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The observability principle and beyond  
 Reply to comments on “Seeing mental states: An experimental  
 strategy for measuring the observability of other minds”  
 by Cristina Becchio et al.

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## 1. Direct perception versus Inferentialism

Is it possible to directly perceive others' mental states? Mediating the debate between Direct Perception and Inferentialism proponents would require knowing “what counts as an inference and how to tell the difference between inferential and non-inferential processing” [1]. However, few theorists have even attempted to answer the question of what counts as inference. The consequence, as noted by Spaulding [1], is that “given that neither Inferentialists nor DSP [Direct Social Perception, Ed.] proponents specify what they mean by inference, it is hard to tell what exactly each side is affirming and denying. Thus, the debate between Inferentialism and DSP is at an impasse”. Similar considerations apply to distinguishing between what is ‘observable’ versus ‘unobservable’ [2].

The motivation for the work discussed in the target article [2] was partly to reconceptualize the notion of ‘direct perception’ to make the observability of others' mental states empirically addressable. This resulted in the proposal to reformulate ‘direct perception’ as reflecting the conditional probability of perceiving a given mental state from the observation of certain movement features.

We do not claim that this formulation resolves the issue of whether perception of others' mental states involves inferential steps. As noted by Overgaard [3], in principle, a stimulus may contain discriminatory information about a mental state, the information may be perceptually useful, while identifying the mental state could still involve ‘inferential’ steps. This argument brings us back to the initial impasse of what counts as inference. More radically, one

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could ask whether the distinction between inferential versus non-inferential processing is justified in terms of brain functioning [4]. ‘Inferential’ is sometimes taken to mean extra-perceptual (e.g., [3]). As we continue to more fully understand the continuity of perception, action, and cognition (e.g., [5]), however, distinguishing between perceptual and extra-perceptual processes is no less problematic than distinguishing between inferential and non-inferential processes [6].

## 2. Which mental states

Operationalization has both advantages and disadvantages. One advantage is testability. Once a concept has been operationalized, it can be tested. Several questions raised by the Commenters would be best answered by gathering empirical data. Which mental states and under which circumstances is it possible to perceive [7]? Can one perceive intentions such as pretending or deceiving? Consider the case of a person attempting to disguise her dislike for wine by pretending to drink without ingesting the beverage. Would an observer be able to notice it [8]?

The target paper [2] delineates a precise experimental strategy to answer such questions. First, one would have to quantify the specificational information available in the pattern of behavior, e.g., to determine whether movement patterns contain information to discriminate between ‘real drinking’ and ‘pretend drinking’ (*Step 1*). Provided that specificational information is available, one could then test the perceptual efficiency of this information (*Step 2*). Finally, one could identify the features observers use to detect pretense (*Step 3*) and test them through manipulation (*Step 4*). Unpublished data from our lab suggest that discriminating between real versus pantomimed grasps is almost automatic in human observers (see also [9]). With regards to our earlier example, there would be little surprise if we were to determine that observers can identify fake drinking.

Of course, there are questions we cannot or we do not know how to address experimentally: what must a mental state be if it can be perceived [10]? Can we discern mental states in others because their mental states cause their observable behavior or because observable behavior at least partially constitutes the mental states [11]? What must perception be if we can perceive mental states [10]?

While these questions cannot be operationalized (not using the proposed strategy, at least), we wish to acknowledge their importance as they force us consider what exactly it is that we want to know about the observability of mental states.

## 3. Extending the paradigm

Beyond raising questions about the nature of the mental states that one can perceive, the Commenters also identified several new directions for research. In what follows, we briefly comment on three directions we regard as especially promising.

### 3.1. Integrating expectations and previous experience

Information to discern others’ intentions is not merely available in the movements, but also in the context in which the movements take place [10,11]. How does the brain combine contextual information with the stream of incoming kinematic information toward a response? (see also [8,12]). Contextual cues allow expectations to form about what is likely to occur, facilitating efficient processing of expected stimuli [13]. At the same time, these cues can be distracting. For example, in the case of a table laid out for tea-time in the context of drinking tea, a person may grasp a cup with the intention of tidying up. Preliminary findings from our laboratory [14] suggest that under these circumstances, human brains incorporate context into the decision process as a dynamic bias affecting both the starting point and rate of evidence accumulation. In line with the principle that priors hold the most sway over decisions when sensory evidence is ambiguous [15], when motion conveys no discriminative intention-information, we determine intention choice via context. When motion does convey discriminative intention-information, we determine intention choice by kinematics. It will be important for future studies to examine how prior experience [12] and interaction history [8] influence the intention attribution process.

### 3.2. Taking a second-person perspective

Why do we perceive or strive to perceive the mental states and intentions of others [7]? Perception services agentive responses and interaction [16] – as Gallagher [10] puts it, perception is pragmatically or enactively smart. While

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