22 WHAT APES KNOW ABOUT SEEING

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Introduction

Humans are able to infer what objects another agent can or cannot see, given that other agent's point of view. Psychologists refer to this as level 1 visual perspective taking (Flavell 1974). Visual perspective taking is generally characterized as a form of mindreading because it requires that an individual reason about the perceptual states of other agents. Mindreading, in turn, is thought to underlie many other important cognitive abilities, such as empathy, self-awareness, and even phenomenal consciousness (Baron-Cohen 1997; Carruthers 2009; Apperly 2011). Given this, there has been much interest in the question of whether our nearest primate relatives, such as chimpanzees (*Pan troglodytes*), have visual perspective taking abilities. Over the last decade, comparative psychologists have conducted many experiments with the aim of determining this. The results of these experiments have been mainly positive, leading some researchers to conclude that chimpanzees are capable of this form of mindreading (see Call and Tomasello 2008 for a review).

This essay examines what constitutes evidence for level 1 visual perspective taking (hereafter, VPT1) in nonhuman primates. Specifically, it evaluates the view that the dominant research paradigm used to test for this ability in apes is flawed (Povinelli and Vonk 2004; Penn et al. 2008; Penn and Povinelli 2007; Penn 2011; Lurz 2009, 2011; Lurz and Krachun 2011; see also Whiten 2013). There are various strands to this view; however, one of the central claims is that the current research program fails to provide evidence for VPT1 because there is an alternative behavior-reading explanation for the positive results of the experiments conducted thus far. This point is coupled with the further claim that there is an alternative research paradigm (namely, experience projection tasks) that succeeds in eliminating these behavior-reading alternatives, and it is not until subjects pass tests in this new paradigm that we have evidence for VPT1 in nonhuman animals.

If the critics are correct, then contrary to the current consensus in comparative psychology, we lack compelling evidence that chimpanzees have visual perspective taking abilities. However, in this chapter, I argue that the critics' position is misguided. First, the new paradigm advanced by the critics does not succeed in eliminating behavior-reading explanations – that is, behavior reading can still account for the positive results of these experiments. Second, our inability to eliminate behavior-reading explanations is unsurprising, given their nature: they are a version of what Carl Hempel identified as the "theoretician's dilemma." This dilemma states that when a theory positing unobservable entities allows one to establish an observable regularity in the world, then these unobservable posits are no longer necessary because one can always redescribe that regularity in terms of observable entities alone. Applied to mindreading research, the claim is that we can reinterpret any mindreading ability in terms of an agent's ability to recognize and act on observable regularities. Given this, the critics' position is best understood as a general skeptical problem, rather than an empirical or methodological problem that psychologists must solve before concluding that nonhuman animals are capable of visual perspective taking (see Halina 2015).

Level 1 visual perspective experiments and the behavior-reading alternative

The main experimental strategy used to investigate whether chimpanzees are capable of VPT1 is to present a subject (A) with a social situation that involves interacting with another agent (B). Researchers then vary some property so as to affect what B can see. This may be a property of B (open versus closed eyelids or head turned toward versus away from some object), or a property of the environment (a transparent versus opaque barrier or a well-lit versus dark room). The question is whether A will recognize these changes and respond in the manner of someone who takes into account the perceptual states of others. For example, will A prefer to use begging gestures toward a recipient who can see those gestures and prefer to steal food from a competitor who cannot see that food? If chimpanzees consistently behave in a wide variety of circumstances in the manner of individuals capable of VPT1, then comparative psychologists take this as evidence that they, in fact, have this ability.[1] And indeed, this is what the experimental results suggest (see, for example, Hare et al. 2000; Tomasello et al. 2003; Kaminski et al. 2004; Liebal et al. 2004; Melis et al. 2006; Tomasello and Call 2006; Bräuer et al. 2007; Tempelmann et al. 2011).

Critics of the above approach argue that the results obtained from such experiments are confounded by learned or evolved behavioral rules. The reason for this is that the observable properties that psychologists vary across experimental conditions are all properties that normally covary with an agent's ability to see or not see objects. Thus, one should expect these observable properties to covary with seeing and not-seeing behaviors in a chimpanzee's natural environment. For example, the property of there being no opaque barrier between an agent's eyes and an object should regularly co-occur with that agent exhibiting behaviors consistent with seeing that object (such as approaching that object if it is desirable food, retreating from that object if it is a harmful predator, etc.); while the property of there being an opaque barrier between an agent's eyes and an object should regularly covary with that agent exhibiting behaviors consistent with not seeing that object (such as not approaching it even if it is desirable food, not retreating from it even if it is a harmful predator, etc.). Given these co-occurrences, chimpanzees might have learned or evolved behavioral rules that link these observable properties with seeing and not-seeing behaviors. Although the regular co-occurrence of a particular observable property and a suite of behaviors may be caused by an underlying mental state, an individual adapted to this observable regularity need not reason about these mental states in order to successfully predict behavior.

According to the critics, an experiment cannot provide evidence for mindreading unless it excludes the possibility that subjects are solving the experimental task using complementary behavior reading, where complementary behavior reading (CBR) operates on precisely those observable regularities caused by an underlying mental state (Lurz 2011). The advocates of this position (whom I will refer to as CBR theorists) do not take their argument as rendering mindreading empirically intractable, however. Their point is rather that comparative psychologists are using the wrong experimental approach for testing for VPT1 in nonhuman animals. It is not until the appropriate experiments are conducted – those capable of eliminating behavior-reading alternatives – that psychologists can claim that they have evidence for or against mindreading in nonhuman animals. The CBR theorists go on to maintain that the appropriate experiments to conduct are "experience projection tasks."

In the following section, I present two versions of the experience-projection task that CBR theorists cite as the most promising way forward for visual perspective taking research. I then argue that both versions of this task fail to eliminate alternative behavior-reading explanations. Thus, they fail to satisfy the criteria imposed by their designers.

Experience-projection experiments

The general idea behind an experience-projection experiment is that a subject is given the opportunity to learn that some situation S_1 reliably leads her to experience the psychological P_1, while some other situation S_2 reliably leads her to experience the psychological state P_2. Once the subject learns to associate S_1 with P_1 and S_2 with P_2 in herself, the researcher then tests if the subject will reason that S_1 leads to P_1 and S_2 to P_2 in other agents. For CBR theorists, an experience-projection experiment seems like a promising way to prevent subjects from relying on complementary behavior reading because experimenters can make S_1 and S_2 differ in some arbitrary way – that is, in a way that does not normally vary with the psychological states P_1 and P_2. Given this, subjects purportedly have no reason to infer that S_1 will lead to P_1-like behaviors in another agent, unless they reason that S_1 will lead to P_1 in that agent.

Cecilia Heyes (1998) proposed one of the first experience-projection experiments, which has been cited as an exemplar of the CBR experimental approach (see Povinelli and Vonk 2004; Penn and Povinelli 2007). In Heyes's experiment, an ape subject is given the opportunity to interact with two pairs of goggles. The goggles are designed so that their external features are identical except that one pair has red trim and the other pair has blue trim. However, when the subject puts on these goggles, she discovers another important difference between them: she can see through the lenses of the blue-trimmed goggles, but not through the lenses of the red-trimmed goggles. By familiarizing herself with these goggles, the subject is expected to learn to associate the observable state of wearing blue-trimmed goggles with the psychological state of being able to see and the observable state of wearing red-trimmed goggles with the psychological state of not being able to see. Once the subject learns these properties, the question is, will she expect agents wearing the blue-trimmed goggles to behave as if they can see, and agents wearing the red-trimmed goggles to behave as if they cannot see? If so, CBR theorists hold, the subject must be capable of attributing perceptual states to others because there is no other reason to expect seeing and not-seeing behaviors from agents wearing blue-trimmed and red-trimmed goggles. The only way to come to this conclusion is by analogically inferring that when other agents wear these goggles, they are having the same perceptual experiences that I have when I wear them.

As commentators on this experiment have pointed out, however, the above is not the only means of inferring that agents wearing the blue and red goggles will behave in ways consistent with seeing and not-seeing, respectively. For example, Andrews (2005) points out that subjects might experience themselves behaving like seeing agents while wearing the blue-trimmed goggles (walking around, manipulating objects, etc.) and experience themselves behaving like not-seeing agents while wearing the red-trimmed goggles (colliding with objects and agents, failing to perform familiar tasks, etc.). From these behavioral experiences, a subject might reason analogically that other agents will behave as I do when wearing these blue- and red-trimmed goggles. To make this inference, the subject need not attribute to agents the psychological states of seeing and not seeing. Lurz (2011) also points out that even if subjects were not to attempt to move around or do anything while wearing the goggles, they could still recognize that wearing the red-trimmed goggles is like having an opaque barrier in front of one's eyes, while wearing the blue-trimmed goggles is like not having an opaque barrier in front of one's eyes. Given that the property of having an opaque barrier in front of one's eyes normally covaries with an inability to see, and the property of not having an opaque barrier in front of one's eyes normally covaries with an ability to see, subjects could rely on the learned or innate behavioral rule: expect agents with an opaque barrier in front of their eyes to exhibit X behaviors (behaviors normally exhibited by not-seeing agents in this context) and expect agents with no opaque barrier in front of their eyes to exhibit Y behaviors (behaviors normally exhibited by seeing agents in this context). The original experience-projection task proposed by Heyes, then, can be solved using complementary behavior reading alone and thus does not constitute a test for visual perspective taking in nonhuman animals according to the criteria advanced by the critics.

Lurz (2011; Chapter 21 in this volume) maintains that all experiments aimed at testing a nonhuman animal's ability to attribute perceptions of reality fail to reject the behavior-reading hypothesis. The reason for this is that normal visual experiences of real objects involve having a direct line of gaze to those objects, and normal visual experiences of not being able to see real objects involve not having a direct line of gaze to those objects (where a direct line of gaze to an object X is a spatial relationship between one's eyes and X, such that one can draw an imaginary line from one to the other). Thus, the attribution of visual experiences of reality will always be confounded with the observable property of having or lacking a direct line of gaze (Lurz 2011: 82–83). Given this, Lurz argues that our best bet for empirically identifying whether apes can attribute visual perceptions to others is to determine whether they can attribute non-veridical perceptual experiences to others.

To this end, Lurz designs a set of experiments aimed at testing whether a subject can attribute to others the perception that an object appears to be one way, when the subject knows that it is in reality another way. The particular example that I will focus on here is an experiment that relies on size-distorting lenses; however, the analysis of this experiment extends to the others in this paradigm. In Lurz's size-distorting-lens experiment, a subordinate subject competes over food with a dominant conspecific in a room that contains strategically placed transparent barriers – some of which have size-distorting properties. Before the test begins, a subject is familiarized with the fact that the dominant competitor will take the larger of two rewards (let us say bananas) when given the opportunity. The subject is also familiarized with the effects that three types of transparent barriers have on objects that are located behind them. A blue-trimmed magnifying barrier makes objects appear larger, a red-trimmed minimizing barrier makes objects appear smaller, and a black-trimmed barrier has no distorting effect on the appearance of objects.[2]

After this pretraining phase, the subject and competitor are placed in separate rooms on opposite sides of an adjoining competition room (Figure 22.1). In the middle of the competition room are two barriers, each with one banana behind it. The bananas are located on the subject's side of the room, so that when the subject and competitor enter the room, the subject has visual access to both bananas, while the competitor is only able to view the bananas through the barriers. Imagine, as depicted in Figure 22.1, that the subject and competitor are competing over two same-sized bananas, one of which is located behind a blue-trimmed magnifying barrier and the other of which is located behind a red-trimmed minimizing barrier. When the subject and competitor enter the room, which banana will the subject expect the competitor to retrieve?

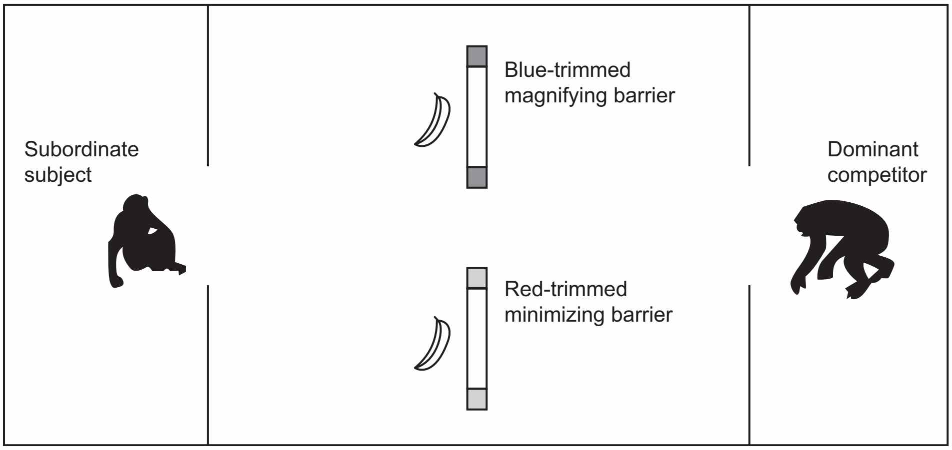

Figure 22.1 An experience-projection experiment that uses distorting transparent barriers. The subject anticipates which banana the competitor will attempt to retrieve.

According to Lurz, a subject that reasons about both observable properties and mental states will expect that the competitor will retrieve the banana behind the blue-trimmed magnifying barrier. Such a subject knows that both of the bananas are equal in size, but also knows that the banana behind the blue-trimmed magnifying barrier appears larger than the banana behind the red-trimmed minimizing barrier from the competitor's point of view. The subject can see that the competitor must view the bananas through the barriers and knows that the competitor has no experience with the distorting effects of these barriers.[3] Given this, the subject will predict that the competitor will retrieve the banana that appears to be the largest to him, which is the one behind the blue-trimmed barrier.

What will a subject that reasons only in terms of observable properties predict that the competitor will do in this situation? According to Lurz, there are two possibilities, neither of which is the same as the prediction made by a mindreading subject. The first possibility is that the subject views the competitor as having a direct line of gaze to both bananas. Under this scenario, the subject has learned that when it comes to the blue- and red-trimmed barriers, the reality of the situation is what lies behind the barriers, and the reality is that two same-sized bananas lie behind these barriers. Thus, the subject will predict that the competitor will choose randomly between the two bananas because that is how agents generally behave when having a direct line of gaze to two identical food items. The second possibility is that the subject has learned that when objects are placed behind the blue- and red-trimmed barriers, images appear on the surfaces of these barriers. The reality of the situation for the subject in this case is that there are two same-sized bananas behind the blue- and red-trimmed barriers, but the competitor cannot establish a direct line of gaze to these bananas because the images on the barriers block the competitor's line of gaze to them. Given this, the subject will expect the competitor to retrieve neither banana – at least not until the competitor has the opportunity to walk around one of the barriers and establish a direct line of gaze to one of them.

If Lurz's analysis is correct, then it is empirically possible to reject the hypothesis that apes reason on the basis of complementary behavior reading alone.[4] From this, CBR theorists can argue that until apes pass such a test, one cannot conclude that they attribute mental states to others. They can also argue that if apes fail this task, then that is all the more reason to doubt the positive results obtained by comparative psychologists thus far. As with the original experience-projection experiment, however, it is possible to pass this task on the basis of behavior reading alone, as I will now argue.

When chimpanzees first encounter size-distorting lenses, they are fooled by the effects of these lenses and treat the distorting glass as non-distorting transparent glass (Krachun et al. 2009). Thus, when encountering the red- and blue-trimmed barriers for the first time, we should expect subjects to interact with them as if they were normal transparent barriers. Such subjects could be said to be acting on the behavioral affordances that such normal transparent barriers have. For example, they would recognize that the way to retrieve **A** (the apparent object as seen through the barrier or the image of the object as it is projected onto the barrier) in such a situation is to walk around the barrier towards **R** (the object behind the barrier) (see Figure 22.2).

This is how agents typically respond to transparent barriers. They do not treat them as opaque barriers (ignoring the objects behind them) nor as the absence of a barrier (trying to walk through them). Later, after becoming familiar with the effects of the blue- and red-trimmed barriers, subjects will revise their understanding of the situation. Specifically, in order for the experiment to succeed, subjects must learn during the pretraining phase that there is a regular, predictable relationship between **R** and **A**.[5] In this case, because the blue-trimmed barrier magnifies objects and the red-trimmed barrier minimizes objects, subjects must learn that **A** on the blue-trimmed-barrier will always be a larger version of **R** behind it and that **A** on the red-trimmed-barrier will always be a smaller version of **R** behind it.

Although subjects are expected to learn during the pretraining phase the properties of the blue- and red-trimmed barriers, there is nothing preventing them from recalling that when they first encountered these barriers, they responded to them (or would have responded to them) as if they were normal transparent barriers. With this recollection in mind, subjects could reason that any agent encountering these barriers for the first time is likely to respond to them as if they were normal transparent barriers. This is all that is needed in order to predict that a competitor will attempt to retrieve the banana behind the blue-trimmed barrier on the basis of behavior reading alone. Such a subject might reason that the competitor has a direct line of gaze to the apparent banana (**A**) and hold that for every action the competitor is likely to perform on **A**, he will perform this action on **R** because this is how agents typically behave around transparent barriers. In other words, the competitor will treat this as a normal transparent barrier and thus behave like agents typically behave around transparent barriers, with the added caveat that the relationship between **A** and **R** for this particular barrier is a function other than **A** equals **R**.

The above technique can be applied to all of the new experience-projection tasks proposed by Lurz.[6] This is because any subject with the observable information necessary for mindreading

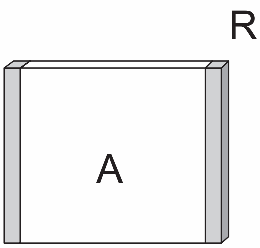

Figure 22.2 A transparent size-distorting barrier, where **R** is the object behind the barrier and **A** is the apparent object as seen through the barrier or the image of the object as it is projected onto the barrier.

will also have the information necessary for behaving like a mindreader using behavioral reading. Specifically, if you give a subject the chance to experience that a situation has the effect of making **R** (some real object) appear as **A** (the illusory state), and also give the subject a chance to learn that **R** is not really **A**, then that subject will have also learned that when they were new to the situation, they treated (or would have treated, if given the opportunity) **R** as if it were **A**. Such a subject would then have the information needed to predict that other naïve agents (agents new to the situation) will respond to **R** as if it were **A**. This does not mean that the subject understands that the other agent perceives **R** (the observable state) *as* **A** (a mental state). Rather, the subject could simply reason that the agent will behave as naïve agents generally behave in this situation (as an agent responding to **A**).

The mindreader's dilemma

The new experience-projection tasks do not succeed in eliminating behavior-reading hypotheses as possible explanations for the positive results of visual perspective taking experiments. What are the consequences of this on the investigation of what apes know about seeing? Elsewhere I have argued that it is impossible to eliminate all behavior-reading alternative explanations of mindreading experiments (Halina 2015). The reason for this is similar to Carl Hempel's well-known "theoretician's dilemma." Hempel (1958) noted that if a theory positing unobservable entities is successful at capturing some observable regularity in the world, then the unobservable posits in that theory are no longer necessary, because the theory can be redescribed in terms of observable entities alone. This leads to a dilemma because either a theory positing unobservable entities fails to capture an observable regularity, in which case it is simply an unsuccessful theory, or it is successful at capturing such a regularity, in which case it is unnecessary because it can be cast in terms of observable entities alone. Similarly, we have a mindreader's dilemma: if the attribution of mental states allows an agent to capture some observable regularity in the world (between colored barriers and the behavior of a competitor, for example), then that attribution is unnecessary because the agent could be relying on some innate or learned rule that captures this observable regularity directly instead.

Does the mindreader's dilemma render the question of what apes know about seeing empirically intractable? I do not think it does. Rather, it tells us that eliminating all possible complementary behavior-reading explanations is an impossible task and thus cannot serve as the standard for evidential success in mindreading research. Instead, we should rely on other standards, such as controlling for those variables that we know might serve as confounds in our experiments (see Heyes 2015 for a move in this direction). Comparative psychologists, however, already adhere to this evidential standard. Pointing out empirically plausible confounds is a constructive way to move the field of animal mindreading research forward; arguing that we have no evidence for animal mindreading until we exclude all possible complementary behavior-reading hypotheses is not. Given the positive results of the experiments conducted thus far (including a recent goggles test, see Karg et al. 2015), I suggest that the evidence currently favors the hypothesis that nonhuman apes know a lot about seeing.

Notes

1 See Halina (2015) for an account of the logic behind this experimental approach in terms of Mill's methods.
2 When a subject is familiarized with these barriers, controls are put into place so that he does not learn that objects behind the blue-trimmed magnifying barrier are more likely to be approached or retrieved than objects behind the red-trimmed minimizing barrier. Also, the objects that the subject will be

competing for during the experiment (in this case, bananas) are not used during the pretraining phase, so that the subject has no experience of preferring bananas located behind one type of barrier over another.

3 It is not clear from Lurz's description of the experiment how a subject is to know that the competitor is naïve to the distorting effects of the barriers. It seems possible that a subject would infer from the fact that she has had experience with these barriers that a competitor might have experience with them too. Let us assume that there is a way to control for this and that the subject knows that the competitor is ignorant of the effects that the blue- and red-trimmed barriers have on the objects behind them (because, for example, the subject has never observed the competitor interacting with these barriers).

4 This is under the assumption that a failure to pass this task is best attributed to a failure of mindreading as opposed to a failure in one of the inferential steps not involving mindreading (such as that noted in note 3).

5 Recall that in the testing phase of this experiment, subjects have visual access only to **R**, not **A**. Thus, they must infer **A** on the basis of **R** and the color of the barrier. If they could not do this, they would not know what **A** is and would be unable to make any predictions about the competitor's response to **A**.

6 See Halina (2013) for a more detailed presentation of this argument and Buckner (2013) for a similar analysis with respect to Lurz's "transparent colored barrier" variation of this experiment (Lurz 2011: 96–101).

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