Povinelli's Problem and Introspection

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Abstract: Povinelli's Problem is a well-known methodological problem confronting those researching nonhuman primate cognition. In this paper I add a new wrinkle to this problem. The wrinkle concerns introspection, i.e., the ability to detect one's own mental states. I argue that introspection either creates a new obstacle to solving Povinelli's Problem, or creates a slightly different, but closely related, problem. I apply these arguments to Robert Lurz and Carla Krachun's (2011) recent attempt at solving Povinelli's Problem.

The final publication is available at Springer via http://dx.doi.org/10.1007/s13164-013-0152-5

Povinelli's Problem, named after the primatologist Daniel Povinelli, is a well-known methodological problem confronting those researching nonhuman primate cognition.[1] In this paper I will add a new wrinkle to this problem. The wrinkle concerns introspection, i.e., the ability to detect one's own mental states. I will argue in sections one and two that introspection either creates a new obstacle to solving Povinelli's Problem, or creates a slightly different, but closely related, problem. In the remaining sections I will apply these arguments to a concrete case, namely, Robert Lurz and Carla Krachun's (2011) recent attempt at solving Povinelli's Problem.

1. Povinelli's Problem

Suppose a primate successfully predicts another agent's behavior, *b*. There are at least two ways of explaining how the primate made this prediction. According to a mindreading hypothesis, the primate made the prediction by (i) attributing a mental state, *m*, to the agent, where this attribution was based on observations of the agent's behavior and environment, and (ii) believing that agents in *m* typically perform *b*. A behavior-reading hypothesis, in contrast, claims that the primate made the prediction by (iii) observing the agent's behavior and environment, and (iv) believing that the facts observed are typically connected with behavior *b*. A behavior-reading hypothesis is *complementary* to a mindreading hypothesis when the observations cited in (iii) are just those observations cited in (i). An example will help to clarify these definitions.

[1] More precisely, the problem covers any non-verbal primate (human or non-human). In what follows, though, I'll focus on nonhuman primates, usually dropping the 'nonhuman' qualification: 'primates' and 'animals' will refer to nonhuman primates and nonhuman animals, respectively.

Imagine that a young child successfully predicts that her dog will run after a bone on the other side of the yard. A mindreading hypothesis might claim that the child did this by (i) judging that her dog *saw* the bone, where this mental state attribution was based on her observing that her dog's eyes were open and that her dog had an unobstructed line of gaze towards the bone, and (ii) believing that when her dog sees a bone, it typically runs after that bone. The behavior-reading hypothesis that is complementary to this mindreading hypothesis claims that she did this by (iii) observing that her dog's eyes were open and that her dog had an unobstructed line of gaze towards the bone, and (iv) believing that when her dog's eyes are open and when her dog has an unobstructed line of gaze towards a bone, it typically runs after that bone. Notice here that the observations cited in (iii) are just the observations cited in (i).[2]

Povinelli's Problem, also known as the 'Logical Problem', is the problem of designing an experimental protocol capable of distinguishing a mindreading hypothesis from its complementary behavior-reading hypothesis.[3] Non-complementary behavior-reading hypotheses, which Lurz (2009) calls 'minimal behavior-reading hypotheses', are irrelevant to Povinelli's Problem.[4] Given the relationship that a mindreading hypothesis bears to its complementary behavior-reading hypothesis, solving this problem is extremely challenging. Indeed, Robert Lurz (2011b) argues that the problem is insoluble with respect to certain kinds of mental states (e.g., simple seeing). Next, I will add a new wrinkle to Povinelli's Problem.

2. A New Wrinkle to Povinelli's Problem

To begin, notice that some mental states are such that they are attributed to others partly on the basis of introspective evidence, i.e., evidence about the state of one's own

[2] Importantly, the notion of an 'unobstructed line of gaze', or something like it, can be spelled out in non-mental terms. That is, a non-mindreader can observe that another has an unobstructed line of gaze towards an object. Lurz (2009, p 309) does a nice job of explaining this point. I will discuss his explanation later on in section 5.2.

[3] For presentations of this problem see Povinelli and Vonk (2006), Vonk and Povinelli (2006), and Penn and Povinelli (2007). Hurley and Nudds (2006), along with Lurz (2009, 2011b), have used the 'Logical Problem' label.

[4] A different problem claims that no experimental protocol can rule out every plausible behavior-reading hypothesis (minimal or complementary). Lurz (2009, p 306) claims that no experimental protocol can control for every plausible behavior-reading hypothesis, and so would seem to find this problem both unsolvable and uninteresting. Unfortunately, he does not defend this claim there. While I accept that controlling for every behavior-reading hypothesis is impossible, I do not see why controlling for every *plausible* behavior-reading hypothesis is impossible. Nevertheless, I will be concerned in this paper only with the problem described in the main text.

mind. For example, I might judge that the lines in the Müller-Lyer illusion *visually appear* to you as being unequal in length (despite my knowing that they are equal) partly on the basis of the introspective fact that they visually appear to me to be unequal in length. This introspective evidence constitutes only part of my grounds for attributing that mental state to you, given that my attribution is also based on your eyes being open and your having an unobstructed line of gaze towards the lines.

Implicit in the above presentation of Povinelli's Problem is the claim that mental states are attributed to others on the basis of observational evidence concerning their behavior and environment. But for the reasons just given, this claim is too narrow. Some mental states are attributed to others on the basis of behavioral, environmental, *and* introspective evidence.[5] How, though, does this fact affect the definition of a complementary behavior-reading hypothesis given above? More specifically, when the grounds of a mental state attribution are partly introspective, should these introspective grounds be included in the complementary behavior-reading hypothesis (CBRH)? There are two options:

> Option 1: a CBRH includes *all* of the grounds (non-introspective and introspective) of the mental state attribution alleged by the corresponding mindreading hypothesis.
>
> Option 2: a CBRH includes *only* the non-introspective grounds of the mental state attribution alleged by the corresponding mindreading hypothesis.

On either of these options, a complementary behavior-reading hypothesis will claim that a primate predicted another agent's behavior without attributing a mental state to that agent. In this sense, such a hypothesis will compete with a mindreading hypothesis. However, if Option 1 is taken, then a complementary behavior-reading hypothesis might claim that a primate predicted another agent's behavior, in part, on the basis of introspective evidence.

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[5] Lurz and Krachun (2011), when describing Povinelli's Problem, write that "since mental state attribution by animals must be based on *observable features of an agent's behavior and environment* – for the minds of others are not open to direct inspection – every mindreading hypothesis has a complementary behavior-reading hypothesis" (453, my emphasis). They say nothing about *introspective* bases of mental state attributions.

An example will help to illustrate the difference between these two options. Suppose that I successfully predicted that my student, who has no knowledge of the Müller-Lyer illusion, would say that the two lines are unequal in length, when presented with the illusion (and when asked). A mindreading hypothesis might claim that I made this prediction by (i) judging that the lines *visually appeared* unequal to my student, where this mental state attribution was based on my observing that my student's eyes were open and that my student had an unobstructed line of gaze towards the lines, along with the introspective fact that the lines visually appeared unequal to me, and (ii) believing that when two lines visually appear unequal to an individual (and when that individual is ignorant that appearances might not match reality), that individual will typically say that the two lines are unequal (when asked). Depending on which of the above options is adopted, the complementary behavior-reading hypothesis will be either of the following:

> $CBRH_1$: I made my prediction by (iii) observing that my student's eyes were open and that my student had an unobstructed line of gaze towards the two lines, along with learning (via introspection) that the lines visually appeared to me to be unequal in length, and (iv) believing that if my student's eyes are open, if my student has an unobstructed line of gaze towards the two lines, and if the lines visually appear to me to be unequal in length, then my student will likely say that they are unequal in length (when asked).
>
> $CBRH_2$: I made my prediction by (iii) observing that my student's eyes were open and that my student had an unobstructed line of gaze towards the two lines, and (iv) believing that if my student's eyes are open, and if my student has an unobstructed line of gaze towards the two lines, then my student will likely say that they are unequal in length (when asked).

Either of these options significantly complicates the task of researching whether non-human primates are mindreaders. If Option 1 is taken, then Povinelli's Problem becomes more difficult to solve. Consider a mindreading hypothesis on which the alleged mental state attribution is based, in part, on introspective evidence. On Option 1, the complementary behavior-reading hypothesis will be (partly) introspective. But distinguishing *this* kind of complementary behavior-reading hypothesis from the corresponding mindreading hypothesis will be more difficult than distinguishing a *non*-introspective complementary behavior-reading hypothesis from the corresponding

mindreading hypothesis. Option 1 thus creates a new obstacle to solving Povinelli's Problem.

In contrast, Option 2 does not directly affect Povinelli's Problem. It does, however, create a *new*, closely related problem. This is the problem of designing an experimental protocol capable of distinguishing a mindreading hypothesis from a complementary introspective hypothesis on which primates are not claimed to attribute mental states to others. For lack of a better name, call this problem 'Povinelli's Problem$_I$', where the subscript 'I' stands for 'introspection'. If Option 2 is taken, then a researcher who solves Povinelli's Problem does not necessarily solve Povinelli's Problem$_I$. But solving this latter problem would seem to be of great concern to those who are primarily interested in obtaining evidence that primates attribute mental states to *others* (as opposed to merely attributing mental states to themselves via introspection). For such researchers, solving Povinelli's Problem$_I$ is the real goal.

Incidentally, this is a good place to address a potential concern with the discussion so far. Suppose the mechanisms subserving mindreading are the same as those subserving introspection. That is, suppose that mindreading and introspection are the same capacity, merely oriented in different directions (outward towards others' minds versus inward towards one's own mind). If this were the case, then the kind of introspective hypothesis that I've been discussing would be true of a primate only if that primate were a mindreader; little would be gained by distinguishing a mindreading hypothesis from an introspective hypothesis that is its complement. Importantly, though, many philosophers and psychologists regard mindreading and introspection to be subserved by distinct mechanisms, and (in some cases) to have appeared at different times in our evolutionary history. At the very least, it cannot be assumed that such a story is false.[6] That non-human primates can introspect, but not mindread, is a very real possibility for such researchers. Accordingly, if these researchers are interested in whether non-human

[6] Lycan (1996), Nichols and Stich (2003), Goldman (2006), and Lurz and Krachun (2011) are examples of researchers who deny that these capacities are really just a single capacity. On the other hand, Peter Carruthers has recently argued that introspection is simply mindreading oneself (although this is an oversimplification of his position). In his 2009, he argues that this capacity evolved, first and foremost, for mindreading *others*. But once in place, we began to use it on ourselves. This is the sense in which, for Carruthers, mindreading is evolutionarily *prior to* introspection/metacognition. See also his 2010 and 2011.

primates mindread others, they should be concerned with ruling out the kind of complementary introspective hypothesis that I have identified.[7]

The above discussion has been a bit abstract. To help make things more concrete, I will apply the ideas just presented to Lurz and Krachun's recent attempt at solving Povinelli's Problem. I will explain their quite complex proposal in the following section. Then, in section four, I will argue that, depending on which of the above two options is taken, Lurz and Krachun's protocol either fails to solve Povinelli's Problem, or fails to solve a different, but closely related problem, namely, Povinelli's Problem$_I$. In section five I will consider some replies on behalf of Lurz and Krachun.

3. Lurz and Krachun's Attempted Solution of Povinelli's Problem

Lurz and Krachun, in "How Could We Know Whether Nonhuman Primates Understand Others' Internal Goals and Intentions? Solving Povinelli's Problem" (2011), offer a new experimental protocol that they claim "has the power, in principle and in practice, to overcome Povinelli's Problem" (451).[8] Before describing their protocol, some background is required.

According to the mindreading hypothesis at the center of Lurz and Krachun's alleged solution, chimpanzees attribute 'action-guiding perceptual states' to others. As their name suggests, such perceptual states "feed rather directly into the production of predictable types of behavior" (470). For example, an animal's perception of a predator will (rather directly) cause it to engage in certain predator-avoidance actions, such as fleeing the area. Similarly, an animal's perception of available food will (rather directly) cause it to engage in certain food-attaining actions, such as moving towards the food. According to Lurz and Krachun, the strong connection that these perceptual states have to action qualifies them as a simple form of 'internal goal' (thus the title of their paper).[9]

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[7] On Option 1, this means that they should be concerned with overcoming the complication that introspection introduces to solving Povinelli's Problem; on Option 2, this means they should be concerned with solving Povinelli's Problem$_I$.

[8] In what follows, all references to Lurz and Krachun are to their 2011.

[9] Here, they appeal to Millikan (2004) who characterizes such states as being "perceptions on the one hand and directives on the other" (158-159). Millikan calls such mental representations 'pushmi-pullyu' states. Also, 'internal goals' are contrasted with 'external goals', only the former of which are psychological. Lurz and Krachun claim that an internal goal is a "particular type of motivational or conative state in an agent", while an external goal is an "external object or state of affairs that an agent's action is understood to be directed at or expected to bring about" (452). The ability to mindread is not required in order to represent another agent's external goals.

The background for this hypothesis is an account of mindreading that they call the 'appearance-reality mindreading theory' (ARM theory). Consider the following remarks from Lurz and Krachun concerning this theory:

> [T]he ARM theory hypothesizes that internal-goal attribution in chimpanzees (and perhaps other primates), in so far as it exists, may have evolved as a result of chimpanzees coming to introspect their own ability to distinguish the way environmental objects perceptually appear to them from the way they know (believe) them to really be, and using this introspective knowledge of perceptual appearances in illusory (as well as non-illusory) settings to predict other agents' behavior (470).

Importantly, on this theory, chimpanzees' ability to attribute action-guiding perceptual states to others depends upon their being able to introspect their own ability to distinguish appearance from reality. Such introspection is thus *prior to* mindreading.[10]

This point is significant, given the discussion concerning the relationship between mindreading and introspection near the end of the previous section. Because the ARM theory claims that introspection is evolutionarily prior to mindreading, the existence of animals capable of introspection, but incapable of mindreading, would not at all be surprising on that theory. The ARM theorist should thus be especially concerned with distinguishing a mindreading hypothesis from the kind of complementary introspective hypothesis discussed in section two. I'll return to this point later on.

3.1 Lurz and Krachun's Protocol – Pre-Test Trials

Lurz and Krachun's proposed experimental protocol places chimpanzees in a competitive situation where food is at stake. One of the dependent measures in their protocol is anticipatory looking, which is taken to indicate expectation/prediction.[11] This is true in both the pre-test and test trials, to which I now turn.

In pretest trials, a chimpanzee sits behind a transparent barrier that rests flush against a table. On the table are two transparent containers. The experimenter baits these containers while the chimpanzee is present, placing a small grape in one and a larger grape in the other. The tops of the containers are then covered with opaque lids. At this

[10] Both Lurz and Krachun have recently defended the ARM theory: see Krachun (2008), Krachun et al. (2010), and Lurz (2011a, b). They also note that Humphrey (1976) and Gallup (1982) offer early defenses of the theory. Their mindreading hypothesis, although motivated by the ARM theory, is nevertheless independent of that theory; one can endorse their hypothesis while denying the ARM theory.

[11] They note that their protocol is based upon Krachun et al.'s (2009b) competitive paradigm study with chimpanzees and Southgate et al.'s (2007) anticipatory-looking paradigm study with young children.

point a human competitor enters the room and takes a seat at the table across from the chimpanzee. The competitor conspicuously looks through the sides of the two containers. One of two bells then rings, signaling which of the two (human competitor or chimpanzee) selects first. There are thus two kinds of pretest trial: competitor-first pretest trials and chimpanzee-first pretest trials.

In competitor-first pretest trials, the containers are slid over to the human competitor once the competitor-first bell is rung. In these trials, the human competitor *always* selects the container with the larger grape. Importantly, this should cause the chimpanzees to expect that their competitors will always, when choosing first, prefer the larger grape. However, while the competitor always moves his or her hand towards the container with the larger grape, only half of the time does the competitor successfully remove the larger grape from the container; the other half of the time, the competitor fails to collect the chosen grape, leaving it in the container.

Once the competitor successfully or unsuccessfully retrieves the larger grape, the containers (not just their tops) are covered with opaque coverings, thus making their contents invisible to both the chimpanzee and the competitor. The point of these coverings is to give the chimpanzees a reason to attend to their competitors' selections (in competitor-first trials); only if the chimpanzees attend in this way will they know which container has either the lone remaining grape (when the competitors succeed) or the larger grape (when the competitors fail). This is important because, as already noted, one of Lurz and Krachun's dependent measures in the test trials is anticipatory looking. Chimpanzees will anticipate their competitors' selections only if they are motivated to attend to those selections. Finally, the covered containers are slid over to the chimpanzee so that it can make its selection (via pointing). The chimpanzee is able to observe all that I have just described.

Chimpanzee-first pretest trials proceed in (roughly) the same way, although with the chimpanzee selecting first.[12] According to Lurz and Krachun, the pretest trials have three purposes: "(1) to familiarize chimpanzees with the general testing procedure; (2) to

[12] Two differences are worth noting. First, opaque coverings are not used in the chimpanzee-first pretest trials; once the chimpanzee makes its selection, the containers remain uncovered as they are slid over to the human competitor. Second, in these trials the human competitor always succeeds in retrieving the grape not selected by the chimpanzee.

allow chimpanzees to learn that the competitor will always prefer a large grape over a small one when choosing first; and (3) to make chimpanzees aware of the fact that the competitor will not always be successful in obtaining the larger grape" (474).

3.2 Lurz and Krachun's Protocol – Test Trials

Test trials, like pretest trials, are also of two types: competitor-first test trials and chimpanzee-first test trials. These trials are just like the corresponding pretest trials except that, for some, *size-distorting containers* are used in place of the normal, non-distorting pretest containers. (The purpose of these containers will be made apparent shortly.) On these size-distorting test trials, the larger grape is placed in a minimizing container and the smaller grape is placed in a magnifying container. To those looking at the two containers, the larger grape thus visually appears to be the smaller grape and the smaller grape thus visually appears to be the larger grape. Importantly, just as in the pretest trials, the chimpanzees are present when the containers are baited, and thus see the grapes both before and after they are placed in the size-distorting containers.

The dependent measure in chimpanzee-first size-distorting test trials is simply the chimpanzee's selection: whether it selects the magnifying container, mag, or the minimizing container, min. The dependent measure in competitor-first size-distorting test trials is the chimpanzee's anticipatory looking: whether the chimpanzee, upon hearing the competitor-first bell, looks at mag or min. As already noted, anticipatory looking is taken to indicate expectation/prediction. If a chimpanzee, upon hearing the competitor-first bell, looks at mag (over min), then it is interpreted as expecting/predicting that its competitor will select mag (over min). There are thus four possible patterns of results that might occur for the size-distorting test trials:

(i) Mag-Mag: in chimpanzee-first trials, the chimpanzee selects *mag*; in competitor-first trials, the chimpanzee looks at *mag*, upon hearing the competitor-first bell (and thus expects/predicts its competitor to select mag).

(ii) Min-Min: in chimpanzee-first trials, the chimpanzee selects *min*; in competitor-first trials, the chimpanzee looks at *min*, upon hearing the competitor-first bell (and thus expects/predicts its competitor to select min).

(iii) Mag-Min: in chimpanzee-first trials, the chimpanzee selects *mag*; in competitor-first trials, the chimpanzee looks at *min*, upon hearing the competitor-first bell (and thus expects/predicts its competitor to select min).

(iv) Min-Mag: in chimpanzee-first trials, the chimpanzee selects *min*; in competitor-first trials, the chimpanzee looks at *mag*, upon hearing the competitor-first bell (and thus expects/predicts its competitor to select mag).

Following Lurz and Krachun, I will call patterns (i) and (ii) 'pure' and patterns (iii) and (iv) 'mixed'.

3.3 Solving Povinelli's Problem

As already noted, Lurz and Krachun's mindreading hypothesis is based on the ARM theory. On this theory, chimpanzees' ability to attribute action-guiding perceptual states to others depends upon their being able to introspect their own ability to distinguish appearance from reality.[13] For this reason, Lurz and Krachun's mindreading hypothesis claims that the size-distorting containers will not fool the chimpanzees. The idea is that because the chimpanzees are present for the baiting of the size-distorting containers, and because they can distinguish appearance from reality, they will (correctly) judge that appearances are misleading. That is, although the grape in the minimizing container will visually appear to the chimpanzees to be the smaller grape, they will nevertheless (correctly) judge that it is the larger grape. Because the chimpanzees desire the larger grape, they should select the minimizing container when selecting first. The mindreading hypothesis thus predicts that the chimpanzees will select *min* in chimpanzee-first size-distorting test trials. This is the first half of Lurz and Krachun's mindreading hypothesis.[14]

The second half of the hypothesis concerns the competitor-first size-distorting test trials. According to the hypothesis, the chimpanzees will judge that the (smaller) grape in the magnifying container *visually appears* to their competitors to be the larger grape. This is the mental state attribution alleged by the mindreading hypothesis; the (attributed) visual appearance is an action-guiding perceptual state. Because the chimpanzees will know that their competitors were absent when the containers were baited, the hypothesis

[13] See Krachun et al. (2009a) for evidence that at least some chimpanzees are capable of distinguishing appearance from reality; in their study, about a third of the chimpanzees exhibited this capacity.

[14] There is a potential worry here. Merely being present for the baiting of the size-distorting containers might be insufficient for the chimpanzees to avoid being fooled by those containers (even on the assumption that they can distinguish appearance from reality). The chimpanzees might need more exposure to the size-distorting containers in order to avoid being fooled by them. I thank an anonymous reviewer for bringing this worry to my attention. To address this concern, Lurz and Krachun's protocol should be amended so that, prior to the test trials, the chimpanzees are given time to witness, and even interact with, the size-distorting containers.

also claims that the chimpanzees will expect their competitors to be fooled by the (misleading) visual appearance of the smaller grape. For this reason, the hypothesis predicts that the chimpanzees will expect their competitors, when selecting first, to select the smaller grape in the magnifying container. The mindreading hypothesis thus predicts that the chimpanzees will (anticipatorily) look at *mag* in competitor-first size-distorting test trials.

Putting these two kinds of size-distorting test trials together, we can see that Lurz and Krachun's mindreading hypothesis predicts pattern (iv) from above, namely, the mixed, min-mag pattern. Making this hypothesis explicit will be useful in what follows:

> Lurz and Krachun's Mindreading Hypothesis: (i) the chimpanzees are not fooled by the size-distorting containers, and so judge that the larger grape is in the minimizing container. For this reason, they will select *min* in chimpanzee-first size-distorting test trials; (ii) the chimpanzees judge that the smaller grape in the magnifying container visually appears to their competitors to be the larger grape. For this reason, and because they know that their competitors were absent when the containers were baited, they will (anticipatorily) look at *mag*, upon hearing the bell, in competitor-first size-distorting test trials.[15]

In contrast to this mindreading hypothesis, Lurz and Krachun argue that a complementary behavior-reading hypothesis can predict only a pure pattern: either min-min or mag-mag. Their reasoning is as follows. Either a chimpanzee can distinguish appearance from reality or it cannot. If it can, then it will not be fooled by the size-distorting containers, and so will judge that the larger grape is in the minimizing container; it will thus select *min* in chimpanzee-first size-distorting test trials. But given that it learned during the pretest trials to expect its competitors to select the container with the larger grape, it should also expect its competitor to select the minimizing container when selecting first. On competitor-first size-distorting test trials, it will thus (anticipatorily) look at *min*, upon hearing the bell. This is the pure, min-min pattern. Exactly similar reasoning shows that if a chimpanzee cannot distinguish appearance from reality, then it should exhibit the mag-mag pattern.

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[15] I imagine that some readers will at this point think that Lurz and Krachun's mindreading hypothesis is unlikely to be borne out; the hypothesis may appear to demand too much of the chimpanzees. While this might be true, I would like to set aside such concerns in this paper. My aim is to show that Lurz and Krachun's protocol fails to solve Povinelli's Problem (or Povinelli's Problem$_I$, depending on whether Option 1 or Option 2 is taken), even assuming that their hypothesis (or protocol) is not too complex.

The point is that, on a behavior-reading hypothesis, the chimpanzee's judgment about which container has the larger grape will guide *both* its own selection (in chimpanzee-first test trials) and its expectation of its competitor's selection (in competitor-first test trials). This is why Lurz and Krachun claim that a complementary behavior-reading hypothesis can predict only a pure pattern. Their mindreading hypothesis, in contrast, predicts a mixed, min-mag pattern. For this reason, they conclude that they have solved Povinelli's Problem with respect to the attribution of action-guiding perceptual states (or simple kinds of internal goals).[16]

Note that at the time of this writing, Lurz and Krachun have not yet run their experiment, and thus do not yet have any results. However, there is a difference between, on the one hand, obtaining evidence that favors a mindreading hypothesis over its complementary behavior-reading hypothesis and, on the other hand, designing an experimental protocol capable of distinguishing these two hypotheses. Lurz and Krachun can succeed in this latter task, even if chimpanzees (when tested) fail to exhibit the min-mag pattern.

4. A Complementary Introspective Hypothesis

Notice the strategy used by Lurz and Krachun. They argue that *any* complementary behavior-reading hypothesis can predict only a pure pattern. They do not consider any particular behavior-reading hypothesis that is complementary to their proposed mindreading hypothesis. What would such a hypothesis look like? In order to

[16] I thank an anonymous reviewer for bringing to my attention a very interesting alternative hypothesis that threatens to undermine the conclusion of the argument just described. On this hypothesis, chimpanzees do not distinguish appearance from reality, but rather have a deviant theory of size permanence. They select the grape in min, when choosing first, because they judge that it will return to the size it had prior to its being placed in the container. Moreover, they anticipatorily look at mag, upon hearing the competitor-first bell, because they expect their competitors to select the grape that is the larger grape *at the time of the selection*. This behavior-reading hypothesis predicts the same mixed, min-mag pattern as Lurz and Krachun's hypothesis. The reviewer notes the affinity between his or her hypothesis and a suggestion made by Perner (1991) in response to Flavell et al. (1983). Notice, however, that this hypothesis is not complementary to Lurz and Krachun's hypothesis. Their hypothesis claims that chimpanzees distinguish appearance from reality, not that they have a deviant theory of size permanence. On their hypothesis, the chimpanzees judge that the grape in mag is the smaller grape *period*, not that it is the larger grape *at the time of the selection*. For this reason, a hypothesis claiming that the chimpanzees anticipate their competitors' selections on the basis of such deviant judgments cannot be complementary to Lurz and Krachun's hypothesis. And this is so even if Lurz and Krachun are not warranted in denying the possibility that chimpanzees have a deviant theory of size permanence. What matters is the content of their actual hypothesis. It is important to keep in mind that non-complementary hypotheses of this kind do not threaten Lurz and Krachun's alleged solution to Povinelli's Problem.

answer this, we need to consider the grounds for the mental state attribution alleged by their mindreading hypothesis. That is, we need to consider the grounds for the chimpanzee's judgment that the smaller grape in the magnifying container visually appears to its competitor to be the larger grape.

Recall that, on Lurz and Krachun's mindreading hypothesis, the chimpanzee is not fooled by the size-distorting containers. The chimpanzee correctly judges that the (smaller) grape in the magnifying container is *not* the larger grape. The chimpanzee's alleged judgment that that grape visually appears to its competitor to be the larger grape would thus seem to be based on something aside from how it takes the world to actually be. Specifically, the chimpanzee's judgment would seem to be based, in part, on how the grape appears to it. That is, the judgment would seem to be based, in part, on the following *introspective* ground: the smaller grape in the magnifying container visually appears to me to be the larger grape.

In the remainder of this section I will spell out a hypothesis on which the chimpanzee's prediction is based, in part, on this introspective fact. This hypothesis, like Lurz and Krachun's mindreading hypothesis, will predict the mixed, min-mag pattern. Moreover, this hypothesis will be *complementary* to their mindreading hypothesis, given that this introspective fact is part of the grounds of the mental state attribution alleged by that hypothesis. Importantly, this hypothesis will not claim that the chimpanzees attribute mental states to their competitors.

The complementary hypothesis that I have in mind claims that chimpanzees can distinguish appearance from reality; it shares this feature with Lurz and Krachun's mindreading hypothesis. Thus, it predicts that the chimpanzees will correctly judge that the grape in the minimizing container is the larger grape, even though that grape visually appears to them to be the smaller grape. For this reason, the hypothesis predicts that the chimpanzees will select *min* in chimpanzee-first size-distorting test trials. This is the first half of the complementary hypothesis.[17]

[17] As noted in footnote thirteen, Krachun et al. (2009a) claim that they have evidence that at least some chimpanzees are capable of distinguishing appearance from reality. Importantly, I do not wish to take a stand on whether chimpanzees have this capacity. My complementary hypothesis merely grants this point *for the sake of argument*. By doing so, Lurz and Krachun cannot reject my hypothesis on the grounds that it conflicts with the evidence presented in Krachun et al. (2009a).

Recall the pretest trials from Lurz and Krachun's protocol. In these trials, the competitors, when choosing first, always select the container with the larger grape. As Lurz and Krachun claim, these trials should teach the chimpanzees that: (a) their competitors, when choosing first, always select the container with the larger grape. However, because size-distorting containers are not used in the pretest trials (i.e., appearances match reality), the container with the larger grape is also the container that visually appears to the chimpanzees to have the larger grape. Thus, in the pretest trials, the competitors, when choosing first, always select the container that visually appears to the chimpanzees to have the larger grape. In addition to (a), the pretest trials could thus teach the chimpanzees that: (b) their competitors, when choosing first, always select the container that visually appears to them (the chimpanzees) to have the larger grape. Of course the chimpanzees can learn this lesson only if they can form judgments about how things visually appear to themselves. The complementary hypothesis that I am proposing assumes that they can make such (introspective) judgments. This assumption is reasonable, given that the complementary hypothesis claims that chimpanzees can distinguish appearance from reality.

I admit that the chimpanzees are likely to learn (a), and not (b), as a result of the pretest trials. This is because appearance matches reality in these trials; how things visually appear to the chimpanzees (as opposed to how things actually are) is not relevant, and so is not likely to be something that the chimpanzees consider.[18] Importantly, though, things change when the chimpanzees are introduced to the size-distorting containers. Once they see how these containers work, the way things visually appear to them, as opposed to how things actually are, suddenly becomes relevant. The complementary hypothesis claims that this will cause the chimpanzees to re-conceptualize the lesson drawn from the pretest trials.

Because they are now in an environment where appearances do not match reality, they will draw lesson (b) from the pretest trials, and will thus expect their competitors, when choosing first, to select the container that visually appears to them (the chimpanzees) to have the larger grape. This container is the magnifying container, and thus the complementary hypothesis predicts that in size-distorting competitor-first test

[18] I thank Carla Krachun for making this point clear to me.

trials, the chimpanzees will (anticipatorily) look at *mag*, upon hearing the bell. This is the second half of the complementary hypothesis.

Let me now make this hypothesis explicit; this will allow for easy comparison to Lurz and Krachun's mindreading hypothesis:

> Complementary Hypothesis: (i) the chimpanzees are not fooled by the size-distorting containers, and so judge that the larger grape is in the minimizing container. For this reason, they will select *min* in chimpanzee-first size-distorting test trials; (ii) the chimpanzees form the introspective judgment that the smaller grape in the magnifying container visually appears to them (the chimpanzees) to be the larger grape. For this reason, and because of lesson (b) (learned from the pretest trials), they will (anticipatorily) look at *mag*, upon hearing the bell, in competitor-first size-distorting test trials.

This hypothesis predicts the same mixed, min-mag pattern as Lurz and Krachun's mindreading hypothesis. Moreover, it does so without claiming that the chimpanzees attribute mental states to their competitors. The only mental fact that a chimpanzee appeals to is a fact about its *own* mind. There is thus a significant sense in which this complementary hypothesis is not a mindreading hypothesis.

4.1 Returning to Options 1 and 2

But is this complementary hypothesis a behavior-reading hypothesis? Recall from section two that there are two options for how we should understand a complementary behavior-reading hypothesis. On Option 1, such a hypothesis should include any introspective grounds of the mental state attribution alleged by the mindreading hypothesis. Thus, on this option, the hypothesis that I have put forth counts as a behavior-reading hypothesis that is complementary to Lurz and Krachun's mindreading hypothesis. Because it predicts the same mixed, min-mag pattern as Lurz and Krachun's mindreading hypothesis, their protocol fails to solve Povinelli's Problem; it fails to distinguish their mindreading hypothesis from a behavior-reading hypothesis that is complementary to it.

Suppose, however, that Option 2 is taken instead. If so, then the hypothesis that I have put forth does not qualify as a behavior-reading hypothesis that is complementary to Lurz and Krachun's mindreading hypothesis. This is because it claims that the chimpanzees' predictions are based, in part, on the *introspective* judgment that the

smaller grape in the magnifying container visually appears to them (the chimpanzees) to be the larger grape. If the complementary hypothesis is not a behavior-reading hypothesis, then it cannot threaten Lurz and Krachun's claim to have solved Povinelli's Problem.

Nevertheless, as discussed in section two, there remains a problem that is slightly different from, but closely related to, Povinelli's problem. This is the problem of designing an experimental protocol capable of distinguishing a mindreading hypothesis from a complementary introspective hypothesis on which primates are not claimed to attribute mental states to others. This problem, which I've labeled 'Povinelli's Problem$_I$', is not solved by Lurz and Krachun's protocol. And this is problematic for Lurz and Krachun, given their commitment to the ARM theory of mindreading (discussed at the beginning of section three).

Recall that on that theory, the ability to introspect *precedes* the ability to mindread others. For Lurz and Krachun, then, the existence of primates who can introspect, but who cannot (or do not) mindread others, is thus a very real possibility. The complementary introspective hypothesis claims that this possibility is a reality; it claims that chimpanzees are such primates (with respect to the attribution of action-guiding perceptual states). That Lurz and Krachun's protocol fails to distinguish this hypothesis from their mindreading hypothesis is thus quite problematic from their perspective.[19]

In summary, Lurz and Krachun's protocol, despite its ingenuity, cannot distinguish their mindreading hypothesis from a complementary introspective hypothesis on which chimpanzees do not attribute mental states to their competitors. If Option 1 is taken, this shows that their protocol fails to solve Povinelli's Problem. If Option 2 is taken, this shows that their protocol fails to solve Povinelli's Problem$_I$. Either way, Lurz and Krachun's protocol will be less than fully satisfying to those interested in whether non-human primates attribute mental states to others.

[19] I noted in footnote thirteen that Krachun et al. (2009a) claim to have evidence that at least some chimpanzees are able to distinguish appearance from reality. Assuming that Lurz and Krachun believe that these chimpanzees are able to make this distinction, in part, because they are able to introspect their own action-guiding perceptual states, they should believe that there is already evidence that chimpanzees self-attribute such states. That their protocol aims to determine whether chimpanzees attribute action-guiding perceptual states to *others* shows that they take seriously the possibility noted above.

5. Possible Responses to my Argument

Before concluding, I would like to briefly consider whether Lurz and Krachun's protocol might be amended so that it *does* rule out the complementary introspective hypothesis identified in the previous section. Perhaps a simple adjustment is all that is needed to avoid my negative conclusions. To this end, I will consider two potential amendments. In each case, I will argue that the amendment either fails to solve the problem or creates a new one.

5.1 Trials where the Competitor is Present for the Baiting

The first amendment to be discussed is the most natural, I think. Suppose that on some of the size-distorting test trials, *both* the chimpanzee and its human competitor are present for the baiting of the containers (with each being able to see that the other is present). On some of these new trials, the chimpanzee will select first, while on others, the competitor will select first. What do the two hypotheses predict for these new trials?

Both hypotheses claim that the chimpanzees can distinguish appearance from reality. For this reason, both will predict that the chimpanzees will not be fooled by the size-distorting containers, and so will select the minimizing container when choosing first. So far, then, the proposed amendment does not distinguish the two hypotheses; each predicts *min* for the new chimpanzee-first test trials.

There is reason, however, to think that the amendment will distinguish the two hypotheses on competitor-first test trials. Let's begin with the complementary hypothesis. In the new test trials, the (smaller) grape in the magnifying container will still visually appear to the chimpanzees to be the larger grape. There is no difference in this respect between the new and old test trials. Similarly, the complementary hypothesis will still claim that the chimpanzees will expect their competitors to select the grape that visually appears to them (the chimpanzees) to be the larger grape. The complementary hypothesis thus makes the same prediction as before. That is, it predicts that the chimpanzees will (anticipatorily) look at *mag*, upon hearing the competitor-first bell.

On Lurz and Krachun's mindreading hypothesis, the chimpanzees are alleged to believe that the smaller grape in the magnifying container visually appears to their competitors to be the larger grape. But if the chimpanzees know that their competitors were present for the baiting of the (size-distorting) containers, then they might very well

judge that their competitors are not fooled by how the grapes visually appear to them. If so, then, in the new test trials, the chimpanzees should expect their competitors, when choosing first, to select the minimizing container. There is thus reason to think that Lurz and Krachun's mindreading hypothesis predicts that the chimpanzees will (anticipatorily) look at *min*, upon hearing the competitor-first bell, in the new test trials.

The amendment thus has the power to distinguish the two hypotheses. For the new size-distorting test trials, the complementary introspective hypothesis predicts a min-mag pattern, while Lurz and Krachun's mindreading hypothesis predicts a min-min pattern. Unfortunately, though, this comes at a price. Consider what it means to judge that one's competitor is not fooled by how the grapes visually appear to it. To make this judgment would seem to require thinking something like the following: although the (smaller) grape in the magnifying container visually appears to my competitor to be the larger grape, my competitor nevertheless does not *believe* that that grape is the larger grape. To not be fooled by a misleading visual appearance is to not have a belief that the world is as presented by that appearance.

On the amended protocol, then, chimpanzees will be able to exhibit their ability to attribute action-guiding perceptual states to others only if they can also attribute beliefs to others. The success of the amended protocol will thus hinge on whether chimpanzees can attribute to their competitors a kind of mental state that the original protocol was not intended to concern. If chimpanzees cannot attribute beliefs to their competitors, then even if they are able to form judgments about how things visually appear to their competitors, the amended protocol will be unable to reveal this latter fact.

This is a significant departure from the original protocol. Lurz and Krachun are for this reason likely to look elsewhere for a response to my criticism. Let's now turn to a second possible amendment.

5.2 Trials with an Occluder Panel

The next amendment to consider introduces an occluder panel for some of the size-distorting test trials.[20] In such trials, the competitor's line of sight is blocked by the panel. The idea behind this amendment is fairly straightforward. The mindreading hypothesis claims that the chimpanzees' expectations on competitor-first test trials are

[20] I thank Robert Lurz for bringing this proposed amendment to my attention.

based on judgments about how the grapes visually appear to their competitors. If a competitor's line of sight is blocked by an occluder panel, then the chimpanzee should judge that the grapes do not visually appear *in any way* to its competitor. The mindreading hypothesis should thus predict that, in the amended trials, the chimpanzees will expect their competitors to make either no selection at all or a selection at random.[21] Either way, the hypothesis will *not* predict that the chimpanzees will (anticipatorily) look at *mag*, upon hearing the competitor-first bell.

This is allegedly not the case for the complementary introspective hypothesis. That hypothesis, recall, claims that the chimpanzees' expectations on competitor-first test trials are based on judgments about how the grapes visually appear to *them* (the chimpanzees). Because the occluders will not affect how the grapes visually appear to the chimpanzees, their expectations should remain the same for the new test trials. That is, they should (anticipatorily) look at *mag*, upon hearing the competitor-first bell. Because Lurz and Krachun's mindreading hypothesis does not make this prediction, the amendment appears to succeed in distinguishing their hypothesis from the complementary hypothesis.

I disagree that, on the complementary introspective hypothesis, the occluders should not affect the chimpanzees' expectations. Creatures tend to make selections among choices only when they can see those choices. But to see choices requires having one's eyes open and an unobstructed line of gaze towards those choices. For this reason, if a creature does not have its eyes open and an unobstructed line of gaze towards a set of choices, it will typically not make a selection among those choices. Presumably, chimpanzees will have learned this from experience.

Moreover, because the occluders will prevent the chimpanzees from seeing their competitors' eyes, they should judge that the occluders prevent their competitors from having unobstructed lines of gaze towards the size-distorting containers. But this is

[21] But is this correct? Against this claim, an anonymous reviewer pointed to a well-known study by Povinelli and Eddy (1996). Young chimpanzees begged an individual for food, even though the individual could not see them, either because his or her eyes were covered with a blindfold, or because his or her head was covered with a bucket. This, though, only suggests that the prediction of the mindreading hypothesis would not be borne out; i.e., the study suggests that the occluder panel would not cause the chimpanzees to judge that their competitors do not see the containers. But the point of the present discussion is to devise a protocol capable of distinguishing Lurz and Krachun's mindreading hypothesis from my own. Whether chimpanzees would behave as the mindreading hypothesis predicts is a separate issue.

reason to think that the occluders *should* affect the chimpanzees' expectations. When their competitors are behind the occluder, the chimpanzees should expect their competitors to make either no selection at all or a selection at random. This, though, is in agreement with the mindreading hypothesis.[22]

To put the point another way, the complementary introspective hypothesis should be understood as claiming the following: the chimpanzees will expect their competitors to select the container that visually appears to them (the chimpanzees) to have the larger grape *only if* they judge that their competitors are in a position to make a selection. But for the reasons given in the previous paragraph, the occluders should cause the chimpanzees to judge that their competitors are *not* in a position to make a selection among the size-distorting containers. Because of this, the complementary hypothesis does not claim that the chimpanzees will (anticipatorily) look at mag in the new competitor-first size-distorting test trials. The two hypotheses thus predict the same pattern for these new trials.[23]

6. Concluding Remarks

In this paper I have added a new, introspective wrinkle to Povinelli's Problem. Depending on how we define a complementary behavior-reading hypothesis, I have either introduced a new obstacle to solving that problem, or identified a new, but closely related, problem. Either way, as my examination of Lurz and Krachun's protocol makes clear, introspection significantly complicates the study of mindreading in non-human primates.

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[22] For a chimpanzee to judge that the occluder panel prevents its competitor from having an *unobstructed* line of gaze towards the containers, it must judge that the panel is an opaque barrier. This, though, might seem to require that the chimpanzee judge that the panel is something that prevents its competitor from *seeing* objects that are behind it, in which case the chimpanzee must think about what its competitor *sees*. But Lurz (2009, pp 309-10) convincingly argues that this is not the case. He claims that a chimpanzee's concept of an opaque barrier might be primitive and functionally identified: "A subject's, S's, primitive concept of opaque barriers can be functionally identified (roughly) as the concept C* such that if S sees (or seems to see) an object O behind a barrier Y of a certain size, then, ceteris paribus, S believes that Y is not a C*; and if S sees (or seems to see) Y but does not see (or seem to see) O but believes (based upon the contents of his working memory of the environment) that O is behind Y, then, ceteris paribus, S believes that Y is a C*" (309-10). So long as a chimpanzee can judge that the panel between its competitor's eyes and the containers is a C*, it will be able to judge that its competitor does not have an unobstructed line of gaze towards the containers.

[23] In addition to an occluder panel, there are various other sorts of conditions that would likely cause a chimpanzee to judge that its competitor is not in a position to make a selection. Imagine, for example, that a chimpanzee's competitor, when the competitor-first bell rings, has his hands tied behind his back, or is engaged in another activity, or is lying on the ground, etc.

I considered and rejected two possible amendments to their proposed protocol, only the first of which succeeded in distinguishing their mindreading hypothesis from my complementary introspective hypothesis. This amendment was rejected because it creates a new problem that Lurz and Krachun should want to avoid. Whether there are other amendments that will work to distinguish the two hypotheses is unclear. I suspect, however, that any such amendment will introduce an unwelcome level of complexity, such as that introduced by the rejected amendment just noted. Such complexities are unwelcome because they prevent chimpanzees who are *capable* of attributing action-guiding perceptual states to others (if there are such chimpanzees) from demonstrating this capability; a protocol that takes on such additional complexities thus incurs a great practical cost. The worry, then, is that Lurz and Krachun's protocol will be able to rule out the complementary hypothesis that I have identified only by significantly complicating what was already a complicated protocol, thereby making it unlikely that the mindreading hypothesis will be borne out.

Unfortunately, I suspect that this problem applies more generally. That is, I suspect that any protocol capable of distinguishing a mindreading hypothesis from a complementary non-mindreading hypothesis will require a level of complexity that makes it uninteresting from a practical perspective. Importantly, though, this is *not* to say that there can be no evidence either for or against the hypothesis that nonhuman primates engage in mindreading. I deny that a solution to Povinelli's Problem, or Povinelli's Problem$_I$, is required in order for us to reasonably conclude that nonhuman primates can mindread. I side with the position recently articulated by Logan Fletcher and Peter Carruthers (2013). They remind us that there are numerous considerations that should be weighed when deciding between two theories; these include "simplicity, predictive accuracy, explanatory scope, coherence with surrounding theories, and scientific fruitfulness" (88). Thus, even if these problems cannot be overcome, there remains the possibility that mindreading hypotheses will outcompete behavior-reading hypotheses along these other dimensions, compelling us to conclude that (some) nonhuman primates

are capable of (some forms of) mindreading. Indeed, Fletcher and Carruthers make a strong case, I believe, for the claim that this possibility is an actuality.[24]

Still, I believe that researchers continuing to pursue a solution to Povinelli's Problem is worthwhile. Although such a solution is not required, it would nevertheless be of great interest and value. Both defenders and skeptics of nonhuman mindreading should simply keep in mind that such efforts are directed at but one source of evidence bearing on whether nonhuman primates can mindread.

Acknowledgments I would like to thank Carla Krachun, Robert Lurz, Elliott Sober, Shannon Spaulding, Reuben Stern, and Danielle Wylie for providing very helpful comments on an earlier draft of this paper. Thanks to Shannon Spaulding, William Roche, and, especially, Danielle Wylie for valuable subsequent discussions. Thanks, finally, to an executive journal editor and anonymous referees for their comments and advice during the review process.

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[24] See Sober (2009 and 2012) for the application of probabilistic tools to the question of whether nonhuman primates share with humans the capacity to mindread.

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