



Behavioral methods in consciousness research

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could make would be to argue that Prinz's definition of attention is not a viable option available in this debate, yet a non-question-begging argument would have to be given for this.⁵

It may be retorted that the authors still make a substantial point when showing that attention is not identical to consciousness as they define these terms. Yet with a survey of the literature on the relationship between consciousness and attention, there doesn't appear to be a theorist who holds that the selective filtering and processing of sensory information is the same single cognitive process as that which gives rise to phenomenal consciousness. One could interpret the authors to be showing that it would still be wrong for anyone to adopt such a view as they characterize it. However, if this was the point they wished to make, it would have been beneficial to have been clearer about this by saying more about how to locate Prinz's position on the spectrum, if not as an "identity view" as they construe it.

These issues call into question whether the authors meet some of the main aims they set themselves in this book. The overall position of the authors regarding the level of dissociation between consciousness and attention is left unclear, and some arguments appear to lack force against other theorists. With that said, this should not detract from the value of the authors' original contribution to the philosophical literature on consciousness and detailed discussion of the evolution of attention, making this book of interest to anyone researching the philosophy, psychology, or neuroscience of attention and consciousness.

Notes

1. Also see the authors' glossary entry on attention, p. 229.
2. Any discussion of the possibility of consciousness without attention is more speculative (see p. 72).
3. "[A]ttention is a selection process that allows information to be sent to outputs for further processing ... attention allows perceptual information to access working memory stores" (Prinz, 2005, pp. 387–388).
4. Yet the authors do seem to think that they refute Prinz's position. See p. 192.
5. Prinz acknowledges that theorists may dispute his characterization of attention, saying "other researchers may choose to define attention differently. ... Those who disagree with my analysis of attention could simply drop the term 'attention'" (2012, p. 95).

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1. Introduction

Despite being a persistent phenomenon of our everyday lives, we are a long way from a full scientific explanation of consciousness. As Chalmers put it: "Conscious experience is at once the most familiar thing in the world and the most mysterious" (1995, p. 92). Consciousness has historically been

somewhat of a taboo subject among serious cognitive scientists. It has not seemed like a topic that lends itself to rigorous scientific study. What methods could one use to study something so subjective?

Despite these issues, many researchers have attempted to take on the topic of consciousness. The result is that there are a number of well-developed methods for studying consciousness, though each has its own limitations. *Behavioral Methods in Consciousness Research* provides an overview of these methods, along with summaries of their strengths and weaknesses. This book begins with three introductory chapters that discuss the history of consciousness studies and the common issues and controversies within consciousness research. Chapters 4 to 8 are about experimental paradigms. Each of these chapters provides information about a different experimental paradigm commonly used to study consciousness. Chapters 9 to 11 discuss different measures of consciousness. Chapters 12 and 13 are about statistical methods for analyzing measures of consciousness. Finally, chapter 14 is a concluding chapter. The chapters are written by a number of different authors and are edited by Morten Overgaard, who also contributes as an author of several chapters.

2. Background

Perhaps one of the book's strongest points is its discussion of the underlying issues that plague consciousness research. The central issue with studying consciousness is that it is by its nature subjective. Thus, studying consciousness seems to require by definition some sort of subjective measurement, like verbal report. But verbal reports of ones' experiences hardly seem like the stuff of science. Finding a good measure of consciousness requires thinking deeply about what criteria a measure would have to have to be satisfactory.

One central theme of the book is the search for measures of consciousness that are both *exhaustive* and *exclusive*. A measure of consciousness would be exhaustive if it measures everything that is conscious. It would be exclusive if it only measured only conscious awareness. But these criteria are difficult, if not impossible, to meet in practice.

One might think that simply asking subjects for a report of their conscious awareness may be enough. However, such verbal reports have been criticized as not exhaustive or exclusive. It's likely that subjects have a threshold for how confident they need to be before reporting that a percept is in conscious awareness, and therefore a verbal report might not be exhaustive (Eriksen, 1960). It also isn't clear that verbal reports exclusively measure conscious processing. Unconscious processing can affect a number of behaviors, and there is no reason to think that verbal reports would be unaffected by unconscious processes. Further, asking someone to make an introspective report might actually engage different processes than those engaged without introspective report. Indeed, there is evidence that different neural mechanisms are involved when one introspectively reports (Frässle, Sommer, Jansen, Naber, & Einhäuser, 2014). Finally, some have argued that introspective reports are always variable and uncertain, and thus too unreliable to draw scientific conclusions from (Schwitzgebel, 2008).

Although initially the issues with measuring consciousness may seem insurmountable, there is reason for optimism. There are plenty of examples of phenomena that, though imperfect, seem to offer purchase for studying consciousness. One striking example is blindsight. Individuals with blindsight report not being consciously aware of anything in their visual field (or portions of their visual field). However, they are able to react behaviorally to things in their visual field. Hence, coming to understand blindsight offers a look into consciousness. Researchers have discovered a number of other less extreme situations in which conscious awareness can be separated (at least partially) from outside stimuli or unconscious processing. Leveraging these peeks into consciousness is the key to this area of research.

3. Experimental paradigms

The core problem facing consciousness researchers is coming up with methods to disentangle conscious and unconscious processing. One approach is to find situations in which subjects are not consciously aware of something that affects their behavior. *Behavioral Methods in Consciousness Research* outlines

several such methods. For example, masking paradigms (discussed in chapter 4 by Talis Bachmann) allow us to study an effect similar to blindsight in healthy subjects. By presenting a brief stimulus and a second, masking stimulus soon after, one can block the brief stimulus from being perceived. If the stimulus is presented alone, the subject will report having perceived it, but when presented with the masking stimulus, it is not perceived. These masked stimuli can still affect behavior through priming (Perea & Gotor, 1997). This suggests that conscious perception takes time and unfolds over several stages. Thus, researchers can use masking to gain some amount of control over this percept formation process and to learn about the stages in which a stimulus goes from unconscious to conscious.

Another method for studying conscious awareness is to create situations in which outside conditions are the same, but conscious awareness differs. One such phenomenon discussed in the book is binocular rivalry, discussed in chapter 8 by Jan Brascamp. To elicit binocular rivalry, an image is presented to one eye and a very different image is presented to the other. Instead of seeing the two images superimposed, subjects see one image or the other. The image seen will often flip back and forth between the images presented to the two eyes, despite no change in the actual stimulus. This is interesting for consciousness researchers because it is an instance of a change in conscious perception without a change in stimulus. This allows researchers to investigate the neural mechanisms of conscious perception while holding the stimulus constant.

4. Measures of consciousness

Once we have an experimental paradigm for manipulating conscious awareness, how do we go about measuring it? *Behavioral Methods in Consciousness Research* outlines several methods that can be used in different paradigms. In masking studies, one can simply ask people whether they are consciously aware of a stimulus. However, this might miss much of the nuance of conscious awareness. It is possible to have been aware of something, but not to have had a clear experience of the stimulus. Thus, by breaking awareness down into a graded scale, one can get better measures of conscious awareness in tasks like masking tasks. This is called the Perceptual Awareness Scale, discussed in chapter 11 by Kristian Sandberg and Morten Overgaard.

Another method for the study of conscious awareness employs confidence ratings, the topic of chapter 10 by Elisabeth Norman and Mark Price. The idea is to have subjects make a discrimination based on a stimulus or statistical pattern they have been exposed to. The subjects then report their confidence in their discrimination. Researchers are typically interested in conditions in which the subjects report having no confidence or in which there is no correlation between their accuracy and their reported confidence. In these conditions, there is a disconnect between the subjects' metacognitive sensitivity (usually thought to be conscious) and their actual (presumably unconscious) knowledge.

5. Analysis and statistics

The two chapters on statistical methods make use of examples from consciousness research, but explain statistics in a way that is more widely applicable. Chapter 12 by Zoltan Dienes is about Bayesian statistics and how it can be applied to certain types of data from consciousness experiments. It contains a general overview of Bayesian statistics, which is extremely useful given the movement towards Bayesian statistics throughout science (Kruschke, Aguinis, & Joo, 2012). It contains examples and explicit instructions on how to use Bayesian statistics to test when a null hypothesis should be embraced.

Chapter 13 by Kim Mouridsen focuses on p-values. Like the other statistics chapter, it contains a very readable general overview for understanding p-values. A number of examples are given of how to correctly use and interpret p-values in common experimental consciousness research paradigms. This chapter also spends some time explaining that a failure to reach significance is not evidence in favor of the null hypothesis. Like the Bayesian statistics chapter, this chapter also discusses methods for

providing statistical support for a null hypothesis. This is important because studies of consciousness often require the researcher to show that there is no difference in, for example, performance in two conditions in which awareness does differ. One extremely important lesson in these chapters is that it is wrong to equate a failure to reject the null hypothesis with the truth of null hypothesis.

Disappointingly, an earlier chapter contains an example of this mistake of confusing failure to achieve significance with confirmation of the null hypothesis. In chapter 5, a novel behavioral method is introduced that attempts to manipulate subjective confidence independently of performance. The experimenters had subjects make judgments about the orientation of a grating. By manipulating positive evidence (the contrast of the target grating) and negative evidence (the contrast of a competing distractor grating), the researchers created two conditions—low positive and low negative evidence, and high positive and high negative evidence. The experimenters hypothesized that while performance would be influenced by both positive and negative evidence, subjective confidence would be driven only by positive evidence, leading to a difference in confidence between the conditions but equal performance. To test this, they performed a t-test to see if there was a statistically significant difference in performance or confidence ratings in the two conditions. They found a significant difference for confidence rating but not for performance. The authors then claimed that these results show that they can "manipulate subjective confidence while keeping the task performance the same" (p. 82). However, this is exactly the type of mistake discussed at length in the statistics chapters—the change in performance not reaching significance is not the same as there being no change. A statistical test to embrace the null hypothesis would need to be performed to make this claim. This example shows that these lessons from the statistical chapters have yet to sink into the field of consciousness research, or indeed even into the other authors of the textbook!

6. Conclusion

Overall, this book is likely to be of most use to researchers interested in working in the field of consciousness studies. It provides a solid understanding of the issues the field faces and an overview of some of the most common methodologies. The book contains details on the strengths and weaknesses of different experimental paradigms and metrics for measuring conscious awareness. The introductory chapters of this book are likely to be of interest to students or scholars who want to know more about how researchers approach consciousness.

I learned two major lessons while reading this book. First, there are major issues with every method of studying consciousness. Second, despite their issues, there are methods that clearly tell us something about consciousness. I am left optimistic that progress is possible in understanding consciousness, but cognizant that we still have a long way to go. To quote the final sentences of the book:

Ultimately the evaluation of any method for studying consciousness will require thinking about what consciousness *is*. Behavioral methods might let us bootstrap part of the way there; it will take a critical look at those methods themselves to get the rest of the way. (p. 262)

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The innocent eye: Why vision is not a cognitive process, by Nico Orlandi, Oxford, Oxford University Press, 2014, 272 pp., \$47.95, ISBN: 9780199375035

In *The Innocent Eye*, Nico Orlandi synthesizes longstanding themes within philosophy of perception together with recent debates surrounding the role of mental representation in scientific explanation. The central thesis of the book is that visual processing is best understood as the result of an “embedded system,” as opposed to a cognitive process, where a cognitive process is taken to be an essentially representational and inferential affair. Perceptual constraints and biases, traditionally understood by both “bottom-up” and “top-down” inferentialists as encoded rules operating over representations, are better served by a conception of the perceptual apparatus as an evolved physical system with hard-wired sensitivity to producing outputs. In this review I give a brief overview of each chapter in turn before offering a critical discussion, first of the project as a whole, then second concerning the book’s treatment of predictive coding.

Chapter 1 advances the main thesis and themes of the book, establishing the broadly construed subject-centered “constructivist” camp as the dialectical adversary of the equally broad, world-centered “ecological” camp. Orlandi favors a version of the latter, arguing for what is labelled the “embedded view.” We are familiarized with the author’s distinction between representational *processes* and representational *products*, and it is argued that whilst an embedded approach eliminates the need for the former, it retains the latter in the form of visual “percepts,” the products of visual processing. Finally, the infamous inverse problem—that the profile of retinal stimulation underdetermines its worldly causes—is introduced as a paradigm explanandum of vision science, and one that highlights the differences in approach between the two camps.

Chapter 2 takes up the task of detailing the embedded alternative to the traditional constructivist project of inferentialism. The take-home message of this ecological strategy is twofold. First, we should not view the biases and constraints of the visual processing system as encoded rules, but as physical or physiological features of the system. These features are, “literally just connections, akin to wires or valves, that cause something to happen whenever something else happens” (pp. 45–46). Second, these features are the result of evolutionary pressure for a system to become attuned to real features of its environment—for example, we detect edges when faced with discontinuities because we live in a world of edges, and edges are useful to detect. Such environmental features can be analyzed by the discipline of natural scene statistics that studies the likely environmental causes of retinal images. In short, the burden of analysis is shifted from “internal” to “external” features. Orlandi then considers recent Bayesian-inspired “predictive coding” accounts of vision. Though traditionally seen as a kind of top-down inferentialism, we are presented with an alternative conception according to which even these hypothesis-heavy explanations are, when it comes to visual processing, non-representational.

Chapter 3 engages with recent discussion over the role of representation in cognitive science. The main aim is to defend the distinction between external-oriented biases and constraints versus implicit representations. In doing so, the chapter provides a criticism of so-called “deflationary” accounts