Perceiving Agency[1]

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Abstract: When we look around the world, some things are inert and others are 'alive'. What is it to 'look alive'? An account of animacy perception is crucial, both for a proper understanding of visual experience, and for downstream questions about the epistemology of social cognition. I argue that empirical work on animacy supports the view that animacy is genuinely perceptual. We should construe perception of animacy as perception of agents and perception of behavior. My proposal explains how static and dynamic animacy cues relate, and offers a plausible account of how animacy perception relates to social cognition more broadly. Animacy perception draws perceptual attention to objects that are apt to be well-understood folk psychologically, and in doing so enables us to marshal our folk psychological resources efficiently.

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When we look around the world, some objects appear *animate*, others don't. This distinction is easy to notice phenomenologically, but harder to make sense of philosophically. I'll argue on empirical grounds that animacy detection is perceptual. Some objects are visually presented as animate, others are not.[2] Then I'll argue that 'animacy' should be understood in terms of agency. Perception of 'animate motion' is perception of behavior, and the perception of an animate object is the perception of an agent. We should accept the agency-based view because it explains the functional profile of animacy detection. Jointly, these claims entail that we perceive agents and behavior.

1 What Appears Animate?

Suppose you visit your friends for dinner, and encounter their dog George roaming the house. Visually, George is different from your friends' couch. George is *animate*; the couch is

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[2] I'll restrict my attention to visual cases for simplicity, though I suspect that auditory and tactile cases also exist.

not. The visual difference is not merely that George moves around while the couch doesn't. Your friends' model train moves around too, and yet doesn't appear animate. Moreover, George might lay down to take a nap, while continuing to appear animate.

Well, you might say, the train's movement is predictable, whereas George's movement is unpredictable. Only this doesn't explain the difference. We might see a plastic bag blown about by a strong wind in an entirely unpredictable way, without the bag appearing animate.[3] Moreover, often animate motion is eminently predictable. Perhaps you'll predict that George wil spring up and race towards the door at the sound of the door bell. George's movement is predictable and nevertheless appears. Or take someone walking down the street: not only can you generally predict that they'll continue walking in the same direction, but you have quite fine grained knowledge of the *way* their body will move in doing so: first left leg, then right, repeat; arms swinging opposite. So animacy and predictability seem doubly dissociable.

We might notice that George and the person on the street are *alive*, whereas the train, couch and plastic bag are not. But animacy perception doesn't track life particularly closely. Plants do not generally appear animate. Two apparent exceptions to this generalization exist. Venus fly traps might plausibly be described as 'animate plants'. Second, watching time-lapsed video of plant growth seemingly induces the appearance of exploration. These cases are interesting, but if animacy perception were about life, it would still be doing a poor job in ecologically valid circumstances, in which the vast majority of plants aren't carnivorous or time-lapsed.[4] Additionally, robots can appear animate, without being alive. So animacy perception also appears doubly dissociable from life.

2 Who Cares about Animacy Perception?

Before arguing that we perceive animacy, I want to pause to consider why this thesis is important. Two debates in philosophy of mind are substantially affected by the result that we perceive animacy—especially if we understand animacy in terms of agency.

Thinking about animacy is crucial for understanding access to other minds and social cognition. One question, both for the epistemology of other minds and for an adequate cognitive psychology of social cognition, is how perception contributes to mental state attribution. Animacy perception plays a crucial role in facilitating distinctively social forms

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[3] Of course, that's not to say that plastic bags *never* appear animate, but often unpredictable motion does not appear animate.

[4] I consider the proposal that animacy is life in more detail below.

of understanding. So a full theory of our access to other minds and social cognition must incorporate the contribution of animacy perception.

My focus on animacy marks a shift in emphasis within the philosophical literature. Most discussions of animacy center on the role animacy plays in mental state attribution—in particular, the attribution of intentions.[5] Often, though, we perceive animacy *without* attributing mental states. When seeing something animate, we begin trying to attribute mental states—something we don't naturally do when perceiving inanimate objects. If animacy perception is generally prior to mindreading, then the question of what we are perceiving if not mental states becomes salient.

Second, animacy perception is relevant to the debate over how *rich* perception is. Does perception present only 'superficial' properties like shape, color, and motion? Or, are 'deeper' properties like natural kinds and causal relations, also presented?[6] Animacy perception constitutes an important instance of perceiving rich properties.

One worry about rich content views is that they are reliant on the empirical case for cognitive penetration. Though rich views of perceptual presentation and the existence of cognitive penetration are logically independent,[7] it is easy to take the fate of the rich content view to be bound up with the fate of cognitive penetration, because cognitive penetration seems to be the most plausible mechanism by which perception comes to contain rich content.[8]

Believers in rich content might worry about this state of affairs, since there are reasons to doubt the empirical case for cognitive penetration.[9] If cognitive penetration is the most plausible mechanism for generating rich content, then doubts about the empirical case for cognitive penetration are problematic for the proponent of rich content.

However, a growing body of literature questions the connection between rich content and cognitive penetration. Rather than relying on the empirical case for cognitive penetration, defenders of rich content increasingly suggest that the visual system can extract rich

[5] See e.g. (Proust 2003; Pacherie 2005; Spaulding 2015; Helton 2017).

[6] Susanna Siegel (2006, 2011) is perhaps most responsible for posing this question in recent years.

[7] See Siegel (2011, 10) for an explication of this point.

[8] For an example of developing these views in concert, see (Carruthers 2015).

[9] For a striking survey of reasons for doubt, see (Firestone and Scholl 2016).

properties in a cognitively impenetrable way.[10] My argument that we perceive animacy joins these authors. The motivations I raise for thinking animacy is perceived do not depend on cognitive penetration. Indeed, the empirical evidence suggests that animacy perception is subserved by *modular* processes. So my argument offers support for rich content that does not depend on the empirical fortunes of cognitive penetration, and, more generally, is consistent with perception's being fully informationally encapsulated. So at least some 'deep' properties are perceptually presented, whether or not perception is penetrated by cognition.

3 Animacy Detection is Perceptual

I think animacy is perceptually presented. People with a more austere view will be inclined to resist this. They'll suggest, we perceive only shape or motion gestalts, from which we can infer the presence of animacy. This austere view is not plausible, though. The empirical evidence favors a perceptual construal of animacy detection.

Representations of animacy have the functional profile of perceptual representations. In particular, preferential saccaddes to animate stimuli are extremely fast, and animate stimuli are responsible for bottom-up attentional capture, in both task-relevant and -irrelevant ways, and disrupt visuomotor tasks. The cognitive neuroscience suggests that the brain regions responsible for visual categorization are organized around a distinction between animate and inanimate objects at a very deep level. If the representations have the functional characteristics of perceptual representations, then we should believe that they are perceptual representations.[11]

Before reviewing the empirical evidence, let me make make some general points. As with any empirical evidence, the results reviewed here are open to a variety of interpretations. In each case, alternative explanations are possible. My strategy will not involve a detailed adjudication of how to interpret each individual experiment. Rather, the fact that we see a

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[10] See (Brogaard and Chomanski 2015; Helton 2016; Smortchkova 2017; Toribo 2018).

[11] Grace Helton (2017), in a similar spirit, argues that representations of e.g. fleeing—which I construe as a kind of animate motion—are perceptual from the observation that they do not have the functional profile of belief. As Helton notes, this argument is open to the objection that the relevant representations are neither beliefs nor perceptual representations. Helton endeavors to answer this objection by considering alternative proposals case by case. My argument offers a more direct response to this objection. Representations of animacy don't merely lack the functional profile of beliefs, they *have* the functional profile of perceptual representations.

characteristically perceptual profile across a wide range of experimental paradigms offers *convergent evidence* for a perceptual construal of animacy detection. So while post-perceptual explanations may be available for an individual experiment, the breadth of the data renders these explanations less plausible. Readers may be skeptical that some of the results reviewed in this section indicate *animacy* detection, as opposed to sensitivity to low-level gestalts. This skepticism is healthy, but not dialectically relevant in this section. This section argues that there are perceptual representations responsible for 'animacy detection'. How to assign content to those representations is deferred until the next section. So, someone may be persuaded by this section that perceptual representations explain the experimental data—which we can stipulatively call 'representations of animacy'—and yet think that the most plausible content assignment to those representations is one or more low-level gestalts. This view may be understood either as one on which we do perceive animacy, but animacy is really just one or more low level gestalts, or a view on which we do not perceive animacy. Which way we describe this view is a verbal matter. I use the first description to ease exposition, but nothing substantive hangs on this choice.[12]

3.1 The Empirical Case

Consider the speed with which subjects can recognize animate objects. Holle Kirchner and Simon J. Thorpe showed subjects two pictures, one in each hemifield, one featuring an animal in a natural scene, and the other a natural scene with no animal. Subjects were asked to saccade to the side displaying an animal as quickly as possible, which they were able to reliably do in 120 ms (Kirchner and Thorpe 2006).[13]

How fast is that really? We can compare saccade times with saccades to 'low level' stimuli. Robert M. McPeek and colleagues measured saccade times to red or green diamonds. Subjects stared at a fixation point and then several colored diamonds appeared on a monitor. Subjects saccaded to the differently colored stimulus as quickly and accurately as possible. When subjects knew the color to which they would be saccading, average saccade time varied between 160 and 200 ms, depending on the subject (McPeek, Maljkovic, and Nakayama 1999) .

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[12] Thanks to an anonymous reviewer for encouraging me to clarify this point.

[13] More precisely: the saccades made 114–124 ms included significantly more saccades to the animal. Note that it does not follow that *each* subject was reliable at that time scale. Substantial individual differences exist between subjects with respect to exactly how fast they can reliably saccade. For more discussion of the statistical intricacies, see (Kirchner and Thorpe 2006, 1764–5).

So preferential saccades to animate stimuli are very fast. The evidence suggests that subjects do not tend to be faster saccading to color stimuli than to animate stimuli. Given that color is uncontroversially perceptual, it's reasonable to say that animacy detection is related to saccades in a characteristically perceptual way.

Animacy detection also confers advantages in inattentional blindness paradigms. Inattentional blindness is a phenomenon in which subjects are remarkably poor at detecting unexpected objects when their attention is focused on a visual task. Subjects are more likely to detect an animate than an inanimate object under such conditions—illustrations of animals or artifacts—and detection is further modulated by perceptual load (Calvillo and Jackson 2014). Given that top down attention is occupied, the attentional preference for animate over inanimate objects is apparently bottom up.

Interactions between animacy detection and the allocation of perceptual attention has also been investigated using change blindness (Altman et al. 2016; New et al. 2010). Change blindness is a phenomenon in which subjects are surprisingly unable to notice even quite substantial changes between two pictures, when the transition is masked (Simons and Levin 1997).

Change detection is, in part, a function of allocating attention to the thing that changes (Rensink, O'Regan, and Clark 1997). This feature of change blindness can be exploited to test how subjects attend to animate and inanimate objects. Subjects are presented with two pictures and an intervening mask, and asked to spot the change. The change either involved animate or inanimate features of the scene (New et al. 2010). Subjects were significantly better at identifying animate changes, compared to inanimate changes. Given that change detection is a function of perceptual attention, the authors explained this result by positing that subjects preferentially allocate perceptual attention to animate objects.

Jay Pratt and colleagues used a multiple object tracking paradigm to assess the effects of animacy on the allocation of perceptual attention (Pratt et al. 2010). In their experiments, four objects moved around a screen, bumping into each other and the walls in predictable ways. One of the objects then changes its direction in a way that cannot be accounted for by bumping into something else—a standard cue for animate motion. Subjects must either notice when an object disappears, or recognize a shape that appears inside one of the objects. In both cases, subjects were significantly faster when the change occurred to the object that had moved in a characteristically animate way. Pratt and colleagues interpret this as the result of attention being preferentially allocated to animate motion.

So animacy is apparently a powerful driver of bottom-up attentional capture. It's hard to see how this could be so without perceptual representations of animacy.

Brian Scholl, Tao Gao and colleagues, have also produced a battery of suggestive results.[14] In the most compelling experiment, subjects were asked to move a cursor around a display populated by chevrons (Gao, McCarthy, and Scholl 2010). The chevrons either constantly 'pointed' toward the subject's cursor, or constantly 'pointed' 90° from the cursor. In either condition, the chevrons moved randomly around the display. In a phenomenologically striking result, the chevrons are perceived as 'chasing' the cursor when they are pointed toward it, but not pointed 90.[15] Scholl, Gao and colleagues call this 'the wolfpack effect' (Gao, McCarthy, and Scholl 2010).

Figure 1 around here

The wolfpack effect seems to be genuinely perceptual. The effect is phenomenologically compelling, and—speaking for myself—persists even when I *try* to perceive the chevrons as inanimate. Further, the wolfpack effect disrupts visuomotor tasks in ways that are difficult to explain non-perceptually. Most strikingly, the wolfpack effect was combined with a chasing task. Subjects were asked to move their cursor to avoid both the chevrons and a 'wolf'—a bright red cursor that actually *was* chasing them (Gao, McCarthy, and Scholl 2010, Experiment 4). The chevrons would point to the subject's cursor in some trials, perpendicular to the subject's cursor in others, and to the 'wolf' in still others. Subjects were best at this task in the perpendicular condition, significantly worse when the chevrons pointed to the wolf, and significantly worse than *that* when the chevrons pointed to their cursor (Gao, McCarthy, and Scholl 2010, 1850–1). As Gao and Scholl suggest, this disruption is especially suggestive, since subjects are incentivized to ignore the chevrons entirely (Scholl and Gao 2013, 215–6). They are encoding information that is task-irrelevant, and disruptive to performance. Given that the disruption is task-irrelevant, it again seems hard to resist interpreting these results as bottom-up attentional capture.

Neuroscientific evidence also suggests that the visual cortex is organized around distinguishing animate and inanimate objects. A growing body of evidence indicates that the ventral temporal cortex (VTC), which is responsible for visual categorization, is structured in a way that importantly distinguishes animate and inanimate objects (Grill-Spector and Weiner 2014, 7–8). In order to facilitate flexible categorization at multiple levels of abstraction, the VTC is apparently organized hierarchically, with smaller regions selectively activated for finer-grained categories and agglomerated into larger regions that are selectively activated by more abstract categories (Grill-Spector and Weiner 2014). For

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[14] See (Gao, McCarthy, and Scholl 2010; Gao, Scholl, and McCarthy 2012; Scholl and Gao 2013; Buren, Uddenberg, and Scholl 2016).

[15] To (literally) see for yourself, consult http://perception.yale.edu/Brian/demos/causality.html.

example, regions that are selectively activated by faces are next to regions that are selectively activated by other body parts (Martin et al. 1996; Orlov, Makin, and Zohary 2010; Weiner and Grill-Spector 2013), and these regions are both subregions of a larger region that is selectively activated by animate objects (Grill-Spector and Weiner 2014). The neural evidence suggests that the visual system is distinguishing between animate and inanimate objects rom the beginning. Indeed, it is apparently a fundamental organizing principle of the visual representations that subserve categorization.

Figure 2 around here

I take the empirical evidence to support a perceptual view of animacy detection. The speed with which subjects preferentially saccade to animate objects, the preferential attention to animate objects in both task relevant and irrelevant ways, and significant interactions with visuomotor tasks are all characteristic of perceptual processing. Moreover, a distinction between animate and inanimate objects is topologically respected in the VTC—the neural region associated with visual categorization. We have strong empirical support for the claim that animacy is represented visually.

3.2 Two Worries

I have taken it that static and dynamic cues are integrated in animacy perception. However, this assumption is open to doubt. In particular, the tunnel effect may be thought to tell against the integration of static and dynamic cues.[16] In the tunnel effect, subjects are presented with an animation in which an object passes behind an occluder. An object then emerges with different surface features—e.g. color and shape—but with a trajectory and timing that is expected of a single object. Subjects generally perceive the object that emerges as the same object, though having changed its surface features, but a different object if the trajectory or timing are not what would be expected from a single object (Flombaum and Scholl 2006). So, it seems that the visual system can parse objects purely on the basis of dynamic cues, and even ignores incongruous static cues.

I'm not convinced that the tunnel effect tells against the integration of static and dynamic animacy cues. What the tunnel effect demonstrates is that when static and dynamic cues for object identity are incongruous, dynamic cues trump. However, this cannot be the end of the story concerning parsing a scene into objects. We are also able to parse static scenes into objects. I take it that different cues for object identity are perceptually integrated, but

[16] Thanks to an anonymous reviewer for encouraging me to consider this issue more directly.

when they are incongruous, one or the other trumps.[17] Indeed, many perceptual effects apparently conform to this pattern. For example, in the ‘Pinocchio illusion’ blindfolded subjects experience arm and/or nose elongation as a result of vibrating a tendon in their arm (Burrack and Brugger 2005). During this experiment, subjects are given incongruent sensory information about their own body, and the cues that their arm is extending—stimulation of the tendon—trumps the cues that their arm is static. Another example is the rubber hand illusion. During the rubber hand illusion, subjects report feeling their hand being stroked, on the basis of observing a rubber hand being stroked (Tsakiris and Haggard 2005). The rubber hand illusion is apparently an instance of visual information trumping incongruent tactile information in producing the experience of stroking.

I also wonder whether the tunnel effect is at the same level of processing as animacy perception. Animacy perception concerns the categorization of objects, not the parsing of a scene into objects. I take it that categorization is a posterior stage of processing. As such, we might hold that static and dynamic cues fail to be integrated with respect to parsing a scene into objects, but *are* integrated with respect to categorizing objects as animate or inanimate. I take it that some of the empirical evidence supports this thought. In some experimental paradigms, animacy perception depends essentially on integrating static and dynamic cues. For example, Pauen and Traüble find that seven month olds interpret ambiguous motion events differently, depending on whether the object’s static cues are animate or inanimate (Pauen and Träuble 2009). The wolfpack effect also requires chevrons with directionality—a static cue—that move in particular ways—a dynamic cue. If the visual system did not integrate static and dynamic cues, it’s hard to see how such an

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[17] For more detailed investigation of how cues for object-hood are integrated in children, adults and monkeys see (Spelke et al. 1995; Munakata et al. 2001; Smith, Johnson, and Spelke 2003).

effect could be observed. So despite the tunnel effect, I think the best interpretation of the available evidence is that static and dynamic cues are integrated in animacy perception.[18]

That said, considering the tunnel effect in connection with animacy perception suggests a possible experiment that, to my knowledge, has not been performed. What would happen if the object, before going behind the occluder, moved in characteristically animate ways—or had static cues associated with animacy? It would be interesting to see whether the tunnel effect was modulated by animacy cues.

A second worry is whether I have been too hasty in my assumptions about static animacy cues.[19] Why think that static animacy cues are cues for animate objects, rather than more general cues that distinguish natural kinds from artifacts? Given how many studies involve contrasting animate objects with artifacts, this is a potentially important oversight.[20] Happily, I think there is empirical reason to believe that the visual system is employing static animacy cues that distinguish animate objects from both plants and artifacts, not merely the natural from the artificial.

New and colleagues compared animate objects to both plants and artifacts in their change blindness study (New et al. 2010). Changes involving animate stimuli—people and animals—were significantly faster than comparable changes involving either artifacts or plants. Young children are also able to identify unfamiliar animals as animate at an age when they are resistant to grouping plants and animals together (Opfer and Gelman 2011). As such, I think we have reason to believe that static animacy cues are diagnostic of animacy, rather

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[18] A further question: is there a single module responsible for processing and integrating static and dynamic animacy cues, or are there multiple modules that subserve the detection and integration of animacy cues? I don't answer to this question. My argument concerns what the visual system is doing—functioning to track animacy—not a specific proposal about how the visual system does so. That is, my argument concerns the visual system considered at the computational level, rather than at the algorithmic level (Marr 1982). Analogously, we might perceive faces, even if several modules work synergistically to detect faces. For example, if there is a module for edge detection, that module would presumably be essential to detecting faces, but the fact that face detection requires multiple modules does not undermine the claim that face detection is perceptual, or that perception is modular. (See (Clarke 2020) for discussion.) Thanks to an anonymous reviewer for encouraging me to clarify this point.

[19] Thanks to an anonymous reviewer for raising this question.

[20] See (Wertz 2019) for a recent overview of plant perception. For more detailed investigation of the static features that underlie animacy detection, see (Levin et al. 2001; Long, Yu, and Konkle 2018).

than a broader category that also includes plants, though more empirical work is called for. None of this forecloses the possibility that representations of animacy are in fact representations of life—perhaps representations that often misrepresent plants. In order to foreclose that possibility, we need to consider how best to assign content to these representations.

Figure 3 around here

4 What Animacy Isn't

So I take it that there are perceptual representations that we can stipulatively call 'animate'. But what is it we are representing when we represent 'animacy'? In the next section, I'll argue that we should understand 'animacy' in terms of agency. One might reasonably think that's a rather metaphysically rich understanding of the phenomenon. As such, I'll consider a couple more austere views. Observing that these proposals are unsatisfactory indirectly motivates my more metaphysically robust view.

On an austere view, there are representations that function to detect animacy, but content is assigned in a more deflationist way.[21] So, genuinely perceptual representations underwrite the empirical results reviewed above, but they do not represent novel sorts of properties. Rather, they represent, for example, shape and motion gestalts.[22] So a perceptual representation explains e.g. the visuomotor disruptions induced by the wolfpack effect, but it does not represent 'animacy'. Instead it represents 'simultaneous pointing' or some such complex, but superficial property. Although the visual system is designed to detect animacy, it does so by representing complexes of superficial properties, not deep properties as such. Call these views 'deflationist'.

Distinguish two versions of deflationism. On one version, all that is represented is the particular low level shape or motion property presented. On another, in addition to the particular low level property, a disjunctive property—being one or another of a class of low-level configurations—is also presented. On the first version, all we get in perception is a particular pattern of movement, in the dynamic case. This version does not capture the

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[21] This view can also be thought of as 'eliminativist' about animacy perception. I take it this choice is verbal for reasons discussed above. Thanks to an anonymous reviewer for encouraging me to clarify this point.

[22] A version of this understanding of the wolfpack effect was suggested to me by Chaz Firestone in conversation. Replies of this style are also familiar in debates about rich content in the philosophy of perception.

fact that the perceptual system distinguishes between two *kinds* of motion patterns: 'animate' and 'inanimate'. So this version simply doesn't account for the phenomenon.

The second version does better. Instead of insisting we just get the *particular* low-level complex, the deflationist introduces a disjunctive property: the property had by motion just if, either it is one particular motion, or another particular motion, or…etc. The particular motions that constitute the disjuncts are those that induce animacy detection. On this proposal, in addition to whatever specific motion is detected, *this* disjunctive property is represented in perception, and it is the representation of this property that figures in the explanation of the empirical results reviewed above.

Such disjunctions of superficial properties corresponding to a proposed high level property are always available. This observation is familiar from debates on mindreading in non-human animals and young children.[23] As Cameron Buckner (2014) observes, adjudicating between competing content assignments requires background psychosemantic assumptions. Without a view about what fixes the content of psychological states in general, we aren't likely to make much progress between competing proposals, each of which identifies a property correlated with the internal state at issue. The situation is frustrating, because psychosemantics is no less controversial, so referring our disagreement about content assignment to antecedent views about psychosemantics is not apt to skirt controversy.

When should we take a system to be representing an underlying cause, and when should we take it to be merely representing the cues or some disjunction thereof? This is a general question about mental representation. Fred Dretske puts the point eloquently:

> No matter how versatile a detection system we might design, no matter how many routes of informational access we might give an organism, the possibility will always exist of describing its function (and therefore the [meaning] of its various states) as the detection of some highly disjunctive property of the proximal input. (Dretske 1986, 35)

That said, we can respond to the deflationist without determining the one true psychosemantics. The deflationist proposal is not plausible on a number of popular programs in psychosemantics. So, without adjudicating between competing psychosemantic programs, we have reason to resist deflationism.

I suggest that we query the *point* of animacy detection. This admittedly vague idea has been precisified in different ways. To choose three examples: Ruth Millikan (1984) adverts to evolutionary history; Fred Dretske (1981) adverts to the information a state was developed

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[23] See (Halina 2015) for a lucid statement of this point.

to carry; inferential role semantics adverts to the way in which a state is treated by consumer systems (Block 1986).[24] Though these programs are different, the differences are not relevant for our purposes. What does matter is that the semantics of a state turn on facts about the point of that state for the broader cognitive economy of the organism, and the organism's purposes.

Admittedly, not all psychosemantic views fall under this umbrella. My argument will thus not move those readers who operate within a different paradigm. This observation is cold comfort for the deflationist, though, since deflationism requires rejecting a number of the most popular and plausible views on psychosemantic questions. Moreover, alternative psychosemantic programs also need an answer to the disjunction problem—see Fodor (1987, Chapter 4) for discussion—and it remains to be seen whether a plausible solution outside this umbrella of views will vindicate deflationism about animacy.

Assuming, then, that the meaning of an internal state has something to do with the point of that state for the organism, or the role it plays in the cognitive economy, we have reason to reject deflationism. Although the deflationist proposal secures a correlation between internal states and the proposed property represented, it's dubious that there is *any* point to tracking the proposed disjunction of proximal stimuli, other than its utility in indicating animacy. So although the disjunctive property the deflationist identifies is correlated with organisms' internal states, tracking that property as such would be pointless. So, assuming that representation has something to do with the point of tracking, deflationism is unmotivated.

Perhaps instead animacy is life. Call this proposal 'the biotic view'. Earlier, we briefly considered and rejected this proposal, but we were too hasty. Our reasons for rejecting the biotic view were that we generally don't perceive plants as animate, and arguably do—or could—perceive some robots as animate. These cases suggest that animacy perception comes apart from life in a way that undermines the biotic view. A proponent of the view might reasonably respond that this was too quick. Animacy perception is like other kinds of perception in that it can be non-veridical. The biotic theorist can hold that appearances of animacy are non-veridical when the object in question isn't alive, e.g. a robot. Whether our experience of plants is non-veridical depends on whether one thinks an object appearing inanimate is a matter of it being presented as inanimate, or merely failing to be presented as animate. On the former view, our experience of plants would be illusory. On the latter, we fail to perceive a property, and so our experience would not be illusory.

[24] For more recent work, see (Shea 2007, 2013, 2018; Neander 2017; Buckner, Forthcoming).

The biotic theorist can't be dismissed on the psychosemantic grounds adverted to above. Life does seem like a property it would be useful to track. Though this line of thought has some plausibility, I suggest that we should reject the biotic view. Here are my reasons in short; I'll then make the argument more deliberately. The empirical evidence suggests that we have distinct representations of life and of animacy. As a result, understanding animacy as life requires giving a tortuous account of our cognitive development and the mature cognitive significance of animacy representations. The proposed cognitive system is duplicative and features systematic errors to compensate for the ways in which animacy representations don't track life. Though such a view is coherent, it is unattractive.

Understanding animacy and understanding life come apart developmentally. Young children grasp animacy before they grasp life. Moreover, their understanding of animacy plays crucial and varied roles in their broader understanding of the world.[25] Infants deploy different principles to understand movement when considering animate and inanimate motion (Spelke, Phillips, and Woodward 1995); preschoolers make richer inductive inferences about animate categories, compared with inanimate categories (Gelman 1988); 7 month olds interpret ambiguous motion differently, depending on whether the moving object is animate (Pauen and Träuble 2009). Many other effects have been studied. Reflecting on the role the animate–inanimate distinction plays in our cognitive economy, Rochel Gelman characterizes it as a 'skeletal principle' that fundamentally structures experience, governs deployment of attention, and guides learning (Gelman 1990). By contrast, an understanding of life comes comparatively late in development. Preschoolers don't accept that plants are alive and deny that they can be reasonably grouped with animals (Carey 1985; Hatano et al. 1993; Opfer and Siegler 2004). Children also struggle to understand distinctively biological processes before age three or four (Carey 1985).

The biotic theorist suggests that we construe the animate–inanimate distinction as about life all along. As in many domains, children start off with a partial understanding of life, that is refined over time. If the biotic theorist is right, then we would expect the animate–inanimate distinction to dissipate as development unfolds, supplanted by the alive–not-alive distinction. In fact, though, that's not what we find. Adults—and even college biology professors—exhibit the same pattern of errors when under time pressure, i.e. categorizing moving artifacts as 'alive' and plants as 'not alive' (Goldberg and Thompson-Schill 2009).

The biotic view also struggles to make sense of the connections between animacy perception and folk psychology. If we discover that an object that appears animate is not really the sort of thing that can be understood in folk psychological terms, we are likewise inclined to think that the appearance is illusory. Notice, for example, that folk physical explanations of movement defeat the appearance of animacy. That is, if we accept a folk

[25] For a helpful review, see (Opfer and Gelman 2011).

physical explanation of some perceived movement—e.g. ‘oh it was the wind blowing a leaf’—we are, by the same token, inclined to accept that the experience of animacy was illusory. If the function of animacy is to prompt folk psychological understanding, this makes good sense. We don’t need to deploy social understanding, so the system isn’t really animate. This thought is borne out empirically, with three and four year olds offering different kinds of explanation for the movement of animate and inanimate objects (Gelman and Gottfried 1996), and natural language analysis revealing the same in children as young as 2 (Hickling and Wellman 2001).

Interactions between animacy and folk psychology are also manifest in considering people with autism spectrum disorders (ASD). In addition to the deficits in social cognition canonically associated with ASD, subjects with ASD exhibit deficits in animacy perception, relative to neurotypical subjects. These data support a connection between animacy perception and more elaborate forms social cognition. People with ASD exhibit distinctive deficits in identifying biological motion. Blake and colleagues gave children with autism and neurotypical children the task of identifying either an inanimate object composed of short lines amid many distractor lines, or biological motion in point light displays. While both groups performed equally well on inanimate object identification, the children with ASD were significantly impaired with respect to biological motion (Blake et al. 2003). Deficits in biological motion perception were also found by Congiu and colleagues, this time using Michotte-inspired caterpillar animations (Congiu, Schlottmann, and Ray 2010). Children with ASD were significantly less likely to use animate language when describing squares that moved non-rigidly (i.e. like an inch worm).

Deficits have also been observed for identifying objects that are ‘self-propelled’. Rutherford and colleagues asked children to identify one of two objects in displays, on the basis of how they moved. In the control condition, children were asked to touch the item that moved as though it were heavier, while the test condition required children to identify the object that was ‘self-moving’ rather than moving in response to gravity or being pushed. Interestingly, children with ASD took substantially longer during the training phase, but after training showed no deficit (Rutherford, Pennington, and Rogers 2006). The characteristic deficits in social cognition found in ASD, and animacy detection deficits are plausibly not coincidental. Rather, I think these data support the idea that there is a tight connection between animacy perception and social cognition.

These results fit uneasily with the biotic view. The biotic theorist avers that animacy is life, but living things don’t correspond to the things that can be well-understood folk psychologically. So they must posit a second, systematic mistake. Not only do we systematically fail to detect that plants are animate, even though they are, we are also inclined to understand living systems folk psychologically, even though this kind of understanding doesn’t apply to an important range of the animate systems, i.e. plants.

Happily, these two systematic errors more or less cancel each other out: the things that are animate, but fail to be perceived by us as animate, are also the things that don't fall under the folk psychological generalizations we apply to systems that we perceive as animate. This would be quite a fortuitous coincidence.

Moreover, the neural organization underpinning object recognition seems to strongly support distinct representations of life and animacy. I earlier suggested that the animate–inanimate distinction seemed to be the superordinate categorical distinction being drawn in the VTC. The crucial point, for present purposes, though, is that representational similarity analysis suggests that plants fall on the *inanimate* side, along with artifacts, not on the animate side with people and animals (Kriegeskorte et al. 2008).

So, the biotic theorist is seemingly forced to posit strangely redundant representational structures. An early-developing system tracks the animate–inanimate distinction. Really, the distinction between living and non-living systems is being tracked, despite systematic errors. Then, later, we gain the capacity to track life more closely, and deliberately, while maintaining our animacy representations separately. According to the life theorist, then, these two independent representations, that are responsive to different stimuli, and precipitate different downstream processing, are really representing the same thing. Though such a cognitive system is coherent, the question is why we should endorse this proposal, especially if there is an alternative understanding of animacy that fits the data more naturally. In the next section, I'll suggest that just such an alternative understanding is available.

A final rival proposal is that animacy representations represent organism-fuelled motion (OFM).[26] How exactly to give a non-metaphorical explanation of OFM is not obvious, but perhaps we can say that OFM is apparently self-propelled motion by organisms with the features of biological natural kinds.[27] One reason to find this view attractive is that some motion is perceived as animate that is not plausibly agential, for example, insect movement or microscopic footage of single-celled organisms. On the assumption that insects and single-celled organisms are not agents, animacy perception in these contexts does not correspond to agency, but does correspond to OFM, so apparently the proposal that animacy corresponds to OFM outperforms the proposal that animacy is agency.[28]

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[26] Thanks to an anonymous reviewer for encouraging me to consider this possibility.

[27] Thanks to an anonymous reviewer for this suggestion.

[28] I am unsure whether insects are agents in the broad sense at issue, but I will assume they are not for the sake of argument. If they are not agents, then, according to the agency proposal, experiences of animacy induced by insects are not veridical.

Ultimately, I think the OFM view is not as promising as the agency view. I suggest that we should prefer the agency view because it has a generality not enjoyed by the OFM view. Many examples of perception of animacy do not involve motion—consider the data involving static stimuli reviewed above. Or perhaps, like me, you have gone hiking and been startled by coming upon a deer, standing perfectly still. In cases like these, OFM is not a plausible content ascription, since there is no motion. As such, I believe that the agency view has a generality and can explain the integration of static and dynamic cues in a way that the OFM view cannot.

5 Animacy as Agency

On my view, animacy is agency. More precisely, 'animate objects' are *agents* and 'animate motion' is *behavior*.[29] Animacy as agency meets the psychosemantic challenge that hampered deflationism. Tracking agency allows the organism to identify conspecifics, as well as predators and prey.

Animacy as agency offers a natural explanation of the connections between animacy perception and folk psychology. Unlike the biotic view, which had to posit systematic errors to explain the connection, animacy as agency offers a satisfying explanation of the connection. Agents act. Acting, I take it, requires certain sorts of mental states. Folk psychology, among other things, involves attributing mental states. So the connection between animacy detection and folk psychology is on the right track. We mostly veridically perceive the animate systems—agents—and take these systems to fall under folk psychological generalizations, which they do.

Animacy as agency can also explain the interrelations between static and dynamic cues, and between animate motion and animate objects. Animacy perception can involve *integrating* static and dynamic cues, none of which is individually necessary for animacy.[30] Moreover, representing animate motion and representing animate objects are, as it were, bound together. In representing motion as animate, we thereby represent the moving object as animate. We are also inclined to interpret ambiguous motion events as animate when the

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[29] Though it would be lexically more elegant, I balk at calling animate motion 'action'. 'Action' connotes a more sophisticated subset of the category that plausibly corresponds to animate motion. I am identifying a much broader category than the 'full-blooded action' philosophers of action are often concerned with.

[30] See Opfer and Gelman (2011, 217–9) and citations therein for more details about the relevant cues.

moving object is itself understood as an animate object, and young children are quite good at identifying which unfamiliar objects are self-propelled just by looking at static images.

Animacy as agency secures the intimate connection between animate objects and animate motion. 'Behavior', as I am understanding it, is movement properly attributed to the agent. This is consistent with the differences in how young children explain movement for animate and inanimate objects. Preschoolers are inclined to explain the movement of animate objects as self-produced *even when a visible hand moves the object* (Gelman and Gottfried 1996). So if motion is animate, then the object so moving is animate as well—an agent.

More generally, interacting with other agents is categorically different from interacting with non-agents. Agents *react* to us. We can *cooperate* and *compete* with them, in ways that don't make sense for non-agents. Agents perceive and want things. They know things that we may not. Agents tend to take an interest in us, so we have reason to monitor our own actions in a distinctive way in the presence of other agents.

Given the connections between agency and mental states, why would the perceptual system not simply be set up to detect mental states? I think reflecting on the empirical case for agency perception offers a clue. The case for animacy perception is consistent with perceptual systems being informationally encapsulated. Many kinds of mental state attributions are not apt to be subserved by encapsulated systems. Robust mental state attribution requires contextual semantic information, which is not available to encapsulated systems.[31] So detecting agency may be as close to mental state attribution as the visual system can reliably get us, without incorporating information only available to general cognition.

6 Intention and the Essence of Action

Before concluding, let's consider the relationship between agency perception and mental state attribution. I've suggested that agency perception functions to 'turn on' social cognition. So I take agency perception to precede, and be independent of, mental state attribution. Agency perception gives us *candidates* for mental state attribution, and the attribution of mental states is post-perceptual. This proposal fits with the commonplace experience of seeing an agent, and *wondering* what they are thinking(/intending/desiring).

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[31] Though some kinds of mental state attributions may run counter to this generalization, see e.g. (Gergely and Csibra 2003; Carey 2009).

One might object, though, that animacy as agency is inconsistent with mental state attribution being post-perceptual.[32] If the difference between actions and bodily movements must be understood in terms of the mental states that cause actions, then we can't understand animacy perception apart from the detection of mental states, since the mental states are essential to the category. So perhaps in perceiving animacy, we just are perceiving intentions.

Indeed, Grace Helton (2017) endorses the preceding line of thought in her discussion of Heider–Simmel displays. Helton takes it to follow from animacy perception that we perceive intentions, because she endorses a 'perceptual closure principle':

> if some feature Φ is at least partly constituted by some feature Ψ and this relation is easily conceptually accessible, then to perceive Φ is thereby to perceive Ψ. (Helton 2017, 7)

This principle, together with the claim that actions are partly constituted by an intention, and that this fact is easily conceptually accessible, entails that we perceive intentions. And if we perceive intentions, then, arguably, my proposal about the function of animacy perception is unworkable.

Helton says that we should accept this principle because 'it gives the intuitively correct verdict in a wide range of cases' (Helton 2017, 8). She elaborates:

> [I]t permits us to say: that the subject who perceives some entity as square thereby perceives that entity as a closed geometric figure; that the subject who perceives some entity as azure thereby perceives that entity as blue; and that the subject who perceives some entity as moving thereby perceives that entity as changing in location. (Helton 2017, 8)

Some theorists may harbor doubts about Helton's principle though. Whether a subject sees something is presumably binary—either the subject sees it, or doesn't. But whether the constitution relation between features is easily conceptually accessible comes in degrees—some constitution relations are more easily conceptually accessible than others. How easily

[32] One might also offer more general arguments for a perceptual view of mental state attribution (see, for example, (Neufeld 2018; Carruthers 2015; Block 2014)). Considering that debate is outside the scope of this paper, but see (Parrott 2017; Westfall 2020) for skeptical rejoinders.

conceptually accessible must a constitution relation be in order for seeing one feature to count as seeing the other? A principled answer to this question is elusive.[33]

Supposing we accept the principle, though, an important distinction remains between two senses of 'see' and cognates—one corresponding to the seeing of the first feature, and another corresponding to the relation the subject stands in to the easily conceptually accessible feature. A sense of seeing independent of relations of conceptual accessibility is required to apply the perceptual closure principle without inviting a problematic regress. I believe such a distinction is available in the literature: the distinction between 'object seeing' and 'epistemic seeing'. On this understanding, when subjects are perceptually presented with a feature, and a constitution relation with another feature is easily conceptually accessible, subjects *epistemically* see the second feature. This interpretation aligns with the theoretical role of epistemic seeing—in which conceptual knowledge enables subjects to 'see' more than is perceptually presented. The literature on epistemic seeing commonly observes that epistemically seeing some feature does not always involve perceptual presentation.[34] So I think theorists might accept that agency is perceptually presented, while denying that intentions are.[35]

7 Conclusion

I've argued that animacy perception is a genuinely perceptual phenomenon, and that we should understand animacy in terms of agency. Animacy perception constitutes an important instance of so-called 'rich' perceptual content, while nevertheless being consistent with thinking of perception as fully informationally encapsulated. Theorizing about animacy perception is also of interest for work on the epistemology of other minds, and the structure of social cognition.

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[33] Two possible answers come to mind, though neither strikes me as attractive: we might hold that only the analytic conceptual connections license the perceptual closure inference. This reply will be unappealing to theorists who doubt the well-foundedness of the analytic–synthetic distinction. Alternatively, we might say that how easily accessible the conceptual connection must be is fixed by conversational context. This view may be reasonable when considering the semantics of ascriptions involving 'see', but I am less attracted to such an answer in the philosophy of mind.

[34] See for example (Dretske 1969; Cassam 2009; Parrott 2017; Neufeld 2018).

[35] Though I have not argued that intentions are not perceptually presented. Perhaps they are. My point here is that accepting that agency is perceptually presented is not on its own a sufficient argument for the view that intentions are perceptually presented as well.

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