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# INSECTS AND THE PROBLEM OF SIMPLE MINDS: ARE BEES NATURAL ZOMBIES?

Which animals consciously experience the world through their senses, and which are mere robots, blindly processing the information delivered by their "sensors"? There is little agreement about where, indeed, even if, we should draw a firm line demarcating conscious awareness (that is, phenomenal awareness, subjectivity, what-it-is-like-ness) from nonconscious zombiehood (what Ned Block calls "access" consciousness).[1] I will assume that the solution to what Michael Tye calls the "problem of simple minds" and what Peter Carruthers calls the "distribution problem," does not require us to conceive of consciousness as a graded or "penumbral" phenomenon.[2] Tye is on the right track when he writes that "[s]omewhere down the phylogenetic scale phenomenal consciousness ceases. But where?" (*op. cit.*, p. 171). That is a tough question, though perhaps not intractable. I want to sketch an empirically driven proposal for removing some puzzlement about the distribution of consciousness in the animal world. Perhaps we can make progress on Tye's question by exploiting analogues between the residual abilities found in the dissociative phenomenon of blindsight, and the visual and other sensory functions in certain animals. I want to develop the idea that we quite likely can distinguish conscious from nonconscious awareness in the animal world, and in so doing identify creatures that are *naturally blindsighted*.[3]

[1] Block, "On a Confusion about a Function of Consciousness," in Block, Owen Flanagan, and Guven Güzeldere, eds., *The Nature of Consciousness: Philosophical Debates* (Cambridge: MIT, 1995).

[2] See Tye, "The Problem of Simple Minds: Is There Anything It Is Like to Be a Honey Bee?" in *Consciousness, Color, and Content* (Cambridge: MIT, 2000), chapter 8; and Peter Carruthers, "Animal Subjectivity," *Psyche*, IV, 3 (1998) <psyche.cs.monash.edu.au>.

[3] The claim here is that certain animals might possess phenomenally "blind" ana-

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I will structure my discussion around the "representationalist" theory of consciousness. This is the view that the subjective character of an experience is completely exhausted by its representational content.[4] Representationalism holds it that for any given pair of subjective experiences there can be no qualia difference without a difference in representational content; in other words, representional identities imply qualitative identities. Representationalism is far from assured in the minds of many philosophers. One need only witness Tye's responses to many putative counterexamples to appreciate the breadth of skepticism about the central representationalist thesis.[5] I shall leave this controversy aside and assume that qualia states can (at least) be tracked by way of their representational contents.[6] The next question is: What does representationalism have to say about the problem of simple minds?

Representationalism comes in two main varieties, known as the "first order thought" (FOT) and the "higher-order thought" (HOT) theories of phenomenal consciousness. These share the assumption that conscious representations (especially "analog" or "rough-grained" sensory representations) are those that make a direct impact on an organism's cognitive system: typically by leading to the construction of first-order belief (for example, representations about features of the environment), or higher-order belief (in which another mental state, such as a first-order belief, is taken as the representational content). It is highly implausible that non-mammals and invertebrates possess higher-order

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logues of other modes of sensory consciousness, including touch, smell, and hearing (see footnote 75?).

[4] See Fred Dretske, *Naturalizing the Mind* (Cambridge: MIT, 1995); Robert Kirk, *Raw Feeling: A Philosophical Account of the Essence of Consciousness* (New York: Oxford, 1994); Tye, *Ten Problems of Consciousness: A Representational Theory of the Phenomenal Mind* (Cambridge: MIT, 1995).

[5] See Tye, "Visual Qualia and Visual Content Revisited," in David Chalmers, ed., *Philosophy of Mind: Classic and Contemporary Readings* (New York: Oxford, 2002), pp. ???–??. Tye considers counterexamples offered by Block in his review of Daniel Dennett's *Consciousness Explained* (see Block, this JOURNAL, XC, 4 (April 1993): 181–93), and still more counterexamples in "Blurry Images, Double Vision, and Other Oddities: New Problems for Representationalism?" in Quentin Smith and Aleksandar Jokic, *Consciousness: New Philosophical Perspectives* (New York: Oxford, 2003), pp. ???–??.

[6] One challenge for the representationalist comes in the form of qualia-inversion/absence thought experiments. Those who find such thought experiments plausible, and who also agree that qualia supervene "locally" on a subject's brain states will be natural enemies of representationalism. In short, if it is possible that there can be qualia differences in the absence of differences in the local causal role of sensory representations, then representationalism is false, unless perhaps one abandons the idea that qualia are intrinsic (as does Tye). I prefer to accept that qualia are intrinsic, and so deny the real possibility of absent and inverted qualia.

representational abilities, so higher-order theories seem to imply straightforwardly that there is nothing that it is like to be a fish, amphibian, lizard, insect, and the like. The more interesting case to consider is the FOT theory.

Several explications of the FOT theory claim that many animals, even insects, have states of conscious awareness. However, I will argue that this version of representationalism, especially as conceived by Dretske (*op. cit.*) and Tye[7] faces a dilemma. The dilemma turns on the following question: Are organisms such as insects, and "lower" vertebrates first-order thinkers; that is, can they entertain first-order beliefs and desires? This is a controversial question, however, I will argue that it makes no difference whether or not we decide to call their cognizing "thought." For if they cannot entertain first-order thoughts, then of course the FOT theory entails they are not conscious, and we end up with a skeptical answer to the simple minds problem. However, even if they do possess FO-thought, it is still very unlikely that they are conscious. The reason is because the cognitive "style" of these organisms is so strikingly similar to cognition in blindsight subjects. In short, if cognition in these simple-minded organisms counts as first-order thought, then cognition in blindsight plausibly might as well. But since we know that blindsight is not a form of conscious perception, it would seem reasonable to conclude that the same must be said of organisms with simple minds—they only have "zombievision" (and, perhaps, likewise for other forms of sensation). The second horn of this dilemma suggests that the FOT theory needs to be fine-tuned. If blindsight subjects really are first-order cognizers, of a sort, then the FOT theory needs to be able to distinguish between varieties of first-order thought that are and are not associated with phenomenal awareness. I will say more about this issue further on.

I will also take up the example of the honey bee as a test case for the argument that simple minds are not conscious. To this end, we might turn to techniques widely thought to establish blindsight in monkeys, and ask whether they can be adapted for use in behavioral experiments with other animals. I suspect that there is nothing it is like to be a bee, and that simple minds are naturally blindsighted. This leads me to propose that the place to draw the line between phenomenal consciousness and blind reactivity lies somewhere near the realm of invertebrates.[8] Despite what others have argued, especially Dretske

[7] *Ten Problems of Consciousness.*

[8] I cannot take up the issue in any depth here, but cephalopods (squids and cuttlefish) are a possible exception. Perhaps also many vertebrates are restricted to the zom-

and Tye, there are grounds for thinking that many nonmammals are not phenomenally aware.

## I. A BRIEF SKETCH OF THE FOT THEORY

I begin with a quick sketch of the FOT theory of consciousness. According to the FOT-theory states of phenomenal awareness depend on the tokening of first-order thoughts or judgments (where second-order judgments are thoughts about thoughts). FOT theorists, such as Dretske (*op. cit.*), Tye,[9] Kirk (*op. cit.*), and David Chalmers[10] are united in maintaining that states of sensory consciousness are "analog" (nonconceptualized) representational states that stand ready to make a direct impact on the contents of first-order thought and judgment. Tye neatly expresses the basic idea: raw sensory contents "supply the inputs for certain cognitive processes whose job it is to produce beliefs (or desires) directly from the appropriate nonconceptual representations, *if* attention is properly focused and the appropriate concepts are possessed."[11]

The FOT explanation of consciousness is motivated in several ways. I have already mentioned the representationalist assumption that all conscious awareness has an intentional character (hence the claim that consciousness is always of-something as-something).[12] States of consciousness exhibit classic "marks" of intentionality, including "intentional inexistence" (you can be conscious of things that do not exist) and "aspectuality" (consciously perceiving someone as Peter Parker does not imply that one is consciously perceiving someone as Spiderman, even if Parker is identical to Spiderman). Second, there is the coherence between the structure of phenomenal experience and first-order belief.[13] There is a sense in which seeing is indeed believing, most obviously for veridical perception, but the same is true even for recollected experiences, hallucinations, and mere imaginings. These last are cases where seeing leads to judgments about what one did believe, mistakenly believes, or would believe under the appropriate

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bie mode of perception. One concern about my thesis as applied to insects is the disparity between insect and mammalian neuroanatomy. This paper assumes that the implementing mechanisms for consciousness are blindsight is multiply realizable in a deep sense.

[9] *Ten Problems of Consciousness.*

[10] Chalmers, *The Conscious Mind: In Search of a Fundamental Theory* (New York: Oxford, 1996).

[11] *Ten Problems of Consciousness*, p. 138.

[12] For discussion see William Seager, *Theories of Consciousness* (New York: Routledge, 1999).

[13] Chalmers, *The Conscious Mind.*

circumstances. There is a case for thinking that representational contents of conscious perceptions are always mirrored in the attitudes (though, of course, not vice versa).[14]

FOT theory has other virtues, such as its account of nonconscious biological representations. While representation in the crude sense of information flow is comparatively ubiquitous (as in the nervous system's homeostatic mechanisms, including those implicated in the "representations" of internal temperature, oxygen levels, or blood sugar concentration), conscious representations are presumably rarer. FOT theory accounts for the intuition that only a subset of nervous system representations are conscious—specifically, it is those that "make a cognitive difference." The precise sense in which conscious representations are cognitively efficacious is disputed, but speaking generally, Dretske and Tye maintain that conscious representations "directly" lead to the construction of first-order beliefs.[15] FOT theory is also well equipped to explain certain essential features of consciousness. The ineffability of consciousness, for example, is explained by way of the fine grain of sensory representations which is not preserved during the process of conceptualization (for example, as where one's capacity to experience color far outstrips one's color vocabulary). FOT theory also provides an attractive explanation for introspection, including its "diaphanous" character, or the sense in which introspection always seems reveal aspects of what you are experiencing, rather than features of the experience itself (this is unusual considering that the intrinsic properties of representational vehicles are usually observable, such as the color and shape of a book). In other words, introspection seems to lack any distinct phenomenology: when I introspect my experience of tasting a glass of wine, the content of my self-reflective thought always incorporates content about the wine itself. Whenever one attempts to introspect distinctive features of qualitative experience, one is inevitably led to aspects of what the experience represents.[16]

[14] Do not examples like the Müller-Lyer illusion show that there can be conscious perceptual contents that are not mirrored in belief contents? After all, the lines continue to look different, even though you believe that they are the same length. I prefer to treat these cases in the manner of "imaginings," that is cases of what you *would* believe, if not for collateral information. Were it not for knowing that they are really the same length, you would believe that they are different.

[15] Representationalists disagree over whether nonconceptual sensory representations must *actually*, or, need only *dispositionally*, feed into the concept-exercising system. I will assume the latter—though either way leads to the conclusion that insects and perhaps many "lower" vertebrates are not conscious. Certainly, much can be said about what it means for a representation to lead "directly" to the construction of propositional attitudes.

[16] Cf. "The moment we try to fix our attention upon consciousness and to see what, distinctly, it is, it seems to vanish: it seems as if we had before us a mere emptiness.

Both FOT and its main representationalist rival, the HOT theory[17] are versions of "broadcast" or "Global Workspace" models where conscious states are identified as ones widely available for many different kinds of processing, especially those responsible for flexibility in planning, action, and verbal report.[18] The debate between FO and HO theorists is complex, and not resolvable here. However, while many objections to the HOT theory are tailored with specific versions in mind, an important general complaint is that it specifies conditions for consciousness that are implausibly stringent—it seems doubtful that the HOT theory can acknowledge consciousness in animals and infant humans.[19] On the other hand, it is generally considered a virtue of the FOT theory that it makes room for the strong possibility of consciousness in nonhumans. However, I will argue that this claim is not plausible for the case of simple-minded organisms such as insects, and perhaps even fish, amphibians, and other "lower" vertebrates, whether or not we characterize their cognitive states in terms of beliefs and other attitudes. The reason turns on the cognitive similarity between these simple-minded organisms and blindsight subjects: If simple-minds are believers, then blindsight subjects probably are as well, but then neither are conscious, and FOT is in need of revision. On the other hand, if blindsight subjects are not believers, then neither are the simple minds, but then, once again, neither are phenomenally conscious (and here FOT requires no changes). Either way the FOT theorist should be led to conclude that simple-minds are not phenomenally conscious. This is an interesting result, since, of course, the HOT theorist also accepts this. It appears that leading versions of representationalism deliver skepticism about consciousness in many distant relatives of primates and mammals.

For the sake of exegetical clarity, I will borrow several of Tye's assumptions about the FOT theory as it applies to simple minds,

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When we try to introspect the sensation of blue, all we can see is the blue; the other element is as if it were diaphanous. Yet it can be distinguished if we look attentively enough, and know that there is something to look for"—George E. Moore, "The Refutation of Idealism," *Mind*, XII (1903): 433–53, see p. 450.

[17] See David Rosenthal, "Two Concepts of Consciousness," *Philosophical Studies*, XLIV (1986): 329–59; Carruthers, *Language, Thought and Consciousness: An Essay in Philosophical Psychology* (New York: Cambridge, 1996), *Phenomenal Consciousness: A Naturalistic Theory* (New York: Cambridge, 2000), "Consciousness: Higher-order Theories of Consciousness," *Stanford Encyclopedia of Philosophy* (2001) <plato.stanford.edu>.

[18] Bernard J. Baars, *A Cognitive Theory of Consciousness* (New York: Cambridge, 1989).

[19] Dale Jamieson and Mark Bekoff, "Carruthers on Non-conscious Experience," *Analysis*, LII (1992): 23–28.

especially his criterion for belief in nonhumans. I turn now to Tye's answer to the demarcation problem.

In "The Problem of Simple Minds," Tye is interested in what the FOT theory has to say about the emergence of consciousness, phylogenetically speaking. Tye argues that bees (*op. cit.*, p. 172), though not plants, paramecia, or caterpillars (*op. cit.*, p. 173) are phenomenally conscious. His assessment is worth quoting at length:

> creatures that are incapable of reasoning, of changing their behavior in light of assessments they make, based upon information provided to them by sensory stimulation of one sort or another, are not phenomenally conscious. Tropistic organisms, on this view, feel and experience nothing. They are full-fledged unconscious automata or zombies, rather as blindsight subjects are restricted unconscious automata or partial zombies with respect to a range of visual stimuli (*op. cit.*, p. 172).

I agree that there are explanatory rewards to be gained from the comparison of blindsight subjects to natural zombies (or, perhaps, "zomb-animals"). Here Tye seems to be assuming that a capacity for learning (at least as contrasted with tropism) is a mark of first-order thought, and thus consciousness. Tye qualifies this claim insofar as learning must be carefully distinguished from mere behavioral sensitivity to experience, for otherwise this would not rule out such sources of change as bodily injury. The kind of learning at stake here also goes beyond mere operant conditioning. For there to be consciousness the creature must be capable of possessing an "inner representation…the content of which explains the behavior produced by such changes" (*op. cit.*, p. 184 note 8). This is an important caveat. As I will explain below, blindsight is almost certainly compatible with training and conditioning. It is clearly not just tropism. Indeed, it is probably mediated by inner representations, of at least a rudimentary sort. On the other hand, although there is evidence that insect behavior is mediated by inner representations, of some kind, it is not clear that there is a need to posit the sort of globally integrated representations as demanded by the FOT theory. For example, it is not obvious that it is appropriate to describe simple minds as applying concepts to their sensory representations. In the end, whether or not we call cognition in animals or blindsight subjects "believing" in a strong sense may be tangential. More telling would be the demonstration that there is a similarity in the kinds of processing that allow learning to take place in each case. In the next section I will explore how this point puts pressure on the FOT theory as it currently stands. If blindsight is mediated by first-order belief, then there will have to be a better explanation of the connection between cognition and consciousness.

Tye contrasts simple believers from nonbelievers by emphasizing that the latter "do not learn from experience," nor "acquire beliefs and change them in light of things that happen to them" (*op. cit.*, p. 173). Stimuli elicit only "automatic responses, with no flexibility" as with caterpillars which "have a very limited range of behaviors available...each of which is automatically triggered...by the appropriate stimulus" (*op. cit.*, p. 173). These are on an intellectual par with Daniel Dennett's[20] and Douglas Hofstadter's[21] "sphexish" wasp. But, he adds, not all insects are rigid automatons: honey bees, for instance. In short, Tye suggests that first-order thought consists in having a cognitive system that produces nonsphexish, flexible, adaptive, responses to novel circumstances. Rudimentary forms of stimulus-response conditioning do not count as belief-apt.[22] Tye means to exclude forms of conditioning that do not involve the tokening of behavior-guiding inner representations. Tye also adds that in claiming these humble beings are phenomenally conscious, he is not saying that the bees are aware of their own states of consciousness. For that they would need to "bring their own *experiences* under concepts"[23] using something like a folk-theory of mind.[24]

Tye then turns to examine cognition in the honey bee. Bees learn to use odors in order to recognize conspecifics, they search out new hive sites, they rely on landmarks, perhaps even "cognitive maps," and, of course, they attend to the famous "dance language" in order to locate food sources.[25] While many of these abilities are preprogrammed "equally clearly ... the bees learn and use facts about their environments as they go along" (*ibid.*, p. 178). Bees learn to employ distinctions between shapes and colors to obtain rewards. Researchers have also

[20] Dennett, *Elbow Room* (Cambridge: MIT, 1984).

[21] Hofstadter, "Can Creativity Be Mechanized?" *Scientific American*, CCXLVII (1982): 18–34.

[22] Cf. Dretske's *Naturalizing the Mind* in which evolved hard-wired "systemic" representations are contrasted with "acquired" representations, that is, those that minimally depend on simple learning processes to form associations between "systemic," that is, innate, representations.

[23] Tye, "The Problem of Simple Minds," p. 182.

[24] For Tye it is a corollary of the fact that a creature cannot introspect that it cannot suffer: "Suffering requires the cognitive awareness of pain. The person who has a bad headache and who is distracted for a moment or two does not suffer at that time. The headache continues to exist...but there is no cognitive awareness of pain and hence no suffering. In the phenomenal sense, however, the pain still exists even though its subject is briefly blind to it" (*ibid.*, p. 182). I have difficulty with this. What does it mean to say that there is a headache in the "phenomenal sense" (and not just a nonphenomenal neural vehicle), and yet no subjective viewpoint that is experiencing things in a painful way?

[25] The Dance Language Hypothesis is questioned by some scientists who suspect that olfactory cues account for the dancer's information-bearing role.

had limited success in getting bees to distinguish letters and even, apparently, to "anticipate" the movement of feeding trays. Tye argues that:

> They use the information their senses give them to identify things, to find their way around, to survive...Their behavior is sometimes flexible and goal-driven .... Some of the states honey bees undergo are generated by sensory stimulation and make an immediate impact upon their cognitive systems. This being the case, honey bees...*are* phenomenally conscious: there is *something it is like* for them (*ibid.*, p. 180).

Dretske[26] professes a very similar view, and even echoes Tye's claim about conscious honey bees. Certainly these claims may clash (or not) with your intuitive judgments about whether insects are conscious. I find it easier to believe that insects are not conscious. It is a crucial assumption, hardly obvious, that the sort of learning present in bees is strongly suggestive of first-order belief, and not some less extravagant process.

I happen to think that it would be a virtue of the FOT theory if it does not, after all, attribute consciousness or thought to insects, since this would allow it to evade the charge of "liberalism," but unlike the HOT theory, nevertheless acknowledge consciousness in mammals and birds. I suppose that everyone can at least agree that commonsense attributions of mind get more insecure as we move further away from the paradigm example provided by human beings.[27] Confidence in judgments about other minds gradually fades. Fortunately this debate need not end with exchanges of raw intuition. But before I turn to an empirical proposal, allow me to next address a potentially lethal obstacle to the first-order theory.

## II. THE BLINDSIGHT OBJECTION

Some have challenged the FOT theory on the grounds that it fails to adequately account for blindsight. Blindsight is the disabling condition in which damage to the striate (primary visual) cortex results in some peculiar and selective visual deficits. Blindsight patients insist that they cannot see anything within the region of the scotoma, but

[26] Dretske, "Machines, Plants and Animals: The Origins of Agency," *Erkenntnis*, LI, 1 (1999): 19–31, "First Person Warrant: Comments on Siewert's *The Significance of Consciousness*," *Psyche*, VII, 11 (2001) <psyche.cs.monash.edu.au>.

[27] Harold A. Herzog, Jr., and Shelly Galvin have studied intuitions about the mental lives of nonhumans, and the relevant folk-intuitions seem to be in line with my own. Although there was evidence of various anthropomorphic tendencies, only one-third of respondents believed that invertebrates specifically worms, felt pain—see Herzog and Galvin, "Commonsense and the Mental Lives of Animals: An empirical approach," in Robert W. Mitchell, Nicholas S. Thompson, and H. Lyn Miles, eds., *Anthropomorphism, Anecdotes, and Animals* (Albany: SUNY, 1997), pp. 237–53.

when prompted by researchers they can issue uncannily accurate "guesses" about the location of flashes, the orientation and shapes of simple figures, the presence of movement, and sometimes even differences in color. Carruthers[28] has argued that blindsight constitutes a straightforward counterexample to the FOT theory, that is, insofar as blindsight appears to be a case of perception feeding into first-order cognitive control.[29] Perhaps in anticipation of this objection, some first-order theorists (as above) deny that blindsight involves belief. Others accept that blindsight satisfies the FOT theory, but then claim it is accompanied by a kind of weak experience after all.[30]

## III. TROUBLES WITH THE FOT THEORY

It seems unlikely that blindsight is accompanied by even a weak qualitative aspect. Absent strong grounds to think otherwise, the reports of experimental subjects ought to be taken at face value: it was, after all, patients' verbal reports which led to the discovery of blindsight in the first place. Blindsight also involves cognition—minimally in the sense of nontropistic cognitive control—but perhaps also first-order belief and judgment. My reason for saying this is because blindsight appears to conserve certain implicit memory effects. (Though keep in mind I am claiming that even if cognition in blindsight is not belief-apt, FOT probably implies that insects are not conscious anyway.) However, first consider some reasons for thinking that it is more properly cognitive than usually assumed.

An under-noticed fact about blindsight is that the performance of subjects tends to improve with practice.[31] A gradual improvement in residual visual functioning appears to depend on periods of explicit training in humans,[32] and likewise in monkeys, as discussed by Nicholas Humphrey.[33] A second, especially striking, phenomenon in human

[28] Carruthers, "Animal Subjectivity," "Consciousness: Higher-order Theories of Consciousness."

[29] Fiona MacPherson makes a similar point in her review of *Consciousness, Color and Content* in *The Philosophical Quarterly*, ?? (2003): 619–21. Carruthers has since withdrawn the objection, see Carruthers, "Who Is Blind to Blindsight?" *Psyche*, VII, 4 (2001) <psyche.cs.monash.edu.au>.

[30] See, for example, Chalmers's *The Conscious Mind*.

[31] Petra Stoerig and Alan Cowey, "Blindsight in Man and Monkey," *Brain*, CXX (1997): 535–59.

[32] Lawrence Weiskrantz and Cowey, "Filling in the Scotoma: A Study of Residual Vision After Striate Cortex Lesions in Monkeys," in Eliot Stellar and James M. Sprague, eds., *Progress in Physiological Psychology 3* (New York: Academic, 1970), pp. 237–60, see pp. 243–44.

[33] Humphrey, "What the Frog's Eye Tells the Monkey's Brain," *Brain, Behavior and Evolution*, III (1970): 324–37, "Vision in a Monkey without Striate Cortex: A Case Study," *Perception*, III (1974): 241–55.

blindsight patients is implicit semantic priming. One example discussed by Petra Stoerig and Alan Cowey (*op. cit.*) is where verbal judgment about an auditorily presented (that is, consciously apprehended) polysemous word (such as 'bank') is influenced by another word, related in meaning, and, presented within the scotoma (such as, 'river,' or, 'money')—yet patients insist they are unaware of the priming stimulus. It would appear that semantic content can find its way into judgment through nonphenomenal perceptions—this is a surprising and impressive finding, although, in this regard, blindsight subjects do not differ from those with undamaged brains. It is well established that semantic and other stimuli that are unnoticed, or otherwise below the threshold of conscious awareness, can influence the responses of normal subjects in a variety of contexts.[34] Evidence of intelligent processing, as in implicit concept recognition (here, word meanings), makes it doubtful that blindsight relies on no more than tropism. Perhaps this is not so astonishing: there are many forms of unconscious or "implicit" cognizing.[35] Another example of unconscious conditioning is offered by William R. Kunst-Wilson and Robert B. Zajonc, who showed that "Individuals can apparently develop preferences for objects in the absence of conscious recognition and with access to information so scanty that they cannot ascertain whether anything at all was shown."[36] Another more recent study documents nonconscious effects on emotional responses. John S. Morris and others found that an "angry" face continued to elicit physiological signs of fear in subjects who were not consciously aware of its presence, if they had already been trained to associate it with a negative stimulus (such as a blast of white noise).[37] We have gotten used to the idea that conscious thought is just the tip of a very deep iceberg of intelligence. Considered together these sorts of effects might be suggestive of *blindcognition* and *blindlearning*.

Perhaps semantic priming should be explained in terms of unconscious perceptions and first-order beliefs about lexical stimuli. Or perhaps these points do not decisively establish that blindsight subjects have beliefs of which they are unaware. Nevertheless adaptive flexibility, in the sense of being cognitively sensitive to environmental change

[34] Several examples are given in Patricia S. Churchland, *Brain-wise: Studies in Neurophilosophy* (Cambridge: MIT, 2002), pp. 48–50.

[35] See Kim Kirsner, *Implicit and Explicit Mental Processes* (Mahwah, NJ: Lawrence Erlbaum, 1998).

[36] Kunst-Wilson and Zajonc, "Affective Discrimination of Stimuli That Cannot Be Recognized," *Science*, CCVII (1980): 557–58, see p. 558.

[37] Morris, Arne Öhman and Raymond Dolan, "A Subcortical Pathway to the Right Amygdala Mediating 'Unseen' Fear," *Proceedings of the National Academy of Sciences*, XCVI, 9 (1999): 1680–85.

is *not* a sufficient condition for there being something that it is like. Cognitive change can be driven in the absence of phenomenal feel.

Where do these observations about blindlearning leave the FOT theory? It would be a mistake to conclude that the FOT theory has been refuted. The FOT theorist still has options. She could attempt to explain "blindcognition," in terms of more rudimentary learning processes, or, she could tweak the sort of FO-thought required for consciousness. Next, I shall take up versions of these suggestions.

Carruthers[38] argues that both the HOT and FOT theories can escape criticisms offered by Charles Siewert[39] by appealing to a standard neuropsychological explanation of blindsight known as the "two-systems" theory. This says that vision in the brain is accomplished by two distinct "ventral" and "dorsal" pathways.[40] These pathways process information in distinctive ways: The ventral stream in the temporal lobe is thought to represent objects and the environment, while the dorsal stream, feeding into the parietal lobe, is concerned with the guidance of action with respect to those objects. The two-systems architecture seems to apply to all primate, and quite likely, even mammalian, visual systems. The functional distinction is thought to correspond to solving 'What?' versus 'How?' type problems, as in the difference between a monkey recognizing an object as a piece of fruit, versus its being able to reach out and grab it. But for some reason only the phylogenetically newer (ventral) pathway results in conscious visual awareness. The two-systems theory is also supported by the discovery of processing dissociations between verbal report and blindsight-like prehensile guidance in normal human subjects under experimental conditions.[41] These results, as with the visuo-motor behavior of patients with striate damage, imply that when only the older, dorsal, stream is online, perception is not phenomenally conscious. Blindsight as a permanent disability is thought to result from destruction of the part of the visual cortex (V1) where the dorsal and ventral streams both originate. Although one might expect that a striate cortex lesion would disable both streams, visual processing in the parietal lobe also receives massive visual input via a secondary route known as the "tecto-pulvinar" pathway running through the superior colliculus and pulvinar. In

[38] "Who Is Blind to Blindsight?"

[39] Siewert, "Spontaneous Blindsight and Immediate Availability: A Reply to Carruthers," *Psyche*, VII, 8 (2001) <psyche.cs.monash.edu.au>.

[40] See David Milner and Melvyn Goodale, *The Visual Brain in Action* (New York: Oxford, 1995).

[41] Goodale, Milner, Lorna S. Jakobson, and David Carey, "A Neurological Dissociation between Perceiving Objects and Grasping Them," *Nature*, CCCXLIX (1991): 154–56.

short, it is thought that striate lesions leave dorsal stream functioning largely intact.

This brings me to Carruthers's suggestion that the two-systems theory is compatible with an alternative explanation of the semantic priming effects in terms of tropism and subtle (yet conscious) proprioceptive cuing.[42] Since reflexive tracing of stimuli is preserved, perhaps a patient's eyeballs give rise to subtle sensations as they blindly trace the outlines of a (for example, lexical) stimulus. This might help rescue the first-order theory from the criticism that it is incompatible with blindsight, for this would show that semantic content need not play any role in producing the priming effects; in other words, maybe nonsemantic tactile information about the physical form of the stimulus is serving as a cue. However, I doubt that tactile cuing can account for semantic priming, or other blindsight related phenomena.[43]

Stimuli presented too briefly to be consciously noticed can exert priming effects in normal subjects, even though they are also too brief for saccadic eye movements to occur. I suppose we might also expect that tactile cues ought to lead to concrete beliefs, not the insecure guesses characteristic of blindsight (as mentioned by Dennett,[44] tactile cues can yield spatial judgments, so why not here as well?). Certainly Carruthers's tactile-cuing hypothesis could be empirically explored. A local anesthetic could be used to inhibit saccades, "tracing" hand move-

[42] Carruthers, "Who Is Blind to Blindsight?"

[43] Carruthers is proposing that even the reaching, grasping, and even discriminatory abilities of blindsight subjects are mediated by subtle tactile feedback from reflexive eye and hand movements. The idea is that, say, a consciously felt "up-and-down" proprioceptive sensation resulting from a reflexive visual function could be implicitly used within cognition to influence a verbal report (say concerning the orientation of a slot). If this is correct, then visual content in blindsight would not necessarily have a direct influence on first-order thought; tactile signals, rather than semantic content, would be directly responsible for producing the cognitive states in blindsight. (Stoerig and Cowey remark that the eye's reflexes are largely unaffected by blindsight: the pupil responds normally to changes in illumination, the eyes track movement, and the blink reflex continues to operate; see *op. cit.*, p. 536.)

One reason to doubt Carruthers's speculation is the fact, as noted by Humphrey, that monkeys with blindsight have been known to recover depth perception ("Vision in a Monkey without Striate Cortex"); it seems doubtful that two-dimensional tactile feelings could account for the representation of positions in three-dimensional space. Tactile cuing also seems an unlikely explanation for the amazing phenomenon of semantic priming, though we *might* discover in such cases as the two meanings of the word 'bank,' that the blindsight subjects tend to move their eyes in specific ways (say in a "zig" fashion when the cue presented in the scotoma is 'river', but a "zag" fashion when it is 'money'). It might also be interesting to see if subjects (including persons without blindsight) who have *not* been primed with lexical cues are more likely to respond in a specific way (for example, 'river' when they are asked to *move their eyes* in the "zig" fashion).

[44] Dennett, *Consciousness Explained* (Boston: Little Brown, 1991), p. 339.

ments could be prevented, etc. However, before we worry too much about this proposal, note that Anthony Marcel's research compensated for cues owing to the mere physical shape of the stimulus by showing that the effect was case insensitive (for example, 'bird' and 'BIRD').[45] Neuroimaging could also be used to confirm that implicit processing of lexical stimuli in blindsight subjects occurs in the fusiform and precentral gyrus, as with normal subjects who are reading. This speculation is at least consistent with James Danckert and Yves Rossetti's view that there are three styles of blindsight corresponding to three anatomically distinct processing pathways.[46]

In the next section I will consider the case for thinking that nonconscious perceptions in blindsight can enter into *implicit* first-order judgments or beliefs—though I stress that I am officially agnostic about this. Again, whether or not cognition in blindsight is properly called "believing," there is reason to be skeptical about consciousness in simple minds. I will return to consider the implications of blindsight for insect cognition further on.

## IV. BLINDSIGHT AND BELIEF?

Many who accept the two-systems theory are also inclined to deny that blindsight involves belief. For example, David Milner and Melvyn Goodale[47] explain the residual abilities in blindsight in terms of a *contrast* between action and belief. In their view the dorsal (blind) system uses *momentary* representations to guide motor responses (action) whereas the ventral (conscious) system is supposed to "code enduring object features" suitable for long-term storage (belief). Then again, "blindlearning" and "blindcognition" seem to depend on long-term memory storage.

Action at the personal level of explanation is typically understood in terms of an interplay of attitudes, especially belief and desire. So perhaps this is a reason for ascribing beliefs in blind-cognition. However, others would argue that there is no belief, even when restricted as a guide to action, because a person with blindsight will not *spontaneously* initiate actions: they must instead be prompted by a researcher's entreaties. As Tye would put it, this is because the *contents* of the guesses

[45] Marcel, "Conscious and Unconscious Perception: Experiments on Visual Masking and Word Recognition," *Cognitive Psychology*, XV (1983): 197–237.

[46] Danckert and Rossetti argue that a sub-variety of blindsight responsible for semantic priming depends on areas MT and V4 in the temporal cortex which also receive input from the tecto-pulvinar pathway. James Danckert and Yves Rossetti, "Blindsight in Action: What Can the Different Sub-types of Blindsight Tell Us about the Control of Visually Guided Actions?" *Neuroscience and Biobehavioral Review*, XXIX, 7 (2005): 1035–46.

[47] *The Visual Brain in Action.*

are not appropriately "poised" to make a direct impact on the contents of first-order beliefs. These points are not to be taken lightly. But before the matter is deemed closed, consider some second-thoughts.

First, the issue of spontaneity. Blindsight in monkeys, at least, requires no entreaties (obviously the matter of verbal instruction is not straightforward!). It is far from clear that monkeys with blindsight should be characterized as guessing.[48] To make sense of this issue we should ask what it means for a behavior to be spontaneous, as opposed to guesswork. The need for guessing in human blindsight patients reflects their ignorance about the required style of response (for example, Should I verbalize? But in what way? Or point? Where? Grasp? How?). In this context, guessing is a response that is structured by "forced choice" conditions, that is, conditions where the subject is provided with information that greatly narrows the range of behavioral response (for example, for a human, knowing that one must choose between two words, or, for a monkey, being restricted to either touching or not touching a screen). If this information is not provided, then the subject will not respond at all to stimuli in the scotoma. But "guessing" so defined is compatible with the tokening of first-order belief. Perhaps knowledge of the narrow range of correct responses is a condition for tokening the belief that *p*. Certainly, a naturally dissociated organism would need to be "tuned" to its environment and naturally occurring "forced choice" conditions, for example, as with a frog that is disposed to always *strike* in a stereotyped way towards any small target moving across the horizontal axis of its visual field. In simpler organisms, information about whether to (say) strike or flee in response to a visual target could be made available in the normal course of development. This could take the form of collateral information imparted by trial and error, or the required narrowness in the response-range could just be built into the cognitive system.

Perhaps it is a peculiarity of human self-consciousness that higher-order judgment suppresses the spontaneous exercise of blindsight. Conflicts between "executive" and implicit cognitive processes are not uncommon, and this would not be an issue for the simple minds. It is known that blindsight can interfere with conscious visual processing—visual targets in the blind field can delay a response to targets in the conscious field. Perhaps primate brains are designed to maintain the dominance of ventral stream processing, where the use of the dorsal stream depends on conscious control. Or perhaps further research will show that human patients can be retrained to further exploit their

[48] As noted by Stoerig and Cowey, *op. cit.*, p. 533.

residual abilities without prompting, and with greater confidence. In human patients, rehabilitation has, quite understandably, focused on widening the conscious field rather than attempting to develop an intuitive trust in the blind field, as noted by Stoerig and Cowey (*ibid.*).[49]

Patients themselves characterize their blind-cognizing as guessing, but might this be a consequence of their being unaware of one or more of their beliefs? Many accept there can be mental states an agent is oblivious to. One such case for Tye is when a sensory representation fails to fall under what he calls a *phenomenal* concept (as in driving distractedly, or animals wholly without phenomenal concepts—such as bees). Certainly the idea that subjects have incorrigible access to their own attitudes has been out of vogue, at least since Freud. Might blindsight subjects, whether human or animal, have beliefs that they act on, but are unaware of, and incapable of using in higher-order representation? The fact that they do not have beliefs about their guesses is compatible with saying these "guesses" are actually insecure meta-judgments about implicit lower-order beliefs.

Another way of approaching the question of whether there is belief in blindsight is by asking what would count as a belief in a simple-mind. Consider next how Tye characterizes a simple case of perceptually mediated cognition (as in a fish): first, he says that a perceptual concept is:

> a stored memory representation that has been acquired through the use of sense organs and is available for retrieval, thereby enabling a range of discriminations .... Perceptual beliefs are (roughly) representational states that bring to bear such concepts upon stimuli and that interact in rational ways, however simple, with one another...in response to [the creature's] needs. Perceptual beliefs are like inner maps by which the creature steers. They function as guides to behavior ....[50]

Tye also says that since fish use vision to learn by trial and error, make associations, solve problems, and achieve their rudimentary goals, we should say that they have beliefs, and, by FOT, tentatively conclude they are conscious (*ibid.*, pp. 175–76). For now I will accept as a working definition Tye's view that beliefs are map-like representations that mediate rudimentary forms of practical reason. Many cognitive ethologists hold that a minimal constraint on the ascription of these map-like representational states is that they explain how an organism

[49] Care is in order here given that blindsight patients are deeply disabled. Nobody should suppose that the "super" blindsight imagined by Block, in "On a Confusion about a Function of Consciousness," is a serious possibility.

[50] "The Problem of Simple Minds," p. 176.

responded adaptively and flexibly to novel stimuli; for example, at least sometimes, in seeking (?) the best explanation as to why an animal took an appropriate, but novel, shortcut to achieve a goal, we cannot appeal, as a behaviorist might, to its conditioning history. But we can explain it by assuming the manipulation of a cognitive map, an inner representation of its spatial environment.[51] Skinnerian learning is not robustly cognitive in this sense, since it does not posit map-like representations to explain flexible, adaptable, and goal-driven behavior. In fact, I suspect that learning mediated by blindsight occurs only in the Skinnerian mode, and that most or all insects are Skinnerian creatures. And while there are some grounds for thinking that map-like representations can be ascribed to navigating insects, the same has been claimed for some animals with blindsight. This is part of the basis for claiming a cognitive similarity between (very) simple minds and blindsight.

Consider the case of a blindsighted monkey, Helen, studied by Humphrey.[52] Helen's behavior seemed to fit the pattern of intentional explanation, she learned by trial and error, she could make simple discriminations, and her blindsight might have included the manipulation of cognitive maps. Moreover, these abilities were spontaneously expressed and depended only on "prompting" from the *environment*, not researchers. Stoerig and Cowey report that Helen

> was able to orient towards, follow, grasp, detect, localize, and discriminate visual objects. Apart from her excellent abilities in formal tests she could move about freely, would not bump into objects and obstacles…and often appeared normal in her spontaneous visually guided behavior as long as she was not alarmed (*op. cit.*, p. 549).

I see little reason to characterize Helen's cognizing as guessing rather than believing. So, the case against the presence of belief (in Tye's sense) in animals with blindsight is not so clear-cut after all. I want to say more about this issue, but first allow me to consider the implications for the representational theory of consciousness if there is belief in blindsight.

It has been suggested that the first-order theory is in danger of refutation if blindsight is implicated in first-order judgment. Actually, this is not the case. My claim is that *if* blindsight does, after all employ belief, then FOT is only in need of amendment. (Though, as I say,

[51] See Charles R. Gallistel, "Insect Navigation: Brains as Symbol-processing Organs," in Don Scarborough and Saul Sternberg, eds., *An Invitation to Cognitive Science*, Volume 4 (Cambridge: MIT, 1998, 2nd ed.), pp. 1–51.

[52] "Vision in a Monkey without Striate Cortex."

the antecedent of this conditional may well be false.) The case of Helen notwithstanding, blind cognition generally seems to lack the integration associated with phenomenal awareness; it does not interface with other sensory modes, or help supply a global model of the environment usable in even basic forms of practical reason. However, even if there is belief in blindsight, FOT can be rescued by appealing to its differing style of information processing as compared with conscious sight. On this alternative version of the FOT theory (for clarity call this FOT*), phenomenally conscious states are those sensory representations poised to construct first-order thoughts characteristic in dorsal-style processing: specifically, poised, abstract, nonconceptual representations that make a direct impact on the use of recognitional concepts in first-order cognition. Why should this make a difference as to whether a representation is conscious? Consider patients with optic ataxia, who are consciously aware of objects, their properties, and spatial relations. Their verbal judgments seem belief-apt, and can be issued spontaneously. However these patients cannot reach and grasp those same objects. Researchers believe that their visuomotor deficits are due to damage in the dorsal stream of the parietal lobe—exactly what is to be expected given the two-systems theory.[53] Perhaps in blindsight the brain continues to represent perceptual elements (for example, edge, orientation, location, luminance, movement), but the integration of these elements in ventral stream processing has been compromised. There is no integration of low-level perceptual features in representations of discrete objects, and their spatial relations. FOT* would therefore be the view that blindsight involves a truncated form of first-order belief where the belief contents are about these disorganized elements of the visual environment. Perhaps that is the sort of cognizing that best explains Helen's behavior. But then the claim that there is not mere information processing, but genuine *belief* in blindsight is not such a devastating point after all.

I advance the notion of FOT* tentatively, partly out of conservatism: clearly there are processing differences between conscious and nonconscious seeing awaiting a more precise characterization by neuroscience. The question of FOT* turns on unresolved empirical matters. The discovery of cognitive maps in animals depends on testing to see if performance in navigation-related (and other) tasks is improved by

[53] Goodale, "Why Vision Is More Than Seeing," *Canadian Journal of Philosophy*, Supplementary Volume 27, *Naturalism, Evolution, and Intentionality* (Calgary: University Press, 2001), pp. ???–??.

allowing the subject to familiarize itself with a stimuli set (for example, the layout of a maze), and then seeing if it is capable of departing from established patterns in new situations (again, as in taking a short-cut to a blocked path). Images of mazes could be presented in the scotoma of blindsight subjects in order to see what affect, if any, this has on navigation tasks. If map-like representations are implicitly processed, then that would be a reason to ascribe implicit beliefs after all. This may have been what was going on with Helen, but without further investigation into the implicit processing of map-like stimuli, the question of whether a change to FOT* is necessary must be tabled.

This is not to deny the serious considerations suggesting that blindsight is not sufficiently belief-apt. Blindsight, at least in humans, is so disabling because it does not facilitate the exercise of practical reason: A thirsty subject will not reach for a glass of water viewable only from the blind field.[54] The informational states in blindsight are not widely available, or "informationally promiscuous," especially for the purposes of planning and inference. I do accept that this is a compelling reason to doubt that cognizing mediated by blindsight is belief. Whatever else a belief is, it is not an unreasonable demand that its ascription to a subject depends on its tendency to facilitate the satisfaction of the subject's desires.

Of course, the sense of belief that I am borrowing from Tye might be inadequate. The question of belief and concept possession in nonhumans is very controversial. Maybe concept possession is restricted to speakers of a language. Or perhaps it is only required that the subject exhibits discriminatory capacities mediated by "map-like" (highly integrated) representational states. Some argue that a generalized ability to make distinctions is strongly suggestive of concept-possession. Two favorite examples of cognitive ethologists are pigeons, which can discriminate Impressionist from Cubist paintings, amazingly, even for paintings never encountered,[55] and the African Grey Parrot, Alex, who could make correct verbal reports about shape, color, and quan-

[54] Block observes that this example is awkward since blindsight patients cannot discriminate glasses of water, even via nonphenomenal guessing, in "On a Confusion about a Function of Consciousness." But the point is just that they cannot satisfy their desires by following cues that appear within the scotoma. On the other hand, one would think that a thirsty person could learn to associate reliable guesses about flashes of light with the presence of a glass of water, that is, on the assumption that the environment is stable and flashes correlate with glasses of water.

[55] Shigeru Watanabe, Junko Sakamoto, Masumi Wakita, "Pigeons' Discrimination of Paintings by Monet and Picasso," *Journal of the Experimental Analysis of Behavior*, LXIII (1995): 165–74.

tity, again, for seemingly arbitrary and novel combinations of objects and properties.[56] Or perhaps these abilities are better explained by appealing to the birds' nonconceptual discrimination of perceptual features in the stimuli sets. In any case, there is little reason to think that insects (or blindsight patients) can perform tasks such as these. Or does blind-cognition satisfy a weaker notion of belief, in which case FOT* would need to specify the stronger sense needed for phenomenal consciousness? In fact, I suspect that learning mediated by blindsight occurs only in the Skinnerian mode of associative learning, which does not cry out for explanation in terms of map-like representations, but that, likewise, simple minds are Skinnerian creatures. In saying this, however, it should be clear that I can remain neutral on the issue of whether animals really have beliefs and concepts: my argument turns on the *analogy* between the global processing styles of blindsight and cognition in simple minds, and not on whether we decide to call this "belief" or "conceptualization."[57] The labels matter less than the clarification of the precise difference between the cognitive-behavioral profiles of blindsight and conscious sight. Blindsight has a distinct signature that can be used to help determine whether or not a nonhuman is perceiving consciously.

## V. BLINDSIGHT IN MONKEYS

In their review of the study of blindsight in humans and animals, Stoerig and Cowey (*op. cit.*) discuss experimental paradigms that might be helpful for the study of nonconscious perception in various other animals.[58] Stoerig and Cowey tested de-striated animal subjects for residual nonconscious visual functions in nonverbal localization and classification tasks of visual targets. Their experimental procedure comprised two stages. The preliminary task is a measure of residual

[56] Irene Pepperberg, "A Communicative Approach to Animal Cognition: A Study of the Conceptual Abilities of an African Grey Parrot," in Carolyn Ristau, ed., *Cognitive Ethology: The Minds of Other Animals: Essays in Honor of Donald R. Griffin* (Hillsdale, NJ: Erlbaum, 1991), pp. ???–??.

[57] It is tempting to think of the cognitive distinction between dorsal stream processing and ventral stream visuomotor control in light of the familiar difference between "knowing-how" versus "knowing-that." The trainability of blindsight is compatible with what psychologists call "procedural knowledge," as in kinesthetic skills such as knowing how to ride a bike, post a letter, track a moving target, and so on. This is usually contrasted with "declarative" knowledge of things and concepts, especially as expressed verbally. But on second thought, the phenomenon of semantic priming does not seem to fit this picture, and the know how/know that distinction generally seems to cut across the distinction between conscious and nonconscious mentation.

[58] Weiskrantz proposes something like this in his review of the blindsight literature—see *Consciousness Lost and Found: A Neuropsychological Exploration* (New York: Oxford, 1997), chapter 4.

vision. The other is supposed to indicate the presence or absence of conscious awareness. The experimental subject is a half-ablated (*hemianopic*) monkey, that is, with hemispheric damage consistent with blindsight on *one* side of the visual field in a human. The subject elects to begin a trial by pushing a button in the center of a video display, causing a target to be briefly flashed in one hemifield. Responses consist in localizing the stimulus, an illuminated spot on the touch-sensitive screen. Note that in this first stage, initiating a trial always leads to the appearance of a target, either in the normal field, or else on the side suspected to be afflicted with blindsight. The brain-damaged monkeys are highly successful at locating targets, regardless of where they appear on the display.

In the second task, the hemianopic monkey is again required to localize visual targets by touching them. Occasionally, however, no visual target is presented after the monkey initiates a trial. In this case, the monkey is required to classify the visual scene as having no stimulus present, or as a "blank field," by touching an omnipresent white square on the left side of the display (lying within the normal visual field). As expected, normal monkeys give the "blank field" response when appropriate. However, the hemianopic monkeys behave differently: they give the "blank field" response for stimuli presented on the damaged side. So, Stoerig and Cowey claim that hemianopic monkeys successfully locate stimuli that they also classify as "no stimulus present." This would seem to suggest that they are responding nonconsciously using their residual visuomotor (dorsal stream) responsiveness: "we interpret their indicating 'blank trial' in the hemianopic field as evidence for phenomenal blindness, another incidence of species similarity" (*op. cit.*, p. 552). Next I will consider how a similar procedure could be used with other kinds of organisms—we may even find it reveals that some are "naturally dissociated."

## VI. NATURAL ZOMBIES

First, consider whether the idea of a naturally dissociated organism is biologically realistic. Nonphenomenal awareness would certainly suffice for survival in some contexts. Truncated sensory capabilities are better than none at all, and under the right conditions they could facilitate catching prey, avoiding predators, some navigational abilities, and acquiring mates. Would we be inclined to say that such behavior is best explained in terms of stereotyped tropes? Not necessarily. Such an animal would seem cognitively "normal" in the respects that seem to count as having a simple mind (at least for Tye): it learns from experience, utilizes perception to guide its goal-directed behaviors, perhaps even employs cognitive maps, and so on. In short, the creature

need not substantially differ from many other animals, insofar as it acts as if it has simple beliefs and desires. It would have to be designed so that environmental cuing sufficed to activate its visuomotor "action oriented" processing. The representation of "elemental" or fragmentary stimuli might be enough for a simple mind to get by. Phenomenally blind visuomotor processing could also be supplemented by tropistic motor-programs, again tuned to release behavior given the appropriate stimulus in environments with an amount of stability worth exploiting (perhaps as in the ritualized prey capture sequences in snakes, web building in spiders, predatory strikes by frogs, or perhaps even waggle dancing in honey bees). Drawing these points together, we are left with the idea that some creatures possess a rudimentary action-oriented psychology, though like blindsight subjects, they are not subjectively conscious. This brings the discussion close to an empirically adequate solution to the problem of simple minds.

## VII. IS THERE NOTHING IT IS LIKE TO BE A BEE?

Consider a concrete example: the honey bee. Does bee vision fall under the behavioral profile of visuomotor processing characteristic of the dorsal stream? It is well known that animal learning is often constrained in surprising and seemingly arbitrary ways. Perhaps we will discover that something like blindlearning is one such restriction as regards bees.

Cognition in bees is impressive, but not so different from what is evident in blindsight. Bees associate colors with food sources by flying directly to the site with the appropriate color. Experiments have shown a learning bias for complex "busy" shapes, and here too responses are indicated by directly landing on feeding trays.[59] Tye mentions that honey bee learning is subject to some "striking limitations" such as the fact that they cannot learn a flower's odor except when they are sitting on it.[60] This is not surprising if bees do not categorize their visual environment in terms of discrete objects; instead it sounds possible that they are advancing or retreating in response to fragmentary stimuli point-sources. Even stinging tends to be arbitrarily directed towards sources of rapid movement: apparently bees do not keep track of which individual provoked them.[61] But instead of jumping to conclusions about whether they satisfy the FOT theory's demand for belief-apt processing, consider how the revised version

[59] See James L. Gould and Carol Grant Gould, *The Honey Bee* (New York: Scientific American Library), p. 165.

[60] Tye, "The Problem of Simple Minds, p. 184, n.9.

[61] As mentioned by Gould and Gould, *op. cit.*, p. 52.

of Stoerig and Cowey's paradigm might be applied to them. How would they perform in a version of the experimental paradigm that Storeig and Cowey argued reveals blindsight in primates? Are bees more like monkeys with, or without, blindsight?

If it can be assumed that Cowey and Stoerig are right, in that destriated monkeys really do have blindsight, then when they choose the white square, the monkeys are indicating an inability to perform the categorization task. This is a key difference between normal monkeys and blindsight subjects—the latter have great difficulty categorizing stimulus situations. Perhaps this is because they lack the integrated representations that make multi-sensory "global" processing possible.

In the case of the bees, things might work like this. Simulated flowers could serve as landing zones. These mock flowers could be contrived in such a way that the presence of sugar-water (the unconditioned stimulus) can be rapidly introduced or removed. The landing pads should also be equipped to shine brightly when necessary. The object here, as in experiments using standard Y-shape mazes to investigate learning in bees, is to test their ability to associate an illuminated landing zone with the reward. As with the monkeys, the point is to see how honey bees handle various localization, discrimination, and categorization tasks. For instance, a bee could be tested for localization abilities by requiring it to learn to land on the appropriate pad in response to its being briefly illuminated—from what we already know, bees should have no problem here.

The interesting question is whether they can perform the categorization task—for this there would have to be two additional colored landing pads in a "response-area," (say, blue for "signal present," and yellow for "blank field"), and these would be physically displaced from the stimulus site. Successful completion would consist in learning to land on the pad with the appropriate color. This sounds easy enough, and certainly many animals, certainly most birds and mammals, are adept at various categorization tasks. As for bees, they have great difficulty with complex patterns: although "[t]hey learn to recognize patterns on the basis of their position in the visual field, spatial orientation, geometry, size, spatial frequency, depth, motion contrast and bilateral symmetry," the categorization of patterns is highly restricted to such features as orientation and bilateral symmetry.[62] Perhaps then it is not obvious that a bee is capable of learning the categorization task, and if it cannot, then this is something it holds in common with the blind-

[62] See Martin Giurfa, "The Amazing Mini-Brain: Lessons from a Honey Bee," *Bee World*, LXXXIV, 1 (2003): 5–18, see p. 8.

sighted monkey; failing it is predicted for blindsighted, but not conscious, subjects. A natural blindsighter also ought to succeed at localization and (some) discrimination tasks, but fail categorization tasks. My explanation of this is that it does not possess a robust representation of the visual field (in the sense of one which allows it to discriminate between stimulus-present and stimulus-not present type situations, especially for novel stimuli).[63] In saying this one need not take a stand on the question of belief in animals: the question of whether there is a nonverbal criterion for consciousness logically differs from the question as to whether the FOT theory offers the best explanation of consciousness.

One nagging concern about this proposal concerns anatomy. Although the organization of the honey bee's nervous system is not very well understood, there does not seem to be anything analogous to the primate visual cortex. Accordingly, it is not expected that there are structures comparable to the dorsal and ventral systems in mammals. So, it is probably not possible to reinforce findings about visuo-motor behavior with deep comparisons of visual functioning. Indeed, even if bees are conscious, it cannot be assumed that a discrimination/categorization dissociation could be induced by surgical intervention, since the neural implementation of vision might be drastically different. However, we can still ask how we would hypothetically interpret the responses of two organisms, one whose behavior fell under the pattern exhibited by the monkey using its conscious field, and another who fell under the pattern of the monkey relying only on blindsight. An organism capable of performing the full variety of visually mediated tasks is more likely seeing consciously.

Allow me to close by addressing some aspects of honey bee behavior that, at least at first, seem to not fit with the hypothesis that they have zombievision. Bees exploit spatial context, using features such as landmarks to navigate. Some have proposed that bees employ cognitive maps in navigation,[64] though this interpretation is not universally accepted.[65] Perhaps instead of cognitive maps, simpler representational mechanisms suffice to explain insect navigational behavior.[66]

[63] Again, novelty is necessary to offset possible "killjoy" explanations appealing to mere conditioned response.

[64] For some discussion see Gould and Gould, *op. cit.*

[65] Wolfgang H. Kirchner and U. Braun offer skepticism in "Dancing Honey Bees Indicate the Location of Food Sources Using Path Integration Rather than Cognitive Maps," *Animal Behavior*, XLVIII (1994): 1437–41.

[66] See Rüdiger Wehner and Randolf Menzel, "Do Insects Have Cognitive Maps?" *Annual Review of Neuroscience*, XIII (1993): 403–14; Rüdiger Wehner, "Middle-Scale Navigation: The Insect Case," *The Journal of Experimental Biology*, CXCIX (1996): 125–27.

Their sensitivity to landmarks might seem to stand in contrast with the reduced abilities in blindsight. Bees can also be trained to land on the geometric center in a pattern of surface features. This too suggests that bees can make use of visual information in more ways than merely approaching or retreating from a stimulus point source. Yet these results are not necessarily hostile to the proposal here. Even in blindsight the target stimulus can be complex, rather than a mere point source, if spatial-perceptual elements, such as edges, orientation, movement, luminosity, and location, are available to be exploited.

The bees' use of landmarks can also be compared to the blindsighted monkey Helen who, recall, gradually learned to navigate and avoid obstacles.[67] Despite her inability to recognize familiar objects, she would pick a currant up from the floor, but squash a cockroach (*ibid.*, p. 245). Even the reported ability of bees to "anticipate" the movement of feeding sites is echoed in the blindsighted monkey's abilities. Sometimes, when reaching for a scurrying cockroach, Helen would direct her grab appropriately in "anticipation" of the insect's motion. Perhaps the bees' "anticipation" of a change in a feeding site's position is a kind of slow motion version of grasping actions that incorporate target deflection. And perhaps Helen's blindsight utilized map-like representations, as do the bees. Or perhaps maps are not necessary for either. It is sobering to consider that at least one type of learning in the honey bee—olfactory—is mediated by a single (token!) neuron. Is the processing in this neuron sufficiently map-like to count as an inner-representation guiding flexibly adaptive behavior? All that can be said for sure is that blindsight is far more complex than this.[68]

## VIII. CONJECTURAL CONCLUSION: A SCIENCE OF NATURAL ZOMBIES?

FOT theorists are mistaken to assume that HOT theory is the only representationalist account of consciousness that delivers a skeptical assessment of simple minds. The leading versions of representationalism claim that consciousness depends on a kind of "attitude apt" information processing. The monkey experiments suggest an empirical test for nonconscious awareness in primates. Fitting these together yields both a general method for detecting consciousness in nonhumans, and an explanation: Animals are conscious if they can manipulate internal map-like representations of a perceptual field so as

[67] See Humphrey, "Vision in a Monkey without Striate Cortex," pp. 244ff.

[68] Giurfa mentions that electrochemical manipulation of this neuron—known as "VUMmx1"—will induce associations between an olfactory stimulus and a "virtual" reward—a genuine, though primitive, case of manufactured learning (*op. cit.* p. 13).

to pursue their goals, as in whether they can not only locate visual targets but also categorize the situation as "stimulus present." The prediction is that simple-minded zombanimals will succeed at localization tasks, but fail categorization tasks. This is an intuitively satisfying result: unlike the HOT theory, FOT theory still has the resources to acknowledge consciousness in many birds, mammals, and other organisms with map-like representations. This skepticism extends only to the simple minds, about whom common sense is at best uncertain. Of course, maybe the honey bee is not the right (or only) candidate that ought to be examined.[69] It may be that blindsight subjects do not have robustly map-like representations, while navigating insects do. Still, even this is compatible with saying that insects which do not navigate are zombanimals.

But perhaps bees accomplish all they do using only sensorimotor responses akin to the visuomotor processing characteristic of blindsight. This was a two-pronged argument: blindsight seems to be more sophisticated than what is to be expected from tropism and simple conditioning. Meanwhile, cognition in insects is not so obviously best characterized in terms that would distinguish it from blindsight. Insects, and perhaps many "lower" vertebrates might not need to construct representations of objects and their global spatial relations.

For the natural zombie hypothesis to be fleshed out, it will be necessary to show that the localization/signal-detection paradigm can be adapted to other sense modalities, such as audition, olfaction and so on—and this (worryingly) might require something like a what/how processing distinction, and concomitant anatomical divisions. Then again, phenomena reminiscent of blindsight have been discovered in other sensory modalities, including a tactile analogue known as "blindtouch" or "numbsense," "blindsmell," "deafhearing," and even an emotional variant known as "alexithymia."[70] If consciousness is a high-level natural kind, then perhaps there is a common behavioral

[69] Other blindsight-like cases may include "extra-optic" perception, such as the "parietal eye" in some reptiles (actually a light sensitive pineal gland), and the light sensitive cutaneous photo-receptors in the tail of the sea snake (for some discussion of extra-optic perception see N.B. Ford and Gordon M. Burghardt, "Perceptual Mechanisms and the Behavioral Ecology in Snakes," in R.A. Seigel, J.T. Collins, eds., *Snakes: Ecology and Behavior* (New York: McGraw-Hill, 1993), pp. 117–64, see p.120.

[70] See Jacques Paillard, François Michel, and George Stelmach, "Localization without Content: A Tactile Analogue of 'Blindsight'," *Archives of Neurology*, XL (1983): 548–51, and Rossetti, Gilles Rode, and Dominique Boisson, "Numbsense: A Case Study and Implications," in Beatrice Gelder, Edward Haan, and Charles Heywood, eds., *Out of Mind: Varieties of Unconscious Processes* (New York: Oxford, 2001), pp. 265–92. Blindsmell is discussed in Gary E. Schwartz, Iris R. Bell, Ziya V. Dikman, M. Fernandez, John P. Kline,

profile for all varieties of conscious sensing. There is hope for making further progress on the problem of simple minds.

Finally, versions of the Stoerig-Cowey paradigm could be adapted for use with other animals, especially nonprimate mammals, in which the issue of divergent neural architecture is less of a concern. For example, destriated *bat*s would probably also exhibit signal-detection/localization dissociations. It is well known that many bats can be trained to make simple visual discriminations, and since they are mammals, the dorsal-ventral processing distinction presumably applies to them, and so a visual cortex lesion in a bat would probably result in blindsight-like residual seeing. Such an investigation could help answer skeptics, such as Kathleen Akins, who have argued on neuroanatomical grounds that there is nothing it is like to be a bat.[71]

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Affliation

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Julie Peterson and Kenneth P. Wright, "EEG Responses to Low-level Chemicals in Normals and Cacosmics," *Toxicology and Industrial Health*, x (1994): 633–43. For some discussion of alexithymia see Richard D. Lane, Gregory L. Ahern, Gary E. Schwartz, and Alfred W. Kaszniak, "Alexithymia: A New Neurological Model based on a Hypothesized Deficit in the Conscious Experience of Emotion," in Ad Vingerhoets, Frans van Bussel, and Jan Boelhouwer, eds., *The (Non)Expression of Emotions in Health and Disease* (Tilburg: University Press, 1997), pp. 131–38, Lane, Ahern, Schwartz, and Kaszniak, "Is Alexithymia the Emotional Equivalent of Blindsight?" *Biological Psychiatry*, xlii (1997): 834–44.

These grounds for thinking that there are "blind" cognates for other (perhaps all) modalities should not be mistaken for evidence that the neurophysiological implementation of nonconscious perception will always neatly mesh with the details about blindsight, such as the ventral/dorsal stream distinction. On the other hand, Lane et al. ("Alexithymia: A New Neurological Model," p. 135) mention that the "common denominator" for at least two of these conditions (numbsense and blindsmell) is damage in the primary sensory cortex specific to that sensory function. Josef Raushecker even offers a "two-system" explanation of human audition that distinguishes between a conscious/ventral path and a blind/dorsal path—Rauschecker, "Cortical Processing of Complex Sounds," *Current Opinion in Neurobiology* viii (1998): 516–21. Rauscheker's model is mentioned by Andy Clark, "Visual Experience and Motor Action: Are the Bonds Too Tight?" *The Philosophical Review*, cx, 4 (2002): 495–519. For more on "deaf-hearing" see Almut Engelien, Walter Huber, David Silbersweig, Emily Stern, Chris Frith, Wolfgang Döring, A. Thron, and R.S.J. Frackowiak, "The Neural Correlates of 'Deaf-hearing' in Man: Conscious Sensory Awareness Enabled by Attentional Modulation," *Brain*, cxxiii (2000): 532–45.

[71] Akins, "A Bat without Qualities," in Martin Davies and Glyn W. Humphreys, eds., *Consciousness: Psychological and Philosophical Essays* (Malden, MA: Blackwell, 1993), pp. 258–73.