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CHAPTER 5

Invertebrate concepts confront the generality constraint (and win)

Peter Carruthers

1. INTRODUCTION

What does it take to possess a concept? Do any non-human animals have concepts? One crucial constraint on the concept *concept* is that concepts are the building blocks of thought. Hence no creature could count as a concept-user that wasn't capable of thinking. This mightn't seem like a significant additional restriction, but actually it has some teeth, ruling out some otherwise concept-*like* phenomena. Consider the Australian digger wasp (Gould and Gould [1994]). The female builds a tower-and-bell structure above the hole in which she lays her eggs, to protect them from another species of parasitic wasp. At various points during construction she uses her own body as a yardstick. For example, she stops building the tower and begins on the bell once the former is three of her own body lengths high. Does she, then, have the concept, *three body lengths* (or some sufficiently close analog)? She does at least possess a sort of recognitional capacity which she deploys to end one phase of her activity and initiate another. (And likewise she must be capable of recognizing the materials that she collects for the construction of the tower, as well as recognizing that one side of the tower that she is constructing is higher than the other, and so forth.) But does the wasp *believe* that the tower is now three body lengths high, and is that why she moves on to the next activity (the construction of the bell)?

There are multiple reasons for denying that she does. The most fundamental derives from the fact that the overall pattern of her behavior is *rigid* (albeit displaying flexibility of detail – collecting mud from here rather than there, placing the mud on this side rather than that side, and so on). For example, if an experimenter progressively buries the tower in sand

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while she is constructing it, she will just keep on building, indefinitely, because she never reaches the three-body-lengths trigger for initiating the next phase. But once she has completed the tower and begun on the bell, she takes no notice if an experimenter buries most of the tower in sand, even though the bell then ends up resting on the ground and will consequently be quite useless. Likewise if an experimenter makes a small hole in a completed portion of the tower before it is finished, she will build *another* tower-and-bell structure on top of it, rather than effecting a simple repair.

Another consideration is that the state that ends the tower-construction phase never interacts with any other "goal" states. This gives us reason to think that the state isn't genuinely a *belief*. For it is of the essence of beliefs that they should be apt to interact with desires in such a way as to issue in motor plans and behavior.[1] Moreover, we have no reason to think that the state in question factors into two (or more) conceptual components, *tower* and *three body lengths*. But again, it is of the essence of beliefs that they should be structured out of distinct conceptual components, each of which can figure in other attitudes and be suitably combined with other concepts to formulate distinct thoughts. What the wasp actually has is an abstract, innately specified, but flexibly implementable, motor plan, which is guided in its detailed execution by perceptual information, and whose various stages are triggered and/or completed by the matching of concept-like recognitional templates against the perceptual data.

From these considerations we can extract the following constraints. In order to count as having concepts, a creature needs to be capable of thinking. And that means, at least, that it must possess distinct belief states and desire states, which interact with one another (and with perception) in the selection and guidance of behavior. In addition, the belief states need to be structured out of component parts (concepts) which can be recombined with others to figure in other such states with distinct contents. Moreover, belief and desire states need to play causal roles that are sensitive to their underlying structures, figuring in simple inferences that bring to bear belief states to select actions that will enable the realization of the creature's goals.

These constraints on concept possession are by no means trivial. Nevertheless, many invertebrates actually satisfy them (or so I shall argue in section 2). This is especially clear in the case of honeybees, whose powers of thought have been intensively studied – notably their flexible use of spatial

[1] Editor's note: See Saidel (chapter 2) for a similar account of the distinctness condition for beliefs and desires, and Roberts (chapter 12) for an account of concepts (employed in emotions) that are not detachable or recombinable in thought.

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information in the service of a multitude of goals. But the constraints are probably satisfied by Australian digger wasps, too, in respect of the states that guide their navigational (but not their nest-construction) behavior. (And there is surely no requirement that *all* of an organism's behavior should be guided by genuine concept-involving thoughts if *any* is to count as such. For much of our own routine, habitual, or "inconsequential" behavior wouldn't pass muster, either.) I have argued for these claims in some detail elsewhere (Carruthers 2004, 2006), and will only sketch those arguments here. (But see Tetzlaff and Rey [chapter 4], for some closely related considerations.) My main focus will be on an argument purporting to establish yet further constraints on genuine concept possession (the so-called "generality constraint"), which invertebrates (together with most other animals) would turn out to fail.

Let me say a word about terminology, however, before we proceed. The use of the term "concept" in philosophy is systematically ambiguous (Laurence and Margolis [2007]). It is sometimes used to designate the *content* of a word or a component of thought. In this usage a concept is an abstract object, often identified with a "mode of presentation" of the things that the word picks out. But sometimes concepts are intended to be mental representations, concrete components of the physical tokenings of the thoughts of which they form part.[2] In the present chapter I am concerned almost exclusively with concepts in the latter sense. Our question is whether invertebrates possess the sorts of mental representations that are the components of genuine thoughts. Whenever I want to refer to one of these mental representations I shall use italics (as well as using italics for emphasis – the difference should always be clear). And on those occasions when I do want to refer to the content of a mental representation I shall insert the relevant words or phrases within square brackets.

2. THE CASE FOR INVERTEBRATE CONCEPTS

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

[2] There is also a third usage, which equates concepts with mental *capacities*. This is what Evans himself has in mind when formulating the generality constraint (1982, p. 101). But I take this usage to be closely related to the idea of concepts as mental representations. For any capacity must have a categorical basis, and distinct capacities that bear systematic relationships to one another are likely to have distinct categorical bases (Fodor and McLaughlin 1990). The latter can then be equated with the mental representations postulated by language-of-thought theorists.

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current location in relation to the point of origin; see Gallistel [1990]). 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 (Collett and Collett [2002]). And some researchers have shown that bees will, in addition, construct mental maps of their environment from which they can navigate.

Gould (1986) 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.) Other scientists have found it 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, Menzel *et al.* (2000) 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. 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.* (2005) have provided strong evidence of the map-like organization of spatial memory in honey bees through the use of harmonic radar. The latter technology enabled the investigators to track the flight-paths of individual bees. Bees who were just about to set out for a feeder were captured and taken to random release points some distance from the hive. Initially, the bees then traveled along 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.

Moreover, bees can make flexible use of the information encoded in their mental maps, in the service of multiple goals. Thus the very same information that there is nectar 200 meters north of the hive, for example,

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is utilized both when returning to the hive laden with nectar and when setting out to visit the nectar source from the hive once again. It is also used to guide the orientation of the bee's dance to inform other bees of the location, and it can be acquired from observing the dance of another bee as well as from personal experience. In addition, bees learn the locations of many other substances that they take as goals when appropriate, including pollen, water, and tree sap. And the data obtained by Menzel *et al.* (2005) suggests that all of these locations will be encoded on the bee's mental map, in such a way that the bee could, if appropriately motivated, fly directly from a source of water to a source of tree sap, for example.

There is much more that could be said about these and related data. To mention just one issue: does the fact that bees have memory systems with a map-like organization disqualify them from having genuine beliefs? This would be on the grounds that maps lack constituent structure, as Bermúdez (chapter 8; 2003a) claims. However, the latter claim might be true of some topographic maps, but certainly isn't true of symbolic maps. These are composed of elements representing types of entity and substance (water, trees, grassland, buildings) as well as individuals (e.g. a particular river or town) which could be recombined with one another in indefinitely many distinct configurations to represent any number of different geographical layouts.[3] The mental maps of bees are plainly of this latter sort.

Taken all together, the data warrant the claim that bees possess both belief-like states and desire-like states that interact with one another in simple practical inferences to select and guide behavior; and that the belief-like states possess a component structure, containing symbols that refer to various landmarks and substances as well as encoding the distances and directions between them. Whether this is sufficient to qualify bees (and other invertebrates) as genuine thinkers, and genuine concept-users, is the topic of the remainder of our discussion.

3. THE GENERALITY CONSTRAINT

The generality constraint is introduced by G. Evans (1982) as a constraint on genuine concept possession, and thus as a constraint on a creature's capacity for authentic thought. (Others insist, in similar vein, on the "spontaneity" of thought; see McDowell [1996].) The constraint, as Evans formulates it, is this: genuine thinkers must be capable of entertaining all syntactically

[3] Editor's note: See Rescorla (chapter 3) for a similar account of cognitive maps as structured representations.

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permissible combinations of any concepts that they possess (or almost all of them, at any rate – this qualification will be discussed in section 4). So if thinkers possesses the concepts *F*, *G*, *a*, and *b*, then they must be capable of thinking each of the thoughts *Fa*, *Fb*, *Ga*, and *Gb* (but not the "thoughts" *FG* or *ab*, which are ill-formed and uninterpretable).

A word about terminology before we proceed further. For the most part I shall discuss the generality constraint in terms of the *thinking* of thoughts. But Evans himself uses the language of *entertaining* a thought (see his 1982, p. 104). Is this a significant difference? One possibility is that Evans uses "entertain" to mean something like "suppose," in which case the generality constraint would be tantamount to the claim that any creature that has concepts must be capable of supposition. This idea will be discussed, and heavily criticized, in section 4. Alternatively, "entertain" (like "think") can be used generically, to cover all forms of propositional attitude (believing, desiring, supposing, wondering whether, etc.). Thus understood, the difference between the two ways of formulating the generality constraint is merely verbal. And note that, so understood, the generality constraint permits "cross-overs" between the different attitude types. For what one might be incapable of believing one might nevertheless be capable of supposing or wishing. Thus someone who possesses the concepts *a*, *identity*, and *negation* might be capable of *supposing* that *a isn't a*, even if she isn't capable of *believing* it. And someone who is incapable of *believing* that he has never been born might nevertheless be capable of *wishing* it.

Taken at its face, the generality constraint will very likely require us to deny thoughts and concepts to most if not all non-human animals. Hence if it is endorsed, then animals will be capable, at best, of *proto-thoughts* composed of *proto-concepts* (Bermúdez [2003a]; Dummett [1973, 1996]). And the generality constraint will then mark a radical divide between the minds of human beings and the proto-mindedness of non-human animals. This is because, as a number of philosophers have pointed out, there are probably numerous restrictions on the ways in which the concepts (or rather, the proto-concepts) of animals can be combined and recombined. Carruthers (2006) gives the following example. A bee that is capable of thinking that there is nectar 200 meters north of the hive (or something that approximates to this), and that is capable of thinking that the brood chamber is now above it, might nevertheless be *incapable* of thinking that there is nectar 200 meters north of the brood chamber. This is because the bee's spatial navigation and mental map-building outside the hive are based on solar bearings, whereas bees navigate inside the hive in the dark, where they employ quite other (gravity-based and olfactory) ways

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of representing spatial relationships. And bees might very well lack any means of integrating the two sets of spatial representations into a single thought.

Likewise, many who have written on this topic have used the example of a monkey who thinks that the lion is eating the antelope: it may nevertheless be *incapable* of thinking that the antelope is eating the lion. This example is probably not a good one, however. We might well be able to get the monkey to think that the antelope is eating the lion if we rigged things up right – for example, if we could arrange so that the antelope really was eating the lion, or at least appeared to be doing so. But there will be plenty of other examples that can serve to make the point. Thus a monkey that is familiar with an aged matriarch – call her "Elsa" – might be incapable of thinking that Elsa is an infant. For what could we possibly do that might induce the monkey to entertain such a thought (whether believing it, desiring it, or whatever)?

The generality constraint is believed to be warranted by the demand that real thoughts must be compositionally structured. I endorse this demand. I agree that in order to count as a genuine thinker, a creature's thoughts must be composed out of recombinable conceptual components. But there are a number of distinctions that have been overlooked in most treatments of the topic. One is between the different notions of possibility involved, which can be *logical*, *causal*, or *metaphysical*. And the other is between a strong requirement that genuine concepts must be recombinable with *all* (or almost all) syntactically permissible others, and the weaker requirement that genuine concepts must be recombinable with at least *some* others. Let me briefly consider the former set of distinctions first, although it is the difference between strong and weak versions of the generality constraint that is more important for my purposes.

The requirement that it must be *logically* or *conceptually* possible for genuine concepts to recombine with others is too feeble to be of any interest. (Evans himself, however, sometimes seems to have had this reading in mind. For he writes that there should be no *conceptual* barrier in the way of thinkers entertaining the combinatorial variants of their thoughts: see his [1982], p. 102.) For even if a creature's "thoughts" possess no component structure whatever – either realized in simple (componentless) sentence-like representations or in a distributed connectionist network with limited powers of learning – it will still be *conceptually* possible for that creature to entertain novel variants of the "thoughts" that it entertains. We just have to conceive that the creature should somehow acquire new powers of representation.

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In contrast, the requirement that it must be *causally* possible for genuine concepts to recombine with others is probably too strong for our purposes. For the generality constraint is meant to track the cognitive *capacities* that a thinking creature possesses, not its cognitive *performance*. For familiar reasons – having to do with contingent limitations of memory, attention, inferential skills, and so forth – it might be the case that a thinker is causally prevented from entertaining certain recombinations of its concepts, even though the creature possesses the underlying conceptual competence to do so.

What we should claim, therefore, is that it must be *metaphysically* possible for genuine concepts to be recombined with others. This allows us to idealize beyond contingent limitations on a creature's cognitive performance. But such idealization should be relative to the underlying cognitive architecture that the animal possesses. For what prevents a bee from combining solar-based spatial representations with gravity-based ones might be the modular organization of these two distinct kinds of spatial cognition, rather than mere limitations of memory or attention. In which case, to get those different forms of representation combined with one another would require a change to a novel (non-bee-like) cognitive architecture. And the resulting creature would, arguably, no longer be a bee.

The distinction between causal and metaphysical varieties of the generality constraint may be by no means easy to negotiate in practice, involving, as it does, the question of what features of a creature's cognition are *essential* to it, and what accidental. There are delicate issues here that may often be difficult to resolve. This won't matter much for present purposes, however. Although I shall continue to formulate the generality constraint in terms of metaphysical possibility, I shall place little weight on its distinctness from a causal version of the same idea. Much more important is the question of the appropriate quantifier (*all* versus *some*) that should be employed. In fact we have the following two possibilities to consider.

Strong generality constraint: If a creature possesses the concepts *F* and *a* (and is capable of thinking *Fa*), then for *all* (or almost all) other concepts *G* and *b* that the creature could possess, it is metaphysically possible for the creature to think *Ga*, and in the same sense possible for it to think *Fb*.

Weak generality constraint: If a creature possesses the concepts *F* and *a* (and is capable of thinking *Fa*), then for *some* other concepts *G* and *b* that the creature could possess, it is metaphysically possible for the creature to think *Ga*, and in the same sense possible for it to think *Fb*.

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I maintain that the requirement that thoughts must be compositionally structured, built up out of distinct and recombinable concepts as parts, only warrants the weak generality constraint. But this raises no difficulty for the idea of invertebrate concepts. Crucially, compositionality does *not* warrant the strong generality constraint, which is the one that creates problems for the idea that any non-human animals are genuine concept users.

Recall the claim that concepts are the building blocks of thought. Concepts are *components* of the complex representations that are thoughts. And if they really are the components of thought, then each such component must be capable of combining with at least *some* other concepts that the organism possesses in the context of a distinct thought. Conversely, if it were impossible for the concept *F* in *Fa* to combine with any other concept that the creature could possess, then that would suggest that either *F* or *a* (or both) aren't really distinct isolable parts of the larger representational state. Genuine concepts should be *detachable* from the states of which they are parts. And if they are thus detachable, then there should be no principled obstacle to them figuring along with other such parts in at least some other complex states.

The relationship between the weak generality constraint and compositionality is, arguably, an epistemic one. For consider what evidence could convince us that the concept *F* is a detachable component of a state with the content [Fa]. The best evidence would consist of cases in which that very concept figures in other thoughts, for example in a state with the content [Fb]. Hence if the weak generality constraint is satisfied, and we are satisfied that a creature's behavior warrants ascribing an appropriate *range* of thoughts to it, then we have reason to think that it has thoughts that are built up out of component concepts. Otherwise we may lack any warrant for thinking that the creature's state really does break up into the two separate components *F* and *a*. That is, for every concept *F* and every concept *a* that we want to attribute to the creature, we may need to find *some* other concepts *G* and *b* such that we have evidence that the creature is capable of thinking *Fb* and capable of thinking *Ga*. And the best such evidence is to actually find circumstances in which the creature thinks *Fb* and circumstances in which it thinks *Ga*.

Hence it is, arguably, the weak generality constraint that warrants us in thinking that a creature's thoughts are genuinely *composed* of concepts as parts. But this claim poses no threat to the conceptual capacities of invertebrates. Consider, for example, a honeybee's thought with the content [nectar is 200 meters north of the hive] (or some near equivalent). Is this

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genuinely composed of the concepts *nectar*, *200 meters* (or some roughly equivalent measure of distance), *north* (or some similar solar-based measure of direction), and *hive*? Well, yes, because we know that bees satisfy the weak generality constraint in respect of such concepts (Carruthers [2004, 2006]; Tetzlaff and Rey [chapter 4]). We know that a bee can also think thoughts with the contents [the hive is 200 meters north of the nectar], [nectar is 200 meters west of the hive], [pollen is 400 meters north of the hive], and so on for all interpretable combinations of the four candidate concepts, both with each other and with other similar concepts. And we know that the inferences in which bees engage are sensitive to such component structures.

What reason could there be for insisting that genuine concept-users must also satisfy the strong generality constraint, and be capable of combining any concept that they possess with any other concept that they possess? For this certainly isn't required by the core idea that concepts are the building blocks of thought. Of course, from our human perspective, our thought processes are the very paradigm of thinking. And the strong generality constraint, or something close to it, really is true of us. But we need to pay attention to the reason *why* it is true of us. I shall argue that this is best explained by our capacity for creative supposition, combined with our abilities to draw inferences from the things that we suppose. But thinking creatively is one thing, thinking *simpliciter* is another. The fact that most animals can't do the former provides no reason for denying that they can do the latter. There is therefore no good reason, I shall argue, to believe that a creature must be capable of entertaining all permissible combinations of its concepts in order to count as a genuine concept-user, or a genuine thinker. In which case non-human animals can count as full-fledged thinkers, after all (invertebrates included).

4. STRONG GENERALITY AS AN IDEAL

As many have pointed out, not even humans really satisfy the strong generality constraint, if the latter is taken with full generality. For although they are syntactically well-formed, we can't actually interpret or do anything with such thoughts as *Julius Caesar is a prime number* or *Green ideas sleep furiously*. One response to this point has been to claim that the generality constraint shouldn't require all syntactically possible combinations of concepts, but only those that conform to the right *categories*. Thus for these purposes the concept *prime number*, to be real, only needs to be combinable with other number concepts, not with any singular terms whatever. This

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is the line that is generally taken in the philosophical literature, following Evans (1982).

Camp (2004) argues that placing categorical restrictions of this sort on the generality constraint is a mistake, however. For combinations of concepts that seem like nonsense in one era, and which would therefore have motivated a categorical restriction, can not only be interpreted in another, but can even be recognized to be true. The thought *Matter is energy* would provide one clear example, and metaphors like *Juliette is the sun* would provide another. Rather, Camp thinks, the strong generality constraint should be thought of as an *ideal* to which actual organisms approximate (and to which humans come pretty close). On this account, then, the question whether non-human animals have concepts might not always admit of a yes-or-no answer. Rather, most animals might meet the generality constraint to *some* degree, and can therefore be described as *approximating* to genuine thought and concept deployment to a greater or lesser extent.

Although concept possession is here regarded as a matter of degree, there are surely positions at either end of the spectrum where stronger, yes-or-no language would be warranted. Thus humans approximate so closely to the ideal set out in the strong generality constraint that it would be misleading to say anything other than that we *are* genuine thinkers and genuine concept-users (just as it would be misleading to describe someone with a slightly receding hairline as anything other than hirsute, or not bald). And conversely, many animals fall so far short of meeting the strong generality constraint that it would be quite inappropriate to describe them as having concepts at all (just as it would be inappropriate to describe someone with only a few tufts of hair over his ears as hirsute, and equally misleading to deny that he is bald). Rather, the language of "proto-concepts" and "proto-thoughts" is better warranted when describing most species of non-human animal (Camp, in press).

Camp thinks, then, that the strong generality constraint is an *ideal* to which organisms can approximate. The use of evaluative language, here, prompts one to ask: Ideal with respect to what? In the service of what value? Camp replies: with respect to the purposes for which thought is required. Her idea is that a creature whose capacities for representation fall a long way short of what the generality constraint would require isn't getting the full benefit from those capacities. But of course, whether a capacity to generate novel combinations of concepts counts as a benefit must be relative to the cognitive powers (and also the ecological niche) of the creature in question. There is no benefit in being able to entertain a new range of thoughts if

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you can't do anything useful with those thoughts. But this is, I claim, a function of the range of attitudes available to the creature, as well as its inferential abilities, not its capacity to think per se. I shall elaborate these points in turn.

4.1. Creative supposition

What is it that enables humans to approximate to the Strong Generality Constraint? There is no single answer: it is actually a cluster of abilities. One is our capacity to *suppose* – to entertain a thought without commitment to its truth, evaluating it or drawing inferences from it. This capacity is first manifested in infancy in the form of childhood pretend play, as when the child (perhaps struck by the similarity in shape between a banana and a telephone handset) supposes that the banana is a telephone, and pretends accordingly (Nichols and Stich [2003]). No other species of animal on earth engages in pretence in normal circumstances. (Some hand-reared chimpanzees have, as adults, been observed to engage in behavior that at least looks very much *like* pretence, however. See Jolly [1999].) And it is extremely doubtful whether any animals outside of the great ape clade are capable of supposing. (There is some reason to think that chimpanzees might occasionally entertain states that are the functional equivalent of supposition, at least, mentally rehearsing potential actions in advance of decision-making. See Carruthers [2006].)

Moreover, the capacity to generate suppositions *creatively* is a crucial ingredient in human problem-solving abilities. Consider, for example, its role in science, specifically in our practices of inference to the best explanation. When confronted by puzzling data, scientists often need to generate a range of potential explanations before devising experiments to test between the resulting candidate theories. This will often require considerable creativity, since explanatory hypotheses can't in any sense be derived from, or "read off from," the data. Indeed, there is no way to routinize hypothesis generation. For example, consider what took place when scientists first hypothesized that light is a wave, or that light is a stream of particles. Such ideas were, at the time, genuinely novel.

It isn't just in science that creative supposition is important to us. The same is true in much of ordinary life. And the same is equally true of hunter-gatherers. For as Liebenberg (1990) demonstrates, hunters when tracking prey will often need to develop speculative hypotheses concerning the likely causes of the few signs available to them. (And these can be extremely subtle, such as the precise manner in which a pebble has been disturbed, say, or the

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way in which a blade of grass has been bent or broken.) These hypotheses are then subjected to extensive debate and further empirical testing by the hunters concerned. Constructing these hypotheses will often require creative uses of imagination, since they concern the unobserved (and now unobservable) causes of the observed signs, and the circumstances in which they may have been made.

It should be plain, in fact, that a capacity for creative supposition forms an essential component of human life-history, entering into almost everything that is distinctive of us and our unique forms of flexibility and adaptability. It is also plain that it provides a significant part of the explanation for the fact that human thought approximates to the strong generality constraint, since it is what enables us to put together old ideas in novel ways. (And it may be, in turn, our unique capacity for recursively structured language that underlies this capacity, to a significant degree. For we can, at will, select novel combinations of lexical items to be formulated into a sentence, which we can then rehearse and consider. See Carruthers [2006, 2007a] for extensive discussion.)

In light of this account of why human forms of thinking approximate to the strong generality constraint, it should be plain that the latter is simply irrelevant to the question whether a creature is capable of genuine thought (i.e., possesses beliefs and desires), and likewise irrelevant to the question whether a creature is a genuine concept-user. What it *is* relevant to is the question whether a creature is capable of certain *kinds* of thought, specifically suppositional and creative thought. But supposition is a distinctive type of attitude. The question whether a creature is capable of *supposing that P* has no bearing on the question whether it is capable of belief, and capable of desire. And likewise the question whether a creature is capable of freely and creatively generating novel thoughts/suppositions is irrelevant to the question whether it is capable of thought per se, and to the question whether it possesses concepts. To put the same point somewhat differently: the reason why humans approximate to the strong generality constraint isn't because they have concepts, and because there is something about the nature of concepts, or the nature of propositional attitudes, that requires it. It is rather because we are – perhaps uniquely in the animal kingdom – capable of supposition, and of creatively generating thoughts to be taken as objects of supposition. (And even if our unique capacity for language isn't itself responsible for the latter, it certainly greatly enhances it.)

Someone might respond to these points by proposing a doctrine of *the unity of the attitudes* (modeled after Aristotle's doctrine of the unity of the virtues). The claim would be that a creature can't possess *any* attitude type

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unless it possesses *all*. Hence a creature doesn't really count as having beliefs or desires unless it is also capable of supposing. But what could possibly motivate such a claim? One suggestion would be that we take humans as our paradigm cognizers, and then subject the different types of human attitude to functional definition. In which case, since beliefs can interact with creative suppositions in humans, it will be of the essence of beliefs that they should be capable of doing so.

I have two things to say by way of reply. One is that it is very doubtful whether we should select the human mind as our paradigm of what a mind is like. (I shall return to develop this point in section 5.) The other is that, even if we do do this, we plainly shouldn't define the different attitude types holistically, in terms of their interactions with *all* others. For consider the consequences: if it is true that psychopaths are incapable of guilt (as it seems to be; see Blair [1995]), then it would turn out that they are incapable of believing anything or desiring anything, either (and nor would they count as having concepts). And even if it were felt that one could reply to this objection by noting that psychopaths are defective members of the species (which is actually far from clear: they might rather be in balanced dimorphism with normal folk; see Murphy and Stich [2000]), then consider Mr Spock from the television series *Star Trek*. He is said to be incapable of emotion. Is he thereby incapable of thinking at all? Does he have no beliefs, and no concepts? This would plainly be an absurd thing to say.

These points leave an opening, of course, for someone to claim that possession of beliefs and desires doesn't require a creature to be capable of *all* other attitude types, but just creative supposition. That would still leave most non-human animals beyond the pale of genuine thought. But this claim looks equally ill-motivated (and for the same reason). And it is likewise subject to counter-example. We just have to imagine a human who is especially "literal minded," being capable of all other attitude types *except* creative supposition. (It may be that some autistic people are actually like this. Certainly one of the diagnostic features of autism is that autistic children fail to engage in pretend play.) Yet it would surely be absurd to deny that such a person was capable of thinking at all.

4.2. Two systems of reasoning

I have argued that one reason why human thinking approximates to the strong generality constraint doesn't have anything much to do with our

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possession of concepts, as such, but rather with our capacity for creative supposing. Yet this is by no means the whole story. For there would be little point in entertaining creative suppositions if we couldn't also develop new and flexible reasoning strategies for drawing inferences from those suppositions. If we were limited to the same set of fixed inferential capacities employed by non-human animals, then arguably creative supposing would bring us little advantage. (What would a chimpanzee be able to *do* with the hypothesis that light consists of particles, for example, even if it could be induced, somehow, to entertain such a thought?) But we aren't so limited. Indeed, there is a growing consensus in cognitive science that humans possess a unique system for reasoning and drawing inferences. Let me elaborate.

It is now widely accepted by those who work on the psychology of reasoning that humans possess two different *types* of cognitive system for thinking and reasoning (Evans and Over [1996]; Kahneman [2002]; S. Sloman [1996, 2002]; Stanovich [1999]). Most believe that what is now generally called "system 1" is really a collection of different systems that are fast and unconscious, operating in parallel with one another. The principles according to which these systems function are, to a significant extent, universal to humans, and they aren't easily altered (e.g., by verbal instruction). Moreover, the principles via which system-1 systems operate are, for the most part, heuristic in nature ("quick and dirty"), rather than deductively or inductively valid. It is also generally thought that most, if not all, of the mechanisms constituting system 1 are evolutionarily ancient and shared with other species of animal.

System 2, on the other hand, is generally believed to be a single system that is slow, serial, and conscious. The principles according to which it operates are variable (both across cultures and between individuals within a culture), and can involve the application of valid norms of reasoning. These system-2 principles are malleable and can be influenced by verbal instruction, and they often involve normative beliefs (that is, beliefs about how one *should* reason). Moreover, system 2 is generally thought to be uniquely human.

There is an important sense, then, in which distinctively human reasoning abilities (realized in system 2) are socially constructed. This is, no doubt, a large part of the explanation of the fact noted earlier, that thoughts that seem "nonsensical" in one era can be made sense of, and found to be true, in another. But again, this has nothing to do with the capacities to entertain thoughts, or to possess concepts, per se. Whether a creature

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is capable of having beliefs built up out of component concepts is one thing, and whether it possesses an indefinitely flexible socially constructed reasoning capacity is surely quite another.

5. PROTO-THOUGHT VERSUS FAUX-THOUGHT

Someone might seize upon the distinction drawn above between system-1 and system-2 thinking to propose that *genuine* thinking and *genuine* concepts should be reserved to system 2, with the sorts of system-1 thoughts and concepts that we share with the rest of the animal kingdom being described as mere *proto*-thoughts and *proto*-concepts. For after all, doesn't our own human case constitute the very paradigm for both the concept *thought* and the concept *concept*?

One thing wrong with this proposal is that there is actually nothing special about most of the concepts that get deployed in creative supposing, or in system-2 thinking more generally. On the contrary, most system-2 thoughts are built up out of some of the same system-1 concepts that might be available to a non-human animal. Thus many animals might possess the concepts *light* and *particle*, for example, which figure in the thought *Light consists of particles*. And while it is true that there are also many distinctively human concepts, perhaps arrived at – either directly or indirectly – via the operations of system 2, the generality constraint was never supposed to be about the *number* of concepts that a creature possesses. Rather, the question at issue in the strong generality constraint is whether a creature's concepts can be combined with all other concepts that *it* can have. So the fact that humans possess many more concepts than do invertebrates is, in itself, no objection to the claim that the latter possess genuine (as opposed to proto-) concepts.

(Indeed, in light of this point, it seems likely that invertebrates might approximate to the strong generality constraint much more closely than do other non-human animals, who possess a wider range of concepts. If invertebrate concepts are largely drawn from the domain of navigation, it may well be that most such concepts are capable of being combined in thought with most others. If the minds of monkeys, in contrast, are highly modular [Carruthers (2006)], containing multiple specialist systems for forming beliefs of particular types, then there might actually be many *more* restrictions on their capacities to combine together concepts drawn from these different domains. Hence, although monkeys possess many more concepts than do honeybees, it may be that the latter come closer to complying with the strong generality constraint.)

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Another thing wrong with the proposal that system-2 thinking should be taken as the paradigm of thought is that system 2 doesn't really constitute a natural kind (nor a set of natural kinds). Rather it is, as we pointed out above, to a significant extent socially constructed. Its operations are highly variable between cultures, and between individuals within a culture. (In some people, for example, system 2 is largely verbal, running on rehearsed natural-language sentences in the form of "inner speech," while in others it is largely visual, consisting of sequences and manipulations of visual images.) And the operations of system 2 depend, to a significant extent, upon the individual subject's normative beliefs about how she *should* reason.

The system-1 processes that we share with non-human animals, in contrast, do constitute a cluster of natural kinds. There are systems for doing dead reckoning, for extracting geometrical information about the environment, for judging the approximate numerosity of a set, for calculating rates of resource-availability, and so on and so forth (Gallistel [1990]); as well as systems for generating novel desires, of various types, and for selecting appropriate actions in the light of one's desires (Carruthers [2006]). These systems, when present, will be universal to all members of the species, and many will be highly conserved across species. Each represents a legitimate object of scientific study: our goal should be to figure out how each such system works, how it is structured, and how it interacts with other systems in the mind–brain of the organism in question.

Moreover, the most plausible accounts of system 2 on the market maintain that its processes are actually *realized in* the operations of system 1, to a significant degree, rather than existing alongside of the latter (Frankish [2004]; Carruthers [2006, 2009a]). For example, it is by interpreting a given utterance in inner speech as a *commitment*, or a "making up of mind," that the functional equivalent of a new belief, desire, or intention results (depending on the sort of commitment that gets self-attributed) – provided, that is, that one has a standing system-1 desire to execute one's commitments. Thus, suppose that an utterance is interpreted as a commitment to the truth of the proposition that it expresses, and the subject therefore forms a system-1 belief that a commitment of that kind has been made. This will then interact in future with the system-1 desire to honor commitments, issuing in further overt or covert verbalizations. If asked whether he believes the proposition in question, for example, the subject will reply that he does. For one of the things that one ought to be prepared to do, if one has committed oneself to the truth of a proposition, is assert it. And likewise, during one's system-2 practical or theoretical reasoning,

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one will be prepared to rely upon the sentence in question as a premise. For if one has committed oneself to the truth of a proposition, then one ought also to commit oneself to any other proposition that one believes follows from it. And so on.

Thus although system-2 thinking is the variety that is most familiar to us (since its operations are to a significant degree conscious), it is system 1 that is the more basic, both ontologically and for explanatory purposes. For system-2 processes are largely realized in those of system 1. (One difference, in my view, is that system 2 always involves the activity of the motor system, whereas system 1 needn't do so. See Carruthers [2009a].) In which case, although ordinary folk might be inclined to take system-2 thinking as their paradigm of thought, it is plain that they *shouldn't* do so – or not for explanatory purposes or in the context of cognitive science, at any rate.

Even more importantly, it turns out that there aren't really any attitudes at the system-2 level (Carruthers [2007b, 2009b]). For the events that occur within system 2 don't occupy the right sorts of causal roles to be a judgment, for example, or to be a decision. Thus it is surely a requirement on any event that is to qualify as a judgment that it should be immediately available to inform the agent's practical reasoning, without the mediation of any further cognitive process. For a judgment is supposed to be the event that brings a new belief into existence. For example, judging $P \supset Q$ issues in a belief with that content, and should be available to interact with a desire for Q immediately, issuing in a desire to bring about P, without the intervention of any other belief or desire. But a system-2 event like the inner verbalization of the sentence "If P then Q" plays no such role. On the contrary, it first has to issue in a belief that one has committed oneself to the truth of the proposition *if P then Q*, and then this together with one's desire to execute one's commitments leads one to feel committed to wanting to bring about P in the presence of a desire for Q. And since what happens in system 2 doesn't really contain or involve any propositional attitudes, as such, there is good reason for us to insist that system-2 thinking consists of mere faux-thoughts, rather than in the real thing.

Instead of it being the case that animals possess mere *proto-thoughts* in comparison to human forms of thinking, then, distinctively human thoughts are mere *faux-thoughts* compared to those that we share with non-human animals. Each individual token of system-2 thinking is a real enough event, of course, involving the activation of real (system-1) concepts. And such events – individually and collectively – can have immensely important

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consequences. (Witness the march of scientific discovery and technological invention.) But the processes that issue in such events aren't natural kinds, and nor are there any beliefs and desires at the system-2 level. From the standpoint of cognitive science, then, distinctively human thinking consists of mere faux-thoughts. The real thing is done by animals (and by humans insofar as they share the same cognitive systems as other animals).