, there is just the objective threshold, and that performance above the objective threshold but below the subjective threshold simply reflects consciously perceived information, which is not recognized by the subject as possessing



Fig. 1. Mirror-scripted word "awareness" (from Perrig & Eckstein, 2005).

any rules or semantics, or as being relevant to the task at hand. According to this hypothesis, confidence ratings and wagering ask people about the knowledge they themselves know to be relevant whereas PAS asks people about any knowledge that they might have, and correlation between awareness and performance subsequently shows whether the knowledge was indeed relevant and discriminatively diagnostic.

Therefore, the views put forward by Dienes and Seth are not necessarily incompatible with ours; it simply depends what you want to know about what participants know. Dienes and Seth would want to know whether a participant watching a square knows why she reports “square”. This is highly similar to implicit learning experiments where one would want to know whether someone knows the grammatical rules on which they base letter string classification. These kinds of experiments tell us whether people know what influenced their decision but may tell us very little about what they actually perceived. If instead, we wish to learn about participants’ conscious perception, PAS seems a more appropriate method, because it is able to probe for partial conscious perception, and because, for short stimulus durations, it is at an objective threshold level. This way, little surprising, the appropriateness of the method depends on the research question. For the research question as to how we should measure conscious perception, we find the current evidence in favor of PAS.

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