

Letter Response

Ensemble Perception, Summary Statistics, and Perceptual Awareness: A Response

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The extent to which perception is rich or sparse is a foundational issue in consciousness studies. According to those who claim that perception is rich, observers are aware of more information than they can attend to or remember [1]. Meanwhile, those who believe perception is sparse directly link awareness to the finite capacities of attention and working memory [2–4]. However, this view is often criticized since these limited mechanisms are thought to be unable to account for the impression of a rich, detailed perceptual experience that most observers have [5]. In our recent article [6], we argued that this criticism is misguided and that these supposedly limited cognitive mechanisms can support a much richer perceptual experience than is often claimed. By representing information as visual ensembles and summary statistics [7], observers are able to perceive far more than just a few items at a given time. Summary statistics give observers access to some information about the entire scene in the form of an ensemble percept. We claimed that ensembles and summary statistics explain the intuitive sense of a rich perceptual experience without having to rely on a new type of conscious experience, namely

phenomenal consciousness [1]. Put more simply, the sparse view is not so sparse after all.

In response to our article, McClelland and Bayne [8] suggest that there are two alternate views of the data we described: a deflationary view and an overflow view. According to the deflationary view, ensemble representations are not a part of phenomenology at all and only affect post-perceptual judgments. While this is a logical possibility, it is unclear what reason there is to believe that this is the case. More broadly, what empirical evidence could there be to support this claim? If participants can attend to, remember, openly talk about, and even confirm their experience of an ensemble percept, what reason is there to believe that such representations are not consciously experienced?

McClelland and Bayne also put forth an overflow view of ensemble representations in which observers are phenomenally aware of the individual items that make up an ensemble but are simply unable to store those individual items in memory. Again, while this is a logical possibility, it is unclear how to empirically verify that such fleeting perceptual experiences exist. What evidence could confirm that observers consciously experience information that is not ever attended to, remembered, or used to make any types of decisions [9]? McClelland and Bayne suggest that further development of no-report paradigms might one day empirically verify the idea of perceptual overflow [10]. While we do not want to discourage the development of new methods and paradigms, it is unclear how it will be possible to verify or probe the contents of conscious experience when observers' reports are not considered.

Instead, we are largely in agreement with Odegaard and Lau [11] who argue that what is needed is the generation of precise hypotheses for which we can then gather the relevant data. Overall, we believe researchers working towards understanding consciousness should focus on scientifically tractable questions for which there are experimental paradigms that can confirm or reject a particular hypothesis. In this case, we believe there are many outstanding issues regarding the perception of ensembles and summary statistics that can shed light on the nature and quality of perceptual experience.

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