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INVERTEBRATE MINDS: A CHALLENGE FOR ETHICAL THEORY

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ABSTRACT. This paper argues that navigating insects and spiders possess a degree of mindedness that makes them appropriate (in the sense of "possible") objects of sympathy and moral concern. For the evidence suggests that many invertebrates possess a belief-desire-planning psychology that is in basic respects similar to our own. The challenge for ethical theory is find some principled way of demonstrating that individual insects do not make moral claims on us, given the widely held belief that some other "higher" animals *do* make such claims on us.

KEY WORDS: belief, desire, ethics, insect, mind, pain, planning, spider, suffering, sympathy

1. Kinds of Mind

As will be familiar from recent discussions in the philosophy of mind, mindedness comes in degrees, as well as in a variety of kinds. According to some of these accounts, no animals besides ourselves will count as possessing a mind. According to others, it is trivially true that all animals (including insects) possess minds. I shall briefly examine these theories for plausibility – both intrinsic, and in terms of the criteria that they provide for moral relevance. I shall then (in Section 2) outline the account of mindedness that I propose to assume for the remainder of this paper.

Some say: to have a mind means being a user of language in a community of other users of language.[1] To count as having thoughts at all, one must be capable of expressing those thoughts in speech (or

[1] Donald Davidson, "Thought and Talk," in S. Guttenplan (ed.), *Mind and Language* (Oxford: Oxford University Press, 1975), pp. 7–23.

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Sign, or writing), in a way that renders them subject to interpretation by others. And one must also, at the same time, be an interpreter of the linguistic expressions of other speakers; where the interpretation process is governed, *inter alia*, by principles of charity. This view has little to recommend it, however. Most of us find no conceptual difficulty in the idea of non-linguistic thought, and cognitive science routinely makes applications of thoughts to creatures that lack a language, in order to explain and predict their behavior. Moreover, if the account is used as a criterion of moral significance, then it turns out that neither human infants nor people who have been stricken with aphasia will matter morally.

Some say: to have a mind is to exist in a "space of reasons."[2] Mindedness requires that one be subject to norms of rationality, both in the formation of belief and in the making of decisions. This view, too, has little to recommend it. One problem is that even the simplest of norms that have been proposed by philosophers – such as, "Do not adopt a new belief without first checking its consistency with your existing beliefs" – turn out to be ones that it is impossible for beings like us to comply with in anything resembling a realistic time-frame.[3] And the more that actual human reasoning has been studied, the more it turns out to be governed by sets of quick-and-dirty heuristics, rather than by valid norms.[4] Moreover, this view, too, would place many groups of humans beyond the moral pale, if treated as a criterion of moral significance.

Others say: to have a mind is to be capable of thought, and that means possessing concepts that are subject to the "Generality Constraint."[5] On this account, a creature that has the concepts *F*, *G*, *a*, and *b* must be capable of entertaining thoughts consisting of all possible combinations of them – that is, it must be capable of thinking *Fa*, *Fb*, *Ga*, and *Gb* – and likewise for any other concepts that the creature possesses. Now, it is true that *human* thought meets this constraint. But this results, not from our capacity to think

[2] John McDowell, *Mind and World* (Cambridge: The MIT Press, 1994), Lecture 6.

[3] Christopher Cherniak, *Minimal Rationality* (Cambridge: The MIT Press, 1986), Chapter 4.

[4] See D. Kahneman, P. Slovic, and A. Tversky, *Judgment Under Uncertainty* (Cambridge: Cambridge University Press, 1982); and Gerd Gigerenzer, Peter Todd, and the ABC Research Group, *Simple Heuristics that Make Us Smart* (Oxford: Oxford University Press, 1999).

[5] See Gareth Evans, *The Varieties of Reference* (Oxford: Oxford University Press, 1982); and Elizabeth Camp, "Who Can Think Conceptual Thoughts?" (accessed on April, 2006 at: www.people.fas.harvard.edu/~ecamp/).

thoughts as such, but rather from our twin capacities for *creative supposition*, on the one hand, and for utilizing and drawing inferences from what we have supposed, on the other. Let me elaborate.

One of the species-distinctive features of human beings is the extent to which we display creativity in our thought and behavior. This receives its first manifestation in infancy, in the form of pretend play (which is also unique to our species). And it is widely agreed that pretend play requires a capacity to entertain, and to reason with, suppositions, which are states that are distinct in kind from beliefs, desires, intentions, or any combination thereof.[6] Thus the child *supposes* that the banana is a telephone, and then goes on to think and act appropriately within the scope of that supposition (making dialing movements, talking as if Grandma has answered, and so forth). Moreover, supposition plays a central role in our lives as adults. We *suppose* that we do one thing rather than another, and think through the likely consequences; or we suppose that such-and-such might be the case, and line up the implications of that supposition against facts that we know; and so on. And in the course of generating these suppositions creatively we can, indeed, combine any concept that we possess with any other.

It seems plain that our capacity for creative supposition is a late evolutionary addition, which made its appearance against a pre-existing background of mindedness.[7] Only a creature that was already capable of forming beliefs, of drawing inferences from its beliefs, and of planning for the future in the light of its beliefs and goals, could find any use for supposition. The latter greatly extends the *range* of beliefs and plans that we can form. By combining together arbitrary concepts to form novel suppositions, we are sometimes led to theories that we could never have reached by inference from the available evidence, and we are likewise led to plans that would never have occurred to us otherwise. But it is very doubtful indeed whether a capacity for creative supposition could have turned us from mindless brutes into creatures possessing, for the first time, a mind. And it is even less plausible that creative supposition should be a necessary condition for a creature to possess moral significance.

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[6] See C. Jarrold, P. Carruthers, P. Smith, and J. Boucher, "Pretend Play: Is it Meta-representational?" *Mind and Language* 9 (1994), pp. 445–468; Paul Harris, *The Work of the Imagination* (London: Blackwell Publishers, 2000); and Shaun Nichols and Stephen Stich, *Mindreading* (Oxford: Oxford University Press, 2003).

[7] Peter Carruthers, *The Architecture of the Mind* (Oxford: Oxford University Press, 2006).

Might some of the above accounts be rendered more plausible by pulling apart the capacity for *thought* from the capacity for *sentience* (or perception more generally), and by arguing that only the latter is a requirement of moral significance? For in that case we could deny genuine thought to non-human animals and many humans while at the same time claiming that their sufferings are appropriate objects of sympathy. So perhaps it is the capacity to *feel* rather than the capacity to think that makes a creature worthy of our concern. And perhaps capacities to perceive and to feel can exist independently of any capacity for thought.

This last proposal (that a capacity to perceive can be independent of a capacity to think) strikes me as correct. Organisms whose behavior consists of a nested series of innate sub-routines, triggered by bodily state (e.g., pregnancy) or by circumstances (such as an ambient temperature of 70°F or above), will have their behavior guided by perception-like states, but may be incapable of anything resembling conceptual thought or planning. The Australian Digger Wasp, for example, builds an elaborate tower-and-bell structure in which to lay her eggs, protecting them from a smaller species of parasitic wasp.[8] Each stage in the construction process is guided in its execution by perceptual states representing, e.g., the surfaces of the existing structure; and each is ended by a simple stopping rule. But the wasp's behavior is (in this context) entirely *rigid*, lacking even the ability to cope with a minor repair, or to make any adjustment when an interfering experimenter buries the tower in sand (hence rendering it quite useless). So this might be an instance of perception without thought.

The proposal that it might be the capacity to feel rather than the capacity to think that warrants moral concern is problematic, however. This suggestion does, admittedly, have a certain initial plausibility. For if a creature can perceive without being capable of thought, might it not also be capable of feeling pain without being capable of thought? And would that not be sufficient, by itself, to make moral concern appropriate? One problem here, however, is that it is very doubtful whether mere behavior-guiding pain percepts are really sufficient to motivate moral concern. If a creature moves itself and its limbs away from sources of bodily damage, but in a manner that is merely reflex-like, then we surely should not count it as feeling pain in the sense that matters. Some sort of cognitive and/or motivational *uptake* of the perceived pain would be necessary for that.

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[8] James Gould and Carol Gould, *The Animal Mind* (New York: Scientific American Library, 1994), pp. 39–43.

Moreover it is, in any case, neither the perception of pain nor the pain perceived that is the appropriate object of moral concern, but rather the fact that an organism (normally) very much *wants* the pain to go away, and is frustrated in this desire.[9] Consider what happens to people when they are under the influence of certain forms of morphine: they say that the pain *feels* just as it did, but that they no longer *care*. Despite the unchanged character of their perceptions of pain, it is surely quite appropriate to regard morphine as an analgesic, making it unnecessary for us to feel sympathy or concern for the person's state. Moreover, this phenomenon is by no means mysterious or inexplicable. As is now well known, pain is subserved by two distinct nervous pathways, the "old" and the "new".[10] The new path is faster, projects to a number of different sites in the cortex, and is responsible for fine discrimination and feel. The old path, in contrast, is slow, it projects to the more-ancient limbic structures in the mid-brain, and it is responsible for the motivational aspect of pain, or the *awfulness* of pain. What the morphine does is suppress the activity of the old path while leaving the new path intact.

What matters morally about pain, then, is that it is (normally) unwanted. In that case only a creature that is capable of desire, and of having its desires frustrated, is an appropriate object of sympathy. That means, too, that only a creature that is capable of thought (as opposed to mere perception-guided fixed action patterns) should count. But by the same token, if what matters morally about pain is the frustration of the creature's desire for the absence of pain, then our focus should not be on whether an organism is capable of feeling pain, to qualify it as an appropriate object of sympathy and moral concern. Rather, the basic question is whether or not it possesses a belief-desire psychology, and is capable of having its desires frustrated.

I have rejected a variety of accounts of the mind, and of moral significance, that exclude many if not all animals. Others have placed quite minimal conditions on what it takes to possess a mind. Daniel Dennett, in particular, claims that all it really takes is that the system in question should be richly *interpretable as* possessing beliefs and desires.[11] But almost any system – including the humble thermostat – *can* be so interpreted. We can, if we wish, adopt what Dennett calls

[9] Peter Carruthers, *Consciousness* (Oxford: Oxford University Press, 2005), Chapter 9.

[10] D. Z. Young, *Philosophy and the Brain* (Oxford: Oxford University Press, 1986), Chapter 19.

[11] Daniel Dennett, *Brainstorms* (Brighton: Harvester Press, 1978); and *The Intentional Stance* (Cambridge: The MIT Press, 1987).

the intentional stance towards the thermostat, interpreting its behavior as resulting from a desire to keep the temperature of the room above 70°F together with the belief that the temperature has fallen below 70, say. And there is, according to Dennett, no fact of the matter about whether it is right or wrong to adopt the intentional stance towards a given system. Rather, the issue is a pragmatic one. The intentional stance is *useful* to the extent that we cannot easily explain the behavior of the system in other ways (adopting either of what Dennett calls *the physical stance* or *the design stance*). On this approach it is almost trivial that virtually all creatures – including invertebrates – possess beliefs and desires, since the intentional stance is an undeniably useful one to adopt in respect of their behavior.

I propose to assume, on the contrary, that a belief-desire psychology needs to be construed *realistically*. So there needs to be a real distinction between the non-conceptual or pre-conceptual perceptual states, on the one hand, and the concept-involving belief-states and desire-states, on the other. And the latter need to be genuinely distinct from one another in kind, each possessing their distinctive causal role (guiding and motivating action, respectively), and interacting with one another in the construction of plans. Only if realism about minds is assumed is there any interesting question about the minds of non-human animals. And arguably realism is implicit in our common-sense psychology.[12] Or so I shall now briefly argue.

2. The Basic Package[13]

The crucial kind of mindedness required for the appropriateness of sympathy and moral concern, then, involves the possession of a belief-desire psychology, construed realistically. This in turn is subject to a number of quite powerful constraints. We think that *believing* that it will rain here today is a distinct state from *wanting* it to rain here today. And we think that on a given occasion it might be these states and not, for example, the desire to read a book (even if this is something that I

[12] See W. Ramsey, S. Stich, and J. Garon, "Connectionism, Eliminativism, and the Future of Folk Psychology," in J. Tomberlin (ed.), *Philosophical Perspectives 4: Action Theory and Philosophy of Mind* (Atascadero: Ridgeview Publishing, 1990); Martin Davies, "Concepts, Connectionism, and the Language of Thought," in W. Ramsey, S. Stich, and D. Rumelhart (eds.), *Philosophy and Connectionist Theory* (Mahwah: Lawrence Erlbaum, 1991); and Keith Frankish, *Mind and Supermind* (Cambridge: Cambridge University Press, 2004), Chapter 6.

[13] I borrow this term from Robert Kirk, *Raw Feels* (Oxford: Oxford University Press, 1994), pp. 109–113, although I put it here to a somewhat different use.

also want at the time) that leads me to decide not to go out to water my new plants. And it is because those two states are both *about water*, in the right sort of way – in a way that enables them to fit together to lead to a decision – that my action is caused. Moreover, both states are composed out of distinct conceptual components (RAIN, TODAY, HERE), and the processes of reasoning that lead to a decision are sensitive to these parts and their mode of combination. For example, believing that it will rain *there* today or that it will rain here *next week* is likely to lead to quite a different decision being taken.

So in order to count as possessing a belief-desire psychology there needs to be a real distinction between belief states and desire states (and between each of these and perceptual states). Moreover, these states must not only possess intentional contents but must, in addition, be both discrete, and structured in ways that reflect those contents. In addition, their detailed causal roles (the ways in which particular belief states and particular desire states interact in the construction of simple plans) must be sensitive to those structural features. This is the basic package of kinds of state and ability that is necessary for a creature to count as possessing a mind, in the sense that matters for the appropriateness of sympathy and concern.

To be a believer-desirer therefore means possessing distinct content-bearing belief states and desire states that are discrete, structured, and causally efficacious in virtue of their structural properties. These are demanding conditions. But they are not *so* demanding that non-human animals can be ruled out as candidates immediately. Indeed I shall shortly argue, on the contrary, that many invertebrates actually satisfy these requirements.

The requirement that thoughts should be compositionally structured reveals the element of truth in the Generality Constraint.[14] If a creature is to possess mental states of the form "Fa" and "aRb," then it must be possible for *some* other concepts that the creature possesses to occupy the component roles. That is to say, it must be possible for the creature to think *Fb*, for some *b*, and to think *Ga*, for some *G*. Likewise it must be possible for the creature to think *cRd*, for some *c* and *d*, and to think *aSb*, for some *S*. For only if this is the case will

[14] Note, however, that there is nothing in the requirement of compositionality to mandate that thoughts should be realized in sentence-like structures. On the contrary, mental maps and mental models, too, can have compositional structure. This point will prove to be of some importance when we come to discuss the thoughts of honey bees and other navigating invertebrates in Section 3.

there be good reason to believe that the creature's thoughts have component parts and causal roles that are sensitive to those parts. But note that it is *not* necessary (as the Generality Constraint claims) that *all* the concepts that the creature possesses should be capable of occupying the appropriate role.

3. Navigating Invertebrates

In the present section I shall argue that at least some invertebrates (specifically honey bees and jumping spiders) possess a belief-desire-planning cognitive architecture much like our own, as revealed by their sophisticated navigation abilities.

3.1. *Honey Bee Belief*

Like many other insects, bees use a variety of navigation systems. One is dead reckoning (integrating a sequence of directions of motion with the distance traveled in each direction, to produce a representation of one's current location in relation to the point of origin).[15] This in turn requires that bees can learn the expected position of the sun in the sky at any given time of day, as measured by an internal clock of some sort. Another mechanism permits bees to recognize and navigate from landmarks, either distant or local.[16] And some researchers have shown that bees will, in addition, construct crude mental maps of their environment from which they can navigate.[17]

Gould reports, for example, that when trained to a particular food source and then carried from the hive in a dark box to a new release point, the bees will fly *directly* to the food, but only if there is a significant landmark in their vicinity when they are released (otherwise they fly off on the compass bearing that would previously have led from the hive to the food).[18] Other scientists have found it

[15] Randy Gallistel, *The Organization of Leaning* (Cambridge: The MIT Press, 2000), Chapters 3 and 4.

[16] T. Collett and M. Collett, "Memory Use in Insect Visual Navigation," *Nature Reviews: Neuroscience* 3 (2002), pp. 542–552.

[17] The maps have to be crude because of the poor resolution of bee eyesight. But they may still contain the relative locations of salient landmarks, such as a large free-standing tree, a forest edge, or a lake shore.

[18] James Gould, "The Locale Map of Bees: Do Insects have Cognitive Maps?" *Science* 232 (1986), pp. 861–863.

difficult to replicate these experiments directly, perhaps because bees have such a strong disposition to fly out on compass bearings to which they have been trained. But in a related experiment, R. Menzel et al. found that bees that had never foraged more than a few meters from the nest, but who were released at random points much further from it, were able to return home swiftly.[19] They argue that this either indicates the existence of a map-like structure, built during the bees' initial orientation flights before they had begun foraging, or else the learned association of vectors-to-home with local landmarks. But either way, they claim, the spatial representations in question are allocentric rather than egocentric in character.

More recently, Menzel et al. have provided strong evidence of the map-like organization of spatial memory in honey bees through the use of harmonic radar.[20] The latter technology enabled them to track the flight-paths of individual bees. Bees who were just about to set out for a feeder to which they had been trained or recruited by the dances of other bees were captured and taken to random release points some distance from the hive. Initially, the bees then set out on the vector that they were about to fly out on when captured. This was followed by a looping orientation phase, once the bees realized that they were lost, followed by a straight flight, either to the hive, or to the feeder and then to the hive. The latter sequence (a flight straight to the feeder), in particular, would only be possible if the bees could calculate a new vector to a target from any arbitrary landmark that they know, which requires both a map-like organization to their memory and the inferential resources to utilize it.

As is well known, honey bees dance to communicate information of various sorts to other bees. The main elements of the code have now been uncovered through patient investigation.[21] They generally dance in a figure-of-eight pattern on a vertical surface in the dark inside the hive. The angle of movement through the center of the

[19] R. Menzel, R. Brandt, A. Gumbert, B. Komischke, and J. Kunze, "Two Spatial Memories for Honeybee Navigation," *Proceedings of the Royal Society: London* B, 267 (2000), pp. 961–966.

[20] R. Menzel, U. Greggers, A. Smith, S. Berger, R. Brandt, S. Brunke, G. Bundrock, S. Hülse, T. Plümpe, S. Schaupp, E. Schüttler, S. Stach, J. Stindt, N. Stollhoff, and S. Watzl, "Honey Bees Navigate According to a Map-like Spatial Memory," *Proceedings of the National Academy of Sciences* 102 (2005), pp. 3040–3045.

[21] James Gould and Carol Gould, *The Honey Bee* (New York: American Scientific Library, 1988), Chapter 4.

figure of eight, as measured from the vertical, corresponds to the angle from the expected direction of the sun for the time of day; e.g., a dance angled at 30° to the right of vertical at midday would represent 30° west of south, in the northern hemisphere. And the number of "waggles" made through the center of the figure of eight provides a measure of distance (different species of bee using different innately fixed measures of waggles-to-distance).

Although basic bee motivations are, no doubt, innately fixed, the goals that they adopt on particular occasions (e.g., whether or not to move from one foraging patch to another, whether to finish foraging and return to the hive, and whether or not to dance on reaching it) would appear to be influenced by a number of factors.[22] Bees are less likely to dance for dilute sources of food, for example; they are less likely to dance for the more distant of two sites of fixed value; and they are less likely to dance in the evening or when there is an approaching storm, when there is a significant chance that other bees might not be capable of completing a return trip. And careful experimentation has shown that bees scouting for a new nest site will weigh up a number of factors, including cavity volume, shape, size and direction of entrance, height above ground, dampness, draftiness, and distance away. Moreover, dancing scouts will sometimes take time out to observe the dances of others and check out their discoveries, making a comparative assessment and then dancing accordingly.[23]

Bees do not just accept and act on any information that they are offered, either. On the contrary, they evaluate it along a number of dimensions. They check the nature and quality of the goal being offered (normally by sampling it, in the case of food). And they factor in the distance to the indicated site before deciding whether or not to fly out to it. Most strikingly, indeed, it has been suggested that bees might also integrate communicated information with the representations on their mental map, rejecting even rich sources of food that are being indicated to exist in the middle of a lake, for example.

Gould and Gould report experiments in which two groups of bees were trained to fly to weak sugar solutions equidistant from the hive, one on a boat in the middle of a lake, and the other on the lake shore.[24] When both sugar solutions were increased dramatically, both

[22] Thomas Seeley, *The Wisdom of the Hive* (Cambridge: Harvard University Press, 1995), Chapter 5.

[23] Gould and Gould, *The Honey Bee*, pp. 65–67.

[24] Gould and Gould, *The Honey Bee*, pp. 221–225.

sets of bees danced on returning to the hive. None of the receiving bees flew out across the lake, however (while plenty flew to the site on the lake shore). But this was not just a reluctance to fly over water. In experiments where the boat was moved progressively closer and closer to the far lake shore, more and more receiving bees were prepared to fly to it. These experiments went unreplicated for many years, but J. Tautz and colleagues have now fortuitously established the identical result, in the course of experiments designed to test how bees measure the distances that they travel.[25]

How should these various bee capacities be explained? Plainly the processes in question cannot be associative ones, and these forms of bee learning are not conditioned responses to stimuli. This is because many of the behaviors that we have described are undertaken after just a single exposure to a given stimulus, without any history of reward. Thus a foraging bee that has discovered a new source of nectar for itself, and loaded its stomach, will turn and fly directly towards the hive on a vector that it may never have flown before.

Might the bee behaviors be explained through the existence of some sort of "subsumption architecture"?[26] That is, instead of having a central belief-desire architecture, might bees have a suite of input-to-output modular systems, one for each different type of behavior? This suggestion is wildly implausible. For (depending on how one counts behaviors) there would have to be at least five of these input-to-output modules (perhaps dozens, if each different "goal" amounts to a different behavior), each of which would have to duplicate the costly computational processes undertaken by the others. There would have to be a scouting-from-the-hive module, a returning-to-the-hive module, a deciding-to-dance-and-dancing module, a returning-to-food-source module, and a perception-of-dance-and-flying-to-food-source module. Within each of these systems essentially the same computations of direction and distance information would have to be undertaken. This sort of duplication is very unlikely, given the significant energetic costs associated with additional brain mass.[27]

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[25] J. Tautz, S. Zhang, J. Spaethe, A. Brockmann, A. Si, and M. Srinivasan, "Honeybee Odometry: Performance in Varying Natural Terrain," *Public Library of Science: Biology* 2 (2004), pp. 915–923.

[26] Robert Brooks, "A Robust Layered Control System for a Mobile Robot," *IEEE Journal of Robotics and Automation*, RA-2 (1986), pp. 14–23.

[27] L. Aiello and P. Wheeler, "The Expensive Tissue Hypothesis," *Current Anthropology* 36 (1995), pp. 199–221.

The only remotely plausible interpretation of the data, then, is that honey bees have a suite of information-generating systems that construct representations of the relative directions and distances between a variety of substances and properties and the hive, as well as a number of goal-generating systems taking as inputs body states and a variety of kinds of contextual information, and generating a current goal as output. These goal states can then interact with the information states within some sort of practical reasoning system to create a potentially unique behavior, never before seen in the life of that particular bee. It would appear, therefore, that bees possess a belief-desire cognitive architecture.

3.2. *Structure-Dependent Inference*

Recall, however, that the conditions on being a genuine believer-desirer that we laid down earlier included not just a distinction between information states and goal states, but also that these states should interact with one another to determine behavior in ways that are sensitive to their compositional structures. On the face of it this condition is also satisfied. For if one and the same item of directional information can be drawn on both to guide a bee in search of nectar and to guide the same bee returning to the hive, then it would seem that the bee must be capable of something resembling the following pair of practical inferences (using BEL to represent belief, DES to represent desire, MOVE to represent action – normally flight, but also walking for short distances – and square brackets to represent contents).

(1) BEL [nectar is 200 m from the hive, at 30° west of the sun]
BEL [here is at the hive]
DES [nectar]
MOVE [200 m at 30° west of the sun]

(2) BEL [nectar is 200 m from the hive, at 30° west of the sun]
BEL [here is at nectar]
DES [hive]
MOVE [200 m at 210° west of the sun]

These are inferences in which the conclusions depend upon structural relations amongst the premises.[28]

Is there some way of specifying in general terms the practical inference rule that is at work here, however? Indeed there is. The rule might be something like the following: BEL [here is at *G*; *F* is *m* meters from *G* at $n°$ from the sun], DES [*F*], $\rightarrow$ MOVE [*m* meters at $n°$ from the sun]. This would require the insertion of an extra premise into argument (2) above, rotating the order of items in the first premise and adding an extra 180°, transforming it into the form, BEL [hive is 200 m from nectar at 210° from the sun]. And the rule for this inferential step would be: when *here* corresponds to the first position in the directional premise rather than the second, switch the ordering of those positions and add 180° to the direction indicated before extracting the conclusion.

It might be suggested that we have moved too swiftly, however. For perhaps there need not be a representation of the goal substance built explicitly into the structure of the directional information-state. To see why this might be so, notice that bees do not represent what it is that lies in the direction indicated as part of the content of their dance; and nor do observers acquire that information from the dance itself. Rather, dancing bees *display* the value on offer by carrying it; and observing bees know what is on offer by sampling some of what the dancing bee is carrying. So it might be said that what really happens is this. An observing bee samples some of the dancing bee's load, and discovers that it is nectar, say. This keys the observer into its fly-in-the-direction-indicated sub-routine. The bee computes the necessary information from the details of the dance, and flies off towards the indicated spot. If it is lucky, it then discovers nectar-bearing flowers when it gets there and begins to forage. But at no point do the contents of goal-states and the contents of the information-states need to interact with one another.

An initial reply to this objection would be that although the presence of nectar is not explicitly represented in the content of the dance, it *does* need to be represented in the content of both the

[28] Note that I have characterized the contents of the bee's beliefs in terms of our familiar human concepts. But of course I am not committed to the view that bees have the concept meter, let alone 200 m. Rather, what will figure in the bee's beliefs will be a representation that is approximately extensionally equivalent to our concept 200 m, deriving from measures of visual flow (Tautz, et al., "Honeybee Odometry"). And something similar then goes for concepts like sun, hive, and so forth.

dancer's and the observer's belief-states. For recall that bees do not dance even for a rich source of nectar that is too far away. It therefore appears that the distance-information needs to be integrated with the substance-information in determining the decision to dance. Equally, observers ignore dances indicating even rich sources of nectar if the indicated distances are too great. So again, it seems that the distance information derived from the dance needs to be integrated with the value information before a decision can be reached.

Behavior observed and experimentally manipulated by Seeley also makes the skeptical interpretation hard to sustain.[29] Consider a group of bees that had been foraging at a particular site which became depleted near the day's end. The next morning they do not all automatically return to the site. But nor do they allow themselves to be recruited to other sites, either. Rather, a few of them return to check their depleted site periodically, and the rest hang around on the dance floor observing the dances of other bees. Only when they encounter a dance that indicates nectar at their previous site (e.g., because the flowers in question have now opened with the morning sun, or because the experimenter has re-filled the feeder with sugar solution) do they begin foraging again.

We cannot explain this behavior in the skeptical manner indicated above. Not only do we have to ascribe to the bees a belief that there is a nectar-source at a given location (where nectar is the object of a current goal), but we seemingly also have to ascribe to them a representation of *time*. That is, the waiting bees seem to be in a state like, BEL [nectar *was* 200 m from the hive at 210° west of the sun].[30] And then observing a dance of a nectar-bearing bee that carries the content [200 m from the hive at 210° west of the sun] causes them to update their BEL representation to the present tense, leading them to fly out once again to forage.[31]

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[29] Seeley, *The Wisdom of the Hive*, pp. 123–124.

[30] Note that representations of direction of this sort need to be adjusted for the time of day. In fact, bees must continually update their representations of direction throughout the day. If they first learn that a nectar source is 30° west of the sun at midday, then an hour later they will need to update this to represent the nectar as 40° west of the sun, say; and so on.

[31] For further evidence that bees can represent time, see Gallistel, *The Organization of Leaning*, pp. 243–259, together with the discussion in Carruthers, *The Architecture of the Mind*, Chapter 2.

From this discussion we can conclude, I believe, that not only do bees have distinct information states and goal states, but that such states interact with one another in ways that are sensitive to their contents and compositional structures in determining behavior. In that case, bees really do exemplify the belief-desire architecture, construed realistically. There are, of course, many things that bees cannot do, and there are many respects in which their behavior is inflexible. But it is important to see that this inflexibility does not extend to their navigation and navigation-related behavior. On the contrary, the latter displays just the right kind of integration of goals with acquired information to constitute a simple form of practical reasoning.

Some people will fail to be convinced that bees are genuine believer-desirers, no doubt. This is most likely to be because they have in mind some further set of constraints on what it takes to count as possessing a belief-desire psychology, in addition to those laid out in the "basic package" of Section 2. Some of these proposals have already been discussed, and dismissed, in Section 1. But there remain a great many further possibilities. For as we noted in Section 1, there are many different kinds of minds. It might be claimed, for example, that creatures must be capable of explicit representations of causality in order to count as true believer-desirers.[32] Or it might be claimed that consciousness is a prerequisite of genuine mentality.[33] My challenge to those who wish to make such claims is that they should provide them with adequate motivation. We need to be shown that something about our conception of belief-desire psychology requires the presence of these additional properties. And we need to be shown that such properties are necessary for the appropriateness of sympathy and moral concern. I am very doubtful whether these challenges can be met.

3.3. *Advance Planning*

For instances of simple forms of advance planning in invertebrates, I turn from bees to jumping spiders. In the wild, jumping spiders

[32] José Bermúdez, *Thinking without Words* (Oxford: Oxford University Press, 2003), pp. 145–147.

[33] John Searle, *The Rediscovery of the Mind* (Cambridge: The MIT Press, 1992), Chapter 7.

display a number of remarkable hunting behaviors.[34] They typically do not build webs, but rather hunt their prey, including other spiders. They use a variety of "smokescreen" tactics when approaching another spider across its web – sometimes only moving during a gust of wind, when its footsteps will be less easy to detect; sometimes using an irregular gait, which will make its footsteps seem like mere noise; sometimes setting the web into violent motion, during which, again, its footsteps will not be detectable. It might be possible to dismiss such tactics as mere fixed action-patterns. But jumping spiders will also make detours of up to one meter in length to gain access to prey, sometimes initially traveling away from their target in order better to approach it,[35] and sometimes selecting a route that will avoid proximity to another jumping spider in its path.[36] It is these navigation abilities that provide the best evidence of advance planning, in fact.

M. Tarsitano and R. Jackson tested jumping spiders in a laboratory setting.[37] Each spider was placed on top of a pole, from which it could view potential prey on one of two platforms at about the same height. These platforms were positioned on top of two different complex tree-like structures, each of which had a unique base. The spiders had to climb down from their pole in order to reach these structures, and from that time until the very end of the hunt their prey would be obscured from view on one of the two platforms above. Remarkably, the spiders succeeded in these tasks, sometimes traveling away from their prey on reaching the base of their pole in order to reach the correct trunk to begin their climb, and sometimes traveling past the incorrect trunk in order to reach the correct one. It appears that the spiders must have mapped out a possible route to their prey during observation from the top of their pole, and were then able to recall that route thereafter, correctly identifying the

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[34] R. Wilcox and R. Jackson, "Cognitive Abilities of Araneophagic Jumping Spiders," in I. Pepperberg, A. Kamil, and R. Balda (eds.), *Animal Cognition in Nature* (New York: Academic Press, 1998).

[35] M. Tarsitano and R. Jackson, "Jumping Spiders make Predatory Detours Requiring Movement away from Prey," *Behavior* 131 (1994), pp. 65–73.

[36] D. Harland and R. Jackson, "*Portia* Perceptions: The *Umwelt* of an Araneophagic Jumping Spider," in F. Prete (ed.), *Complex Worlds from Simpler Nervous Systems* (Cambridge: The MIT Press, 2004), pp. 5–40.

[37] M. Tarsitano and R. Jackson, "Araneophagic Jumping Spiders Discriminate Between Routes that Do and Do Not Lead to Prey," *Animal Behavior* 53 (1997), pp. 257–266.

various elements of the route (especially the correct trunk to climb) when seen from the very different perspectives involved during travel.

M. Tarsitano and R. Andrew presented jumping spiders with a somewhat different challenge.[38] The spiders were again positioned on top of an observation pole from which they could observe a prey item suspended from supports straight ahead of them. But in this case the spiders were presented with three different set-ups. In all three conditions there were two support poles, one to their right and one to their left, which they could only reach by climbing down from their observation tower and traveling some distance from the base. But in one condition both poles afforded a route to the prey; whereas in the other two conditions there was a gap in the sequence of beams that led to the prey (in the one case on the left, in the other on the right). The spiders were videotaped during their observation phase, so that their direction and extent of gaze could be analyzed thereafter.

The results were striking. In the cases where both poles led to the prey, the spiders showed no preference: they headed left or right from the base of their tower with equal frequency. But when one of the two potential routes was incomplete, the spiders displayed a marked preference for the other, complete, route. Analysis of the spiders' observation-behavior before setting out showed that they scanned along the routes away from the prey, returning their attention to the prey whenever they detected a gap. Hence they rapidly came to concentrate their attention on the complete route, tracing it with their eyes in reverse order (from finish to start) until they located the support pole that they would need to climb.

Taken together, these experiments demonstrate that jumping spiders plan their routes to their prey in advance. They scan the physical layout in search of a continuous path that will take them to the desired spot (where necessary avoiding obstacles, such as the location of a competing jumping spider). They can recall that layout once identified. And they can use it appropriately to inform their current direction of movement, mapping the structures detected during the observation phase onto their later perceptions of those same structures seen from the different spatial perspectives involved during their journey.

Here, as previously, it will remain possible for people to doubt whether spiders engage in genuine planning. For some people will

[38] M. Tarsitano and R. Andrew, "Scanning and Route Selection in the Jumping Spider *Portia Labiata*," *Animal Behavior* 58 (1999), pp. 255–265.

want to place additional constraints on what it takes to be a planner. And my reply (also as previously) is to challenge such people to provide their proposed constraints with adequate motivation, showing how those constraints form a crucial component in our common-sense notion of agency, and showing how they are necessary for a creature to be an appropriate object of sympathy.

4. Sympathy: Appropriate Versus Required

I have argued that many species of insect and spider possess a kind of belief-desire-planning psychology, realistically construed; and that this psychology is of a sort to make them appropriate (in the sense of "possible") objects of sympathy and moral concern. But does it follow from this that we are *required* to have sympathy for them? No, it does not. It is one thing to say that it would be *appropriate* to feel concern at a creature's struggles on the grounds that the creature has a belief-desire psychology and is thus sometimes a subject of frustrated desire. For this is just to say that the states of the creature are of relevantly the same kind as would ground our sympathy for a suffering human. It is quite another thing to say that concern for such a creature is *required*, or to say that we face warranted moral criticism if we *lack* such concern. And it seems plain that the former need not entail the latter.

One way to see this is to notice that we are not always morally required to have sympathy for the sufferings of another human being. Consider a judge passing sentence on a convicted murderer or child rapist, for example. Surely sympathy for the criminal is not required of her. She can be indifferent to the suffering that her sentence will cause without thereby attracting any moral criticism. Indeed, one might also argue that the judge is morally required *not* to have sympathy for the convicted criminal, since this may interfere with her assessment of what the law and the underlying purposes of the judicial system mandate in such a case. Hence she should take care not to enter imaginatively into the perspective of the criminal in any of the sorts of ways that are likely to evoke sympathy.

It might be replied that it is only *qua* judge that she is allowed, or required, to be indifferent to the suffering of the criminal. *Qua* human being, it might be said, she is required to be sympathetic towards anyone who suffers – and that includes the criminal. So when thinking about the people involved in the case when she is not in

Chambers (perhaps while walking her dog at the weekend), or when thinking about the case in retrospect (once her work as a judge has been completed), she should feel sympathy for the suffering that the criminal will endure. These claims strike me as implausible, however. I see no reason why we should think that the judge *must* feel sympathy for the criminal when not occupying her role as judge, or else be subject to moral criticism as a result. I would not think any worse of a judge who was indifferent to the sufferings of convicted criminals no matter when she thinks about them. And if the claim is that the judge, *qua* judge, *should not* feel sympathy for the criminal, then I think this plausibly entails the stronger conclusion that she should not feel sympathy for him *tout court*. For if she feels sympathy for the criminal when thinking about him at the weekend she may be misled into imposing a lighter than appropriate sentence the next day. And if she feels sympathy once the case has been closed she may be tempted to impose lighter than appropriate sentences in such cases in the future.

It is not only as a result of some official role that sympathy for a suffering person may not be required, however. Imagine an ordinary citizen who has been forced to watch while his family are murdered by a serial killer. Later, by chance, he comes across the killer trapped and sinking in quicksand, and desperately calling out for help. Some people might claim that it would be morally admirable (perhaps even saintly) if, in these circumstances, the bereaved citizen were to feel sympathy for his family's destroyer.[39] But surely no one will claim that the citizen may be criticized if he fails to feel such sympathy. So the fact that someone undergoes states of suffering of the sort that makes him an *appropriate* object of sympathy is not sufficient, by itself, to show that sympathy and moral concern are required of us.

There is, of course, a significant disanalogy between these examples and the case of a suffering invertebrate. This is that the humans in these instances are not *innocent*. So it might be said that all suffering – whether human or invertebrate – requires sympathy in the absence of countervailing moral considerations. For it is surely true that the humans in the above examples would have required our sympathy were it not for the fact that they had previously acted very wrongly. This point is well taken. But for all that has yet been shown, the fact that a creature is an invertebrate, or a non-human animal, might itself qualify as a countervailing moral consideration. If you

[39] I would disagree. I would see nothing admirable here.

tell me that an agent's desires are being frustrated somewhere nearby, then this provides *prima facie* grounds for sympathy to be required of me. But if you thereafter tell me that the agent in question is a honey bee or a jumping spider, then this might be sufficient to negate those grounds.

The main claim of this section is surely established: the fact that a creature is subject to states of frustrated desire that make it an appropriate (in the sense of "possible") object of sympathy and moral concern does not, by itself, entail that sympathy is required of us, or that the suffering of the creature makes any sort of moral claim on us. That will be something for moral theory to decide, in which case, from the fact that invertebrates are appropriate objects of sympathy it does not immediately follow that we are required to take their interests into account.

5. The Challenge for Ethical Theory

Most of us believe, in fact, that insects and spiders make no direct claims on our sympathy or moral concern. We think that we are under no obligation, when walking down the street, to avoid stepping on any ants. We likewise feel no compunction about breaking through spider webs when walking in the woods. But this is not because we believe that our own interests, in such circumstances, are more important than the interests of the invertebrates in question, since we could quite easily adjust many aspects of our lives to avoid causing any damage to the latter. It is rather because, we believe, the interests of invertebrates do not generate any direct moral requirements for us to take account of.

This claim about ordinary belief can be challenged. Thus consider a little boy who spends the afternoon pulling the legs off the ants in his yard for fun. Most of us would think that he should be told off for this behavior. And it might be thought that this commits us to the view, not only that the ants really do suffer, but that their sufferings matter morally. But neither conclusion is warranted, in fact. Two things are sufficient to explain the wrongness of the action. The first is that *the little boy* should believe that he is causing the ants to suffer. The second is that bad qualities of character will develop out of intentionally causing believed-in suffering for the fun of it. So the ants do make a moral claim on us, but it is indirect. It is the claim that actions involving them are forbidden whenever those acts encourage or display bad qualities of character.[40]

It seems very likely that most ordinary folk do not really believe that invertebrates have minds at all. Do most people then think that insects and spiders make no moral claims on us *because* (and only because) they believe that invertebrates do not have minds? If so, then the argument of the earlier sections of this paper might be expected to be highly revisionary of ordinary moral thinking. For in that case, were ordinary folk to become convinced that invertebrates are appropriate objects of sympathy, then they should accept that they are required to be concerned whenever the interests of ants, bees, and spiders are threatened. It may well be true that some people are in this sort of situation, having absorbed and accepted the main elements of a utilitarian moral outlook. Once such people come to believe that some invertebrates, at least, have minds, then it might be rational for them to accept that the sufferings of invertebrates make moral claims upon us. For as the old utilitarian adage has it: pain is pain, no matter who feels it. Or as I would prefer to put it in the context of the arguments of this paper: frustrated desire is frustrated desire, no matter whose desires are in question.

Those who accept some form of utilitarian theoretical framework, in which the basic moral currency consists of frustrations and satisfactions of desires and preferences, will find it difficult to resist the conclusion that sympathy is owed to at least some invertebrates, just as it is owed to other human beings. One way in which a utilitarian might attempt to avoid such a conclusion, however, would be by arguing that frustrated desires are only appropriate objects of sympathy when accompanied by the phenomenally conscious sensations that are distinctive of disappointment in our own case, and by arguing that invertebrates lack some of the cognitive prerequisites for consciousness. I have subjected this strategy to extended criticism elsewhere.[41] If my critique is successful, and if there are no other workable strategies that might enable a utilitarian to block the conclusion that invertebrates command our sympathy, then that conclusion will (for a utilitarian) be warranted by the arguments of the present paper.

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[40] For an argument that all duties towards animals are really of this character-evincing sort, see Peter Carruthers, *The Animals Issue* (Cambridge: Cambridge University Press, 1992), Chapter 7.

[41] See Carruthers, *Consciousness*, Chapters 9 and 10.

I regard this as a significant further difficulty for utilitarian approaches to ethical theory (in addition to all of the standard objections to utilitarianism, of course). For it is a fixed point for me that invertebrates make no direct claims on us, despite possessing minds in the sense that makes sympathy and moral concern possible. Invertebrates believe things, want things, and make simple plans, and they are capable of having their plans thwarted and their desires frustrated. But it is not wrong to take no account of their suffering. Indeed, I would regard the contrary belief as a serious moral perversion. And I suspect that most ordinary folk will agree.

Utilitarianism is by no means the only theoretical framework for explaining (and perhaps modifying) common-sense intuitions, of course. Amongst other possibilities, there is the sort of contractualist moral theory espoused (in different forms) by John Rawls and by Thomas Scanlon.[42] Within this kind of framework what fundamentally matters is not so much *agency*, in the guise of a simple belief-desire psychology, as *rational* agency, where the latter requires a capacity to reflect on general rules of conduct. It would then be intelligible that the sufferings of invertebrates should not command our concern, because these are not the sufferings of a rational agent. Of course the immediate challenge then facing any such approach is to explain why sympathy should nevertheless be required of us for the sufferings of human infants, as well as for the sufferings of human adults who do not qualify as rational agents in the relevant sense. I believe that this challenge can be met, and have argued that considerations of stability and sustainability should lead contractualists to accord the same basic moral standing to all human beings.[43] Such considerations would not, however, extend to invertebrates.

The challenge for ethical theory, then, is to reconcile and explain the following set of beliefs. (1) When people suffer, the basic ground for our sympathy and moral concern lies in their states of frustrated desire. (2) Invertebrates share with us a form of belief-desire psychology, and are capable of having their desires frustrated. (3) The sufferings of invertebrates make no direct moral claims on us. The challenge is further compounded (indeed, I would claim that it is rendered intractable) if we also believe: (4) The sufferings of some

[42] See John Rawls, *A Theory of Justice* (Cambridge: Harward University Press, 1971); and Thomas Scanlon, *What We Owe to Each Other* (Cambridge: Harvard University Press, 1998).

[43] Carruthers, *The Animals Issue*, Chapter 5.

"higher" animals (paradigmatically dogs, cats, horses, and primates) *do* make direct moral claims on us.

I have argued herein that both (1) and (2) are well established. One response to our challenge might be to drop (3), embracing one element of the Jainist moral outlook. But that, I claim, would be morally absurd, when not grounded in a belief in transmigration of souls. My own response is to drop (4), or to offer a highly attenuated version of it.[44] But I have neither explained nor defended that option here. I am content to have set out the challenge for others to address as they see fit.[45]

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[44] Carruthers, *The Animals Issue*, Chapter 7.

[45] I am grateful to Robert Francescotti for his comments on an earlier draft of this paper.