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Commentary

Making sense of blindsense: A commentary on Garric et al., 2019

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Blindsight—the phenomenon of preserved visual function despite destruction of striate cortex—has played an immensely important role in scientific and philosophical theorizing about consciousness. Though several individual patients have been extensively studied (notably D.B. and G.Y., see review in Cowey, 2010), epidemiological work on blindsight is extremely limited (e.g., Morland, Lê, Carroll, Hoffmann, & Pambakian, 2004). Moreover, whilst it has long been known that residual vision in blindsight is not entirely unconscious (as in so-called type II blindsight—see Weiskrantz, 1998, and papers in Kentridge & Foley 2015), few systematic investigations of subjective experience have been conducted. Garric et al. (2019) address both lacunae by exploring performance and awareness in eight patients with homonymous hemianopia. They purport to identify "one patient [P2] with type I blindsight, no cases of type II blindsight, three patients with a total absence of blindsight and most importantly, four patients exhibiting a never-before described phenomenon … named *blindsense*" (308). One of these four blindsense patients (P1) is additionally said to exhibit a striking pattern of performance labelled *reverse blindsight*.

In what follows I critically assess these conclusions and offer a very different perspective on the patterns of performance and awareness observed. In particular, I argue that P2 does not exemplify type I blindsight; that blindsense is neither a novel nor a surprising dissociation; and that reverse blindsight has a straightforward explanation. A puzzling (albeit unremarked) pattern of performance is observed in two patients (P6 and P7). However, re-examination of the raw data suggests that this is likely an artefact of both patients adopting highly conservative response criteria in detection and consequent problems with estimating sensitivity. More generally, I argue that the patterns of performance and awareness which Garric et al. observe are consistent with the hypothesis that blindsight involves residual conscious vision masked by conservative response criteria in binary tasks but revealed under more nuanced report protocols (Overgaard, Fehl, Mouridsen, Bergholt, & Cleeremans, 2008; Mazzi, Bagattini, & Savazzi, 2016; cf. Campion, Latto, & Smith, 1983).

1. Overview of Garric et al.'s methods and findings

Garric et al. examined eight patients using two objective tasks with identical stimuli. In each task, either an X, an O, or a blank was presented to one visual hemifield.[1] In Task 1, patients reported whether any stimulus was presented. In Task 2, patients indicated whether the stimulus was an X or an O (including on blank trials, and guessing if necessary). In both tasks, patients provided a subjective report on a trial-by-trial basis using a novel extension of Ramsøy and Overgaard's (2004) Perceptual Awareness Scale (PAS) which Garric et al. name the Sensation Awareness Scale (SAS).

Two problems should immediately be noted concerning this SAS. First, it is not a scale. Ramsøy and Overgaard's original PAS offers four response options: no experience, brief/weak glimpse, almost clear experience and clear experience. Garric et al. instead offer five options: (1) I did not see anything; (2) I don't think that I saw anything, but I am not sure; (3) I felt something; (4) I saw something; and (5) I clearly saw something and can identify it. The key addition, as Garric et al.

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[1] Garric et al. do not report controlling for light-scatter. This is regrettable since this is well known to be a critical confound in studies of hemianopic subjects (Campion et al., 1983; King, Azzopardi, Cowey, Oxbury, & Oxbury, 1996).

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see it, is that their SAS includes "a critical level that does not refer to visual experience" (301). However, this new level (3) cannot be assumed to fall intermediate between levels (2) and (4). Consider a subject who feels something non-visual but is sure they didn't see anything. This subject will wish to respond with (1) *and* (3) yet reject (2). On the other hand, consider a subject who sees the stimulus extremely clearly and so responds at level (5). It remains an entirely open question whether, in the usual sense of feeling as involving bodily sensation, this subject feels anything associated with the stimulus. Thus, the introduction of level (3) means that the SAS is not a scale.[2]

The second problem with the SAS concerns the analysis of responses. Rather than simply focussing on whether sensitivity in the two objective tasks corresponds to reported awareness, Garric et al. analyse SAS responses by computing ROC curves for target present trials and for catch trials. By comparing the areas under these curves, they calculate a "subjective sensitivity" index. As well as assuming that responses lie on a scale, this analysis treats subjective responses as classifiable as hits and misses dependent on the presence or absence of a stimulus. This imposes objective correctness conditions on what are supposed to be subjective responses. The upshot is that "subjective sensitivity" is really a measure of objective stimulus sensitivity in disguise.

On the basis of data from these tasks, Garric et al. report "one patient [P2] with type I blindsight, no cases of type II blindsight, three patients with a total absence of blindsight and most importantly, four patients exhibiting a never-before described phenomenon … named *blindsense*" (308). One of these four patients (P1) is additionally said to exhibit a striking pattern of performance labelled *reverse blindsight*. The relevant patterns of performance are summarized in Fig. 1.

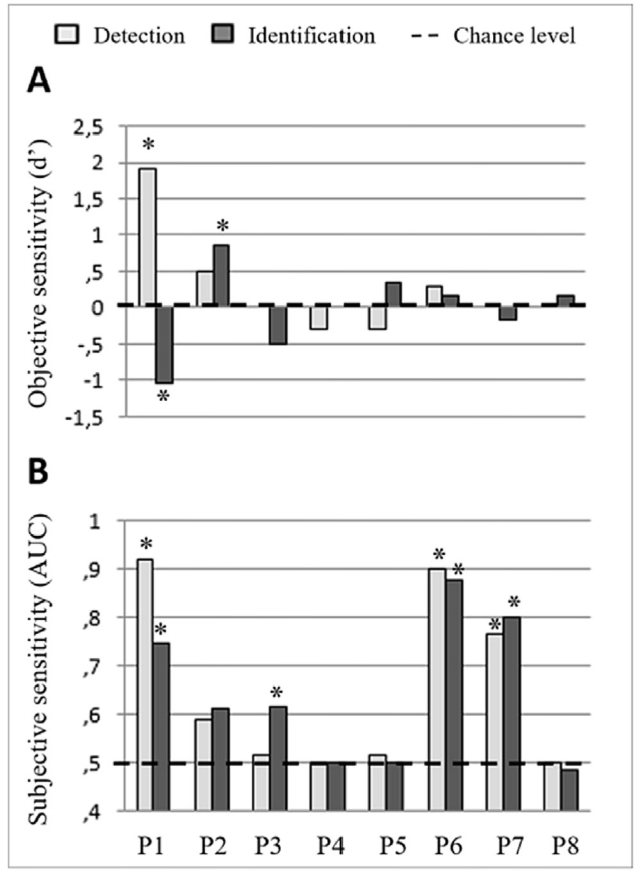

Fig. 1 — Reported data from Garric et al., 2019, p. 305, Figure 4. A. Estimated values of *d'* for P1-8 in Task 1 (light grey) and Task 2 (dark grey). B. "Subjective-sensitivity" (AUC: area under ROC curve) estimates for P1-8 in each task. **p* < .05, performance significantly above chance—see original paper for further details.

2. Critical discussion

Here I argue: (i) that P2 does not exhibit type I blindsight; (ii) that blindsense is neither a novel nor surprising dissociation; and (iii) that reverse blindsight is subject to a simple explanation. I then highlight what appears to be a genuinely puzzling (albeit unremarked) pattern of performance in patients P6 and P7. By turning to the raw performance data, I resolve this puzzle. The proposed resolution, and the overall pattern of performance and awareness observed across all eight patients, is consistent with the hypothesis that blindsight involves residual conscious vision unreported due to conservative response biases in biased binary response tasks but revealed under more nuanced report protocols.

2.1. No evidence of type I blindsight in P2

Garric et al. hold that patient P2's performance "clearly corresponds to type I blindsight" (306) since she "could distinguish between the letters X and O in her contralesional visual field" (304) despite her objective detection being at chance level, and a lack of subjective sensitivity to the stimulus. However, judged by the traditional gloss on type I blindsight as above-chance objective performance in the absence of reported awareness, P2 does not have type I blindsight. P2 reports level 2 or 3 awareness on over 50% of target trials (see Garric et al.'s Fig. 5, light-gray bars). If P2 has blindsight, it would seem to be type II.

To support their interpretation, Garric et al. argue that P2 shows a "lack of explicit sensitivity to the presence of stimuli in both tasks" (304) since her performance was not significantly different in target present trials and catch trials. However, it cannot be concluded from this data that P2 lacked "subjective sensitivity". Absence of evidence is not evidence of absence. P2's performance is equally consistent with (and indeed suggestive of) weak sensitivity. Garric et al. further argue that they found "no correlation between a higher reported sensitivity on the scale and the correct answers" (305). "In fact," they argue, "P2 answered mostly at levels 1, 2 and 3, but performed best at level 2." (ibid.) However, as discussed above, there is no reason to think that level 3 of the SAS is in

[2] Arguably, this simply exacerbates an issue already affecting the original PAS since it is possible to imagine clear (e.g., auditory or somatosensory) experiences which are non-visual, whereas even a weak glimpse must be visual.

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any sense higher than level 2. To the contrary, previous work on type II blindsight suggests that subjects are willing to report feeling something even when adamant that they do not see anything (e.g., Stoerig & Barth, 2001; Weiskrantz, 2009). If we set aside level 3 responses and just compare levels 1 and 2, a clear correlation is found: P2 reports level 2 awareness on 40% of correct trials and only 17% of incorrect trials.

It should be acknowledged that P2's performance in Task 2 reaches significance despite her "subjective sensitivity" not reaching significance. However, casual inspection of Fig. 1, shows that this is very far from a striking dissociation. Rather objective performance in Task 2 just reaches significance, whereas subjective sensitivity just falls short. Especially given the problems already noted with both the SAS and "subjective sensitivity" as a construct, this cannot be a secure basis for attributing type I blindsight to P2.

2.2. *Blindsense is neither novel nor surprising*

The most striking feature of Garric et al.'s discussion is their identification of four patients (P1, P3, P6 and P7) as exhibiting blindsense, allegedly a "never-before described phenomenon" (308). Blindsense is characterized as involving above-chance subjective sensitivity to stimulus presence despite chance-level ability to identify the stimulus in a force-choice setting.[3] However, it is neither novel nor surprising that subjects should be unable to discriminate between distinct stimuli both of which they can detect, either subjectively or objectively. Consider, for instance, a subject asked to discriminate between two metameric colours. Both colours may be as subjectively salient as one likes and yet mutually indiscriminable in a given context. Similarly, subjects may be subjectively certain that a stimulus is present without being able to tell whether it is an X or an O.

2.3. *Explaining reverse blindsight*

A second striking feature of Garric et al.'s discussion is their identification of one blindsense subject as also exhibiting *reverse blindsight*. P1 exhibits significant objective sensitivity in Task 1. However, his performance in Task 2 falls significantly *below* chance. Garric et al. see this as a "remarkable result" (307). Note, first, that, *pace* Garric et al., P1 cannot in fact have blindsense since blindsense is defined as involving chance-level ability to discriminate the stimulus, whereas P1 exhibits a significantly negative value of *d'*. Note, second, that the use of the term "blindsight" is misleading. P1 is subjectively sensitive to stimuli, using levels (2)–(4) on 95% of stimulus present trials. Indeed, since he uses level (4) "I saw something" on 20% of such trials even "type II blindsight" would be an inappropriate label. P1 has at least some residual conscious vision.

Nonetheless, P1's performance requires explanation. If he can consciously see stimuli, why does he perform below chance in Task 2? Garric et al. note that it cannot be response confusion since he performs well in his sighted field. Nonetheless, a straightforward explanation is available. Suppose that Xs and Os do appear differently to P1, providing a subjective basis for above-chance task performance. Suppose also, however, that their appearances are quite different from that of Xs and Os in his sighted field. Finally, suppose (as is surely reasonable) that P1 does not significantly rely on his blind field in everyday life, let alone to discriminate letters. As a result, whilst Xs and Os appear different to him, he may well not know which appearance corresponds to which letter. This could easily lead to systematic below-chance performance if he gets the correspondence between letter and appearance wrong.

Other evidence from blindsighted subjects suggests that destruction of striate cortex abolishes the ability to perceive form and that residual sensitivity may even be limited to the ability to detect differences in subjective salience (Alexander & Cowey, 2010). There is no a priori reason why Xs should be more or less salient than Os. Thus, if P1 can only discriminate differences in subjective salience, it may well not be obvious to him whether a stimulus is an X or an O, despite their differing in appearance.[4] This hypothesis could be tested by seeing whether feedback improves performance.

2.4. *An unremarked puzzle and its solution*

Although blindsense is not a surprising pattern of performance, at least two of Garric et al.'s patients (P6 and P7) do exhibit an apparently remarkable dissociation, for they appear to exhibit significant "subjective sensitivity" to stimuli despite performing at chance-levels in the first so-called "detection" task. This is especially surprising since "subjective sensitivity" is, as I have argued, a disguised form of objective sensitivity. Consequently, it would seem that, judged by one measure, P6 and P7 can see but, judged by another, they cannot. This certainly demands an explanation.

Strictly speaking, Task 1 is not a detection task. Task 1 uses three stimulus types (Xs, Os and blanks), and thus is a one-interval *categorization* task (Macmillan & Creelman, 2005, p. 115ff.). Furthermore, as previously noted, Garric et al.'s calculation of "subjective sensitivity" falsely assumes that the SAS is a genuine scale. However, it is doubtful that these issues suffice to explain such a marked discrepancy in estimated sensitivity. Instead, to solve the puzzle we must turn to the raw data. Here we can see that both P6 and P7 made no false alarms in Task 1. Moreover, P7 also scored no hits whereas P6 scored just one. As a result, in neither case can we appropriately estimate sensitivity using the standard formula for *d'*. The standard formula is: $d' = z(H) - z(F)$. Since $z(0)$ is $-\infty$, we obtain estimates of $d' = \infty$ for P6 and $d' = 0$ for P7. Garric et al. have evidently applied a standard correction to obtain

[3] Although Garric et al. describe their second task as a force-choice identification task, it is a one-interval task with two stimuli (Xs and Os; blank trials are not analysed when calculating sensitivity) and two responses (X or O). As a result, it is more perspicaciously described as a yes-no discrimination task.

[4] Compare here Weiskrantz's description of how patient D.B. had "experiences [which] were apt to mislead him by giving rise to complex experiences and wrong inferences" (1997: 143). Note that although D.B. could discriminate Xs and Os, he did not achieve this due to form perception as shown by his inability to discriminate differently oriented triangles (Kentridge, 2015; Weiskrantz, 2009).

their estimates of sensitivity. However, in the present context such correction-based estimates cannot be considered reliable. For whilst the raw data are consistent with P6 and P7 having no significant sensitivity, their extreme false alarm and hit rates may equally arise from their adoption of highly conservative response criteria (Stanislaw & Todorov, 1999, p. 143).[5] This possibility should be at the forefront of our minds given previous work showing precisely such conservative criteria in the extensively studied blindsight patient G.Y (Azzopardi & Cowey, 1997, 1998).

One way of testing this possibility would be to manipulate each subject's criterion away from its putative extreme value, and re-estimate *d'*. This, however, is just what we might think of the nuanced response options of the SAS as doing. That is, we might understand responses at intermediate levels (2)–(4) as detection responses made using more liberal criteria than those adopted in making simple "yes" responses in Task 1. Seen this way, a plausible interpretation of the data emerges. On this interpretation, P6 and P7 adopt extremely conservative criteria in Task 1, disguising their underlying sensitivity, and confounding the estimation of sensitivity. However, when multiple response options are offered using the SAS, more liberal criteria are adopted in relation to lower levels of the "scale". When sensitivity is calculated in this task, a more accurate estimate of sensitivity is thus obtained. The fact that this estimate does suggest significant sensitivity supports the hypothesis that performance in Task 1 is due to highly conservative response criteria as opposed to a true absence of sensitivity.

This hypothesis is consistent with other studies on blindsight which suggest that blindsight involves residual conscious vision masked by conservative criteria when assessed using with binary responses in biased detection and/or awareness tasks yet revealed when using multi-level response options (Mazzi et al., 2016; Overgaard et al., 2008). In this light, a quite different picture from that articulated by Garric et al. emerges. Their eight patients do not exhibit heterogeneous, striking dissociations. Rather, both "blindsense" and "reverse blindsight" are easily explicable phenomena. Moreover, concerning the five patients who do exhibit some level of residual performance, in no case is there good reason to think that this performance dissociates from awareness (even if this is sometimes masked by conservative response biases). It remains an open question whether such awareness is helpfully described as type II blindsight as opposed to simply being degraded conscious vision.

3. Conclusion

Garric et al. explore performance and awareness in eight patients with homonymous hemianopia. Of the five patients exhibiting residual function, they identify one as having type I blindsight, four as having a novel condition named blindsense, and one as exhibiting a novel pattern of performance named reverse blindsight. To the contrary, and consistent with other work on blindsight using nuanced report options, I have argued that neither allegedly novel pattern of performance is especially surprising and that there is no evidence of performance-awareness dissociations in any patient.

[5] As a referee for this journal points out, some patients may simply "give up" in particular testing regimes in their blindfield. This could easily explain such extreme criteria.

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