

Response to Tsuchiya *et al.*: considering endogenous and exogenous attention

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Tsuchiya and colleagues [1] raise two main points in response to our view that attention is necessary but not sufficient for conscious awareness [2].

First, they point out that, in their previous work, they have been careful to claim that certain types of objects can reach consciousness in the near absence of top-down, endogenous attention [3,4]. They emphasize this fact because it is currently not possible to separate bottom-up attention from conscious awareness. We agree with this point and for this reason do not ever appeal to bottom-up attention to explain how the categories they put forward (e.g., the gist of a scene, animal/vehicle detection in dual-tasks, etc.) reach consciousness. Instead, we specifically focused on the studies that have used paradigms known to engage top-down attention (e.g., the attentional blink, inattention blindness, etc.) and find that the very categories they put forward can all fail to reach consciousness without attention. If it were actually the case that these categories do not need top-down attention to reach consciousness, these tasks should have no effect on those categories. The fact that they are affected by top-down attention manipulations suggests that some amount of top-down attention is necessary for these categories to reach awareness.

Second, they state that there is no reason to believe that top-down attention is needed to perceive items that are presented in isolation. Specifically, top-down attention may not be necessary for items such as a single oriented bar. As it stands at present, this is an empirical question: if attention is engaged by demanding auditory or tactile attentional tasks, will an unexpected single visual item always go noticed? Even though there are examples in the literature of cross-modal inattention blindness [5,6], none of these examples uses isolated visual stimuli. However, such a result would not be particularly informative for two reasons. First, as Tsuchiya *et al.* point out, it would be virtually impossible to ever know that there was no top-down attention available for visual processing. Furthermore, even if it could be shown that no such attention

was available, it would be unclear if the isolated bar captured attention and then was elevated to consciousness or whether it reached consciousness without any attentional amplification.

Without any clear examples in the literature of certain categories always reaching consciousness regardless of the way top-down, endogenous attention is deployed, we argue that attention is necessary, but not sufficient, for a stimulus to reach consciousness. We believe that attention is necessary for a stimulus to reach conscious awareness because attention stabilizes representations and holds them 'on line' long enough to be accessed by a variety of cortical networks and functions [7,8]. Attention is the mechanism that selects certain bits of information, allowing those bits to be processed more thoroughly and reach consciousness. Although there is undoubtedly a dissociation between attention and consciousness, it is not a double dissociation because there is no evidence of stimuli reaching consciousness without some form of attentional amplification.

References

- 1 Tsuchiya, N. *et al.* (2012) Top-down attention and consciousness: comment on Cohen *et al.* *Trends Cogn. Sci.* 16, 527
- 2 Cohen, M.A. *et al.* (2012) The attentional requirements of consciousness. *Trends Cogn. Sci.* 16, 411–416
- 3 Koch, C. and Tsuchiya, N. (2007) Attention and consciousness: two distinct brain processes. *Trends Cogn. Sci.* 11, 16–22
- 4 Van Boxtel, J.J. *et al.* (2010) Consciousness and attention: on sufficiency and necessity. *Front. Psychol.* 1, 217
- 5 Sinnet, S. *et al.* (2006) Manipulating inattention blindness within and across sensory modalities. *Q. J. Exp. Psychol.* 59, 1425–1442
- 6 Macdonald, J.S.P. and Lavie, N. (2011) Visual perceptual load induces inattention blindness. *Attn. Percept. Psychophys.* 73, 1780–1789
- 7 Dehaene, S. and Changeux, J.P. (2011) Experimental and theoretical approaches to conscious processing. *Neuron* 70, 200–227
- 8 Cohen, M.A. and Dennett, D.C. (2011) Consciousness cannot be separated from function. *Trends Cogn. Sci.* 15, 358–364

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