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ANIMAL MINDS ARE REAL, (DISTINCTIVELY) HUMAN MINDS ARE NOT

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Many philosophers think that human and animal minds are radically different from one another. Either they differ architecturally, in such a way that only humans have genuine concepts and propositional attitudes (while animals at best have *proto*-concepts and *proto*-attitudes), or humans possess a second mind (a conscious System 2 mind) that non-human animals lack. This article will argue that both views are mistaken.

1. INTRODUCTION: A DIFFERENT KIND OF MIND?

Everyone allows that human and animal minds are distinctively (indeed, massively) different in their manifest effects. Humans have been able to colonize nearly every corner of the planet, from the arctic, to deserts, to rainforests (and they did so in the absence of modern technological aids); they live together in large cooperative groups of unrelated individuals; they communicate with one another using the open-ended expressive resources of natural language; they are capable of cultural learning that accumulates over generations to result in agriculture, art, science, and advanced forms of technology; and they are remarkably thoughtful and inventive. There is much less agreement about how these manifest differences should be explained, however.

Some have denied that animals have minds at all, either because they lack mental states or the right sorts of mental states, or because their mental states fail to be organized in the right kind of way to constitute a mind. If all animal behavior is explicable in terms of conditioning, for example, then the only mental states that need to be attributed to animals will be perceptions, drives, and motor plans. But if a minimal form of mindedness is defined in terms of interactions within a core architecture of perception, belief (or belief-like states), and desire (or desire-like states), then this will be to deny that animals have minds at all (Kirk 1994; Carruthers 2004). I propose to assume that such views are mistaken. (For a critique, see Carruthers 2006.)

Other people, while allowing that animals have minds, maintain that humans have a distinct *kind* of mind. On such accounts, the differences between humans and other animals are not to be explained quantitatively, by appeal to increased processing power provided by the enlarged human neocortex, nor in terms of incremental change, such as the addition of this or that cognitive competence. Rather, the difference is *qualitative*. On one view it involves a distinctive kind of functional organization that qualifies as a mind but is not possessed at all by other animals, resulting in possession by humans of a *second* (conscious) mind. This view will be critiqued in section 4. Another view also postulates a distinctive functional organization of the human mind, which implies that humans, alone among animals, possess concepts and propositional attitudes properly so called. Views of the latter sort are especially common in contemporary philosophy, and will be critiqued in section 3.

The claims that form the focus of section 3 are widely accepted across a variety of doctrinal and methodological divides. They are arguably grounded in commonsense thought about the mind, but can also be seen as intended to explain the distinctively flexible, open-ended character of human thinking and reasoning. What binds these claims together, as we will see, is an underlying commitment to an amodal (non-sensory) central workspace that is unique to the human mind. Although proponents of these views come from quite different research traditions in philosophy, and although some don't address the cognitive powers of animals directly, we can abstract from their claims a common set of assumptions about the distinctively human mind. These entail that the human mind is radically different in kind from the minds possessed by non-human animals.

Evans (1982), for example, proposes a "generality constraint" on genuine concept-possession, which has been widely endorsed by philosophers since (Peacocke 1992; Camp 2004). The constraint is that each of the concepts possessed by a subject should be capable of combining freely with any of the others to form novel thoughts. Hence if one possesses the concepts *F* and *a* needed to entertain the thought *Fa*, and one can likewise combine the concepts *G* and *b* in the thought *Gb*, then one should also be capable of entertaining the thoughts *Fb* and *Ga*. Likewise Fodor (1983, 2000), who otherwise shares few of Evans's assumptions, insists that human thought and concepts are systematic and productive. As a result of thought's component structure, there is no end to the possible combinations of concepts of which humans are capable, and no end to the thoughts that they can thereby think. But as many have pointed out, it seems quite unlikely that the concepts of non-human animals (which should really be described as *quasi*-concepts or *proto*-concepts, from this perspective) satisfy the generality constraint.

A similar constraint on the possession of genuine *thoughts* is also endorsed by many. It is said that human propositional attitudes are "inferentially promiscuous," meaning that any one of our attitudes can potentially interact with any other attitude in some suitable inferential process (Evans 1982; Brewer 1999; Hurley 2006). Once again Fodor, too, endorses a similar idea. He thinks that any one of our attitudes can in principle be brought to bear in the evaluation of any other, either for purposes of belief-formation or for decision making (Fodor 1983, 2000). As we will see in section 2, however, there is reason to believe that the minds of non-human animals are, in important respects, compartmentalized, in such a way that their thoughts are *not* inferentially promiscuous. From this perspective, then, animals are at best capable of mere *proto*-thoughts, and they lack genuine propositional attitudes.

Neither Evans nor Fodor addresses the mentality of animals directly. McDowell (1994), on the other hand, draws an explicit contrast between human and animal minds. (See also Brandom 1994, 2000, for a closely related set of claims.) Following Kant, McDowell thinks that animal minds remain *passive* with respect to their experiences and the environment, whereas human thought and understanding are characterized by a certain kind of *spontaneity*. Now, one might wonder whether the claim of animal passivity is inconsistent with the evidence of future planning in animals to be discussed in section 2. But McDowell intends by "spontaneity" something much more demanding than this. His claim is rather that human thought occurs in a "space of reasons." We are capable of weighing reasons for belief and for action, and any thought of ours can spark an open-ended process of reflection and inference.[1]

Relatedly, McDowell and others think that belief, properly so-called, is partly normatively constituted.[2] In order to be capable of believing anything, one needs to have some conception of the norms that govern belief-formation. One needs to be capable of reflecting on what one *should* believe in a given evidential context, and of being influenced accordingly. Again, it seems quite unlikely that any nonhuman animals possess genuine beliefs, by these lights (even if they are capable of forming, storing, and having their actions guided by structured representational states, as we will see in section 2).

This collection of ideas pre-supposes a particular sort of architecture to the human mind, which will serve to distinguish it quite sharply from non-human animal minds. There needs to be a freely accessible cognitive realm, or central workspace, within which any of our attitudes can be active, thereby rendering them accessible to mechanisms of inference and decision making. Concepts must also be freely combinable with one another in the same workspace in a stimulus-independent, spontaneous manner to form novel suppositions, analogies, or hypotheses to be tested. Then provided one possesses the relevant concepts of reason, evidence, and so forth, one will also be capable of formulating beliefs about the plausibility or warrant for thoughts that have already been activated in the workspace, thereby placing them in the "space of reasons." Indeed, unless something resembling this workspace exists, it is hard to see how the claims sketched above about human thought and concepts could possibly be true.

Note that it will be an important feature of this account that the central workspace should be amodal (non-sensory) in character. For it is concepts themselves that are supposed to be freely combinable within it, and these are presumably abstract and amodal in nature.[3] Likewise, it is supposed to be our propositional attitudes themselves that can be activated in the workspace and that can figure in inferences with other such attitudes. These, too, are presumably amodal mental states. Section 3 will argue, however, that there is no such workspace, drawing on an extensive literature in cognitive science concerning the nature of working memory. It will follow, then, that many philosophers are radically mistaken about the nature of the human mind, and about what distinguishes it from animal minds. And if (as is often the case) the claims in question are advanced as *conceptual* truths about concepts and propositional attitudes, then a form of eliminativism about such entities will be warranted.

Section 4 will then examine some claims that are consistent with the sensory-based character of human working memory defended in section 3, but which nevertheless entail that humans possess a distinctive *kind* of mind. Dennett (1991, 1996), for example, claims that our possession of natural language means that a whole new—serial and compositionally structured—cognitive architecture is programmed into the mind, which Dennett calls the "Joycean machine" (named after James Joyce's stream of consciousness writing). The idea is that there is a highest-level processor that runs on a stream of natural-language representations in so-called "inner speech," utilizing learned connections between words, and patterns of reasoning acquired in and through the acquisition of linguistic memes. On this account, then, the language-wielding mind is a kind of social construction, brought into existence through the absorption of memes from the surrounding culture. And on this view, the distinctively human mind is both dependent upon, and constitutively involves, natural language.

Dennett's views have been taken up and developed more recently by Frankish (2004, 2009) and Evans (2008, 2010), who interpret the "dual systems" literature in cognitive science to show that humans possess *two* minds, one of which is uniquely human. Most scientific researchers in the fields of human reasoning and decision making now accept a distinction between so-called "System 1" and "System 2" reasoning processes (Evans and Over 1996; Sloman 1996, 2002; Stanovich 1999, 2009; Kahneman and Frederick 2002; Evans 2008, 2010; Kahneman 2011). System 1 is really a *set* of systems that are swift, implicit, unconscious, and largely shared with other animals, issuing in hard-to-eradicate intuitions about the answers to reasoning problems. System 2, in contrast, is uniquely human, and is slow, explicit, conscious, and controlled. By no means everyone in the field thinks that System 2 constitutes a distinct kind of mind, however. Kahneman (2011), for example, is quite explicit in saying that it does not. But Frankish (2004, 2009) and Evans (2010) both claim that it does, existing alongside (or perhaps realized in) the kind of mind that we share with non-human animals.

Such views will be examined and criticized in section 4. The upshot of sections 3 and 4 is therefore an incrementalist conception of the difference between human and animal minds. While both humans and other animals share minds with the same overall architecture, and while all alike possess concepts and propositional attitudes in the same sense, humans have evolved a number of cognitive adaptations that collectively explain the vastly different effects that human and animal minds have on the world, together with the distinctive flexibility of the human mind. These ideas will be sketched briefly in section 5.

2. Animal Minds

While animals do have minds (we are assuming), they are subject to some well-known limitations, and lack the sort of open-ended flexibility displayed by the human mind. Specifically, in many species, goals and the information utilized in pursuit of goals appear to be compartmentalized. Thus it is almost impossible to teach a rat to respond to visual or auditory cues when searching for food, while it is easy to teach a rat to respond to an olfactory cue. Pigeons, in contrast, can swiftly learn to utilize visual cues such as color when foraging, but can't be taught to respond to odors or sounds. When the pigeon's goal is to avoid a shock, in contrast, it can easily learn to respond to an auditory cue, as can a rat in the same circumstances. As Gould and Gould (1994) point out, these restrictions make good ecological sense. Rats are nocturnal scavengers, and in their natural environment will rarely need to rely on visual or auditory cues to recognize food. Likewise the seeds that pigeons eat rarely have odors and never make sounds. But the dangers that pigeons and rats both face will often be associated with sounds.

Similar compartmentalization can be found in the actions that are accessible to animals in pursuit of specific types of goal (Gould and Gould 1994). One can't train a dog to retreat from food in order to obtain it, and one can't train a pigeon *not* to peck an illuminated key that is followed by delivery of food, even when pecking prevents that delivery. Likewise, one can't teach rats to jump to obtain food, while it is easy to get them to press a lever to get food. Conversely, one can't teach them to press a lever to avoid shock, while it is easy to get them to jump to avoid a shock. And while it is easy to train pigeons to peck to obtain food, it is hard to teach them to hop to obtain food. Similarly, while it is easy to get them to hop to avoid shock, it is hard to get them to peck to avoid shock. Again these restrictions make good ecological sense.

Something similar appears to be true of the minds of even our nearest relatives, the great apes. Prior to Hare et al. (2001), it was widely believed that apes are incapable of taking account of the mental states of other agents, despite the intense sociality of many ape societies. But then it was realized that all of the previous tests had been conducted in cooperative contexts, requiring the apes to choose whether to beg for food from a human experimenter who could see them or an experimenter with a bucket over her head, for example (Povinelli 2000). Since that time, there have been a flurry of successful experiments that collectively demonstrate at least limited forms of mental-state understanding in primates in competitive contexts (Hare et al. 2006; Flombaum and Santos et al. 2005; Melis et al. 2006; Santos et al. 2006; Buttelmann et al. 2007, 2009). It appears that in nonhuman primates, the goal of competing with others can recruit mind-reading information, whereas cooperative goals either cannot, or do not do so at all readily.

To these facts we can add the finding that rats disoriented in a confined space will ignore color, olfactory, and pattern cues when searching for a previously hidden item (although they are perfectly well capable of utilizing such cues in other contexts), and rely exclusively on the geometry of the space (Cheng 1986). Young human children behave likewise (Hermer and Spelke 1996; Hermer-Vazquez et al. 1999). The minds of adult humans, in contrast, normally suffer from none of these limitations.

While philosophers tend not appeal to animals' signature limitations when motivating their claims about the distinctive properties of the human mind, it may be that an intuitive appreciation of the remarkable open-ended flexibility of the human mind underlies, in part, the sorts of claims sketched in section 1. If so, this is a mistake. Explaining the unique flexibility of the human mind does not require us to postulate a distinct sort of cognitive architecture, nor a different kind of mental state (belief as opposed to proto-belief, for example). Rather (as we will see in the sections that follow), when combined with a handful of additional cognitive adaptations, some comparatively minor changes in the sensory-based working memory system that we share with other primates are sufficient to explain the difference.

It is important to note that animals' signature limitations are nevertheless consistent with their possessing minds in the minimal sense mentioned earlier (Kirk 1994; Carruthers 2004): they have capacities for perception, belief, and desire (or at least proto versions thereof), together with forms of practical reasoning to select actions that will satisfy their desires given their beliefs. Moreover, the beliefs in question are compositionally structured out of component representations that can figure in other such beliefs, and the inferences in question are sensitive to the structures of the guiding representations. Indeed, even bees satisfy these criteria (Carruthers 2004, 2006). Honeybees form, and can recall, structured representations concerning the distances and directions of various substances in relation to the hive, grounded not only in their own observations but by observing the dances of other bees. And they can utilize these representations appropriately in the service of a variety of goals, including searches for nectar, pollen, water, tree sap, and potential new nest sites, as well as guiding their own dances to inform other bees of the locations of any of the above. Moreover, they can compute novel flight vectors linking previously familiar or communicated locations in a flexible manner (Menzel et al. 2011).

In addition, we know that jumping spiders plan out in advance their routes for stalking prey (Tarsitano and Jackson 1994, 1997; Tarsitano and Andrew 1999), and that both corvids and apes are capable of planning to achieve their goals in quite intelligent ways (Sanz et al. 2004; Clayton et al. 2005; Mulcahy and Call 2006; Correia et al. 2007). We also know that rats (and presumably other mammals) are capable of reasoning about causes (Dickinson and Charnock 1985; Dickinson and Shanks 1995), and that many animals are capable of reasoning about approximate numerosity (Gallistel 1990; Dehaene 1997; Flombaum et al. 2005).

Moreover, we know that nonhuman primates can reason in at least simple ways about the mental states of conspecifics (Hare et al. 2000, 2001, 2006; Flombaum and Santos et al. 2005; Melis et al. 2006; Santos et al. 2006; Buttelmann et al. 2007, 2009).

The question, now, is whether humans not only satisfy the criteria for minimal mindedness, but whether their minds also satisfy the "maximal" criteria outlined in section 1. Do human concepts satisfy the generality constraint, and are human attitudes inferentially promiscuous, for example? If so, then humans will possess a unique kind of mind. Section 3 will argue, however, that they do not. Rather, the distinctive flexibility of the human mind is achieved through greatly enhanced *use* of the same central workspace that we share with other animals.

3. A Workspace for Reflection

While many philosophers are committed to the idea of a central amodal workspace within which concepts can be freely combined, and in which propositional attitudes of all types can be active and can interact with inferential and decision-making systems, the evidence from cognitive science supports a very different picture. There is, indeed, a central workspace of the human mind (as well as of the minds of many other animals, as we will see). It is the working memory system that has been studied extensively over the last half-century. This shares the same resources as the global broadcast of attended perceptual representations in the brain, which makes those representations widely accessible to systems for forming inferences and creating memories, for assigning value and generating affective reactions, and for decision making (Baars 1988, 2002). Working memory utilizes top–down signals directed toward mid-level sensory areas of the brain to issue in globally broadcast imagistic representations in any sense-modality. These can be sustained, rehearsed, and manipulated to provide input to the various consumer systems, often resulting in the activation of yet other imagistic representations that are broadcast in the workspace. While our amodal attitudes (specifically our beliefs, values, and goals) compete to influence the contents of the workspace, only sensorily embedded attitudes (such as episodic memories) figure directly within it.

The extensive empirical support that now exists for these claims has been laid out in some detail elsewhere (Carruthers 2011, and forthcoming), drawing on a number of different areas of research in cognitive science. Here I shall say just enough to render those claims intelligible, and to demonstrate the close continuity between the human mind and the minds of non-human animals.

The global broadcasting of attended sensory representations in the brain is almost certainly an ancient adaptation, designed to coordinate the activity of numerous higher cognitive systems around a common focus. Moreover, it has been known for some time that imagery, in any given modality, shares the same mechanisms and resources as perception in that modality, but resulting from top–down rather than bottom–up stimulation. And we also know that just as concepts are bound into the content of perception and globally broadcast along with it (resulting in a state of seeing something *as* a car or *as* one's mother, say), so are concepts bound into the contents of visual and other imagery (resulting in an image of a car, as such, or of one's mother, as such). Hence the contents of working memory are by no means restricted to purely sensory, non-conceptual representations. They are, however, sensory *dependent*. The only way concepts can gain access to the global workspace is by being bound into the content of a sensory image as a result of perceptual processing. And although the results may combine a number of different concepts, their combination is not direct (*contra* the beliefs of many philosophers), but results rather from the processing of a sensory image.[4]

While philosophers' claims about the distinctive nature of the human mind are false, it remains to be shown that other animals, too, share the same sensory-based working memory system. It also needs to be explained how the minds of humans and other animals can nevertheless differ so markedly in their flexibility. To these tasks we now turn.

Working memory is generally said to embrace a trio of functions: *sustaining* a representation over a period of time, *rehearsing* a representation to give it repeated entry into working memory, and *manipulating* a representation so as to transform its properties in a targeted way. Evidence of human-like working memory abilities in non-human animals can usefully be organized in accordance with these categories of function.

In humans, top–down signals can be used to sustain a representation that has previously been sensorily presented, and the same or similar signals can be used to activate such a representation in the first place and then sustain it. We know that other primates can sustain a presented representation for a period of time, forming expectations about the nature and presence of an object that has moved behind an occluder, for example (Santos et al. 2005), or sustaining a representation of a food item that had been placed in a "magic cup" from which a distinct food item has since been retrieved (Bräuer and Call 2011). There is less direct evidence of the abilities of other primates to activate representations in working memory top–down, for example by calling to mind an episodic memory of some event. But we do know that primates and some other animals (especially corvids) are at least capable of utilizing the *what*, *where*, and *when* components of episodic memory (Emery and Clayton 2004; Clayton et al. 2005).

There is also less direct evidence of a capacity to *rehearse* representations among non-human animals. But we do know that some animals have problem-solving capacities that would be underwritten by mental rehearsal in humans; and we also know that the mechanisms underlying our capacity for mental rehearsal are quite ancient. Let me elaborate on these points in turn.

We have already noted in section 2 that many animals are capable of advance planning. Corvids will cache food of a type that they know will not be available to them at breakfast the next day, thereby providing themselves with the varied diet that they prefer (Correia et al. 2007). And apes in captivity will select and take with them to their sleeping quarters a key needed to unlock a container to access food the next morning (Mulcahy and Call 2006). Moreover, chimpanzees in the wild regularly arrive at termite nests with the tools required to extract termites, although these would need to have been fashioned during the course of their journey while still out of sight of the nests themselves (Sanz et al. 2004). In human beings we know that similar capacities are underwritten by *prospection* (Damasio 1994; Gilbert and Wilson 2007). What we do is mentally rehearse the actions that are open to us, resulting in globally broadcast imagery of those actions that can evoke memories and issue in predictions of their immediate consequences, to which we respond affectively. These affective reactions then determine our choices. By playing out potential future scenarios and plans in working memory, we remind ourselves of what we need to do, or else realize what we should (or should not) be doing.

There is reason to think that mental rehearsal exapts mechanisms that evolved initially for the online control of action, which are of ancient provenance (Jeannerod 2006). We know that when motor commands are issued to the muscles, an *efference copy* of those commands is generated and transformed into sensory representations of what the resulting action should feel like proprioceptively and look like visually. (These are called "forward models" of the action.) These representations are sent to a comparator mechanism that also receives sensory feedback from the action as it unfolds, enabling swift online corrections to be made in the event of a mismatch (Wolpert and Kawato 1998; Wolpert and Ghahramani 2000; Grush 2004; Jeannerod 2006). Mental rehearsal exapts these mechanisms, with overt movements being suppressed, while a forward model is created from an initial set of motor instructions. When targeted by attention, the forward model is globally broadcast and can be used to evaluate the action in question or predict its likely consequences.

Since non-human animals display capacities that would involve mental rehearsal if exercised in humans, and since the mechanisms that enable mental rehearsal in humans are all seemingly present and in place in animals, the simplest explanation is that some animals, too, are capable of mentally rehearsing representations in working memory. One important difference, however, lies in the actions that are available to be rehearsed. Humans alone are capable of speech, and among the actions that can be mentally rehearsed are speech actions. The result is the stream of "inner speech," which plays such an important part in the mental lives of many people, and which constitutes a significant component of Dennett's "Joycean machine." But this is, at bottom, a difference in the *actions* that humans and other animals are capable of performing—albeit a difference that makes a large cognitive difference—not a contrast in mental architecture or in the kinds of propositional attitude of which they are capable.

The capacity to *manipulate* representations in working memory is closely related to the capacity to rehearse them. For one manipulates an imagined shape, for example, by activating motor plans designed to alter that shape (by flipping it or spinning it, say), but with overt action suppressed (Kosslyn 1994; Ganis et al. 2000; Richter et al. 2000; Kosslyn et al. 2001; Lamm et al. 2001). In fact the *manipulative* use of working memory involves an interaction between motor systems and sensory systems, just as does mental rehearsal. So it would seem that any creature capable of the latter should equally be capable of the former. This conclusion is consistent with instances of "insight behavior" in corvids and primates (Köhler 1927; Bird and Emery 2009; Taylor et al. 2010; Hanus et al. 2011), which in human beings would normally result from sustained mental manipulation of the task components until a solution is arrived at.

It appears that capacities to make use of working memory are quite similar among humans and some other animals, and are underlain by a common set of mechanisms. The main difference (in addition to the fact that only humans are capable of inner speech) would seem to be that humans make *chronic* use of working memory, thereby constituting the so-called "default network." As is now known, when not engaged in a task (as well as frequently when they are, in so-called "mind wandering") humans use top–down activation and attention to replay past events, imagine future ones, engage in imagined speech, rehearse snatches of song, and so forth (Mason et al. 2007; Buckner et al. 2008). Out of this process of almost continuous self-stimulation can emerge new ideas, beliefs, or plans for action.

We have no reason to think that non-human primates are likewise chronic imaginers. Indeed, there is good reason to think that they are not. For if they were, one might expect that instances of insight behavior would be more common, and one would expect that other primates, too, would be immune from the sorts of inflexibilities of behavior that are exhibited by other animals. These differences in the extent to which working memory is used may be related to the increased size of the frontal lobes in human beings (which are the seat of top–down influences), and also the increased size of the superior parietal lobe in humans (which is one of the main sources of attentional signals, and which plays a vital role in the manipulative component of working memory; Coolidge and Wynn 2009; Koenigs et al. 2009).

The evidence suggests, then, that many philosophers' conceptions of the distinctiveness of the human mind are radically mistaken. There is no workspace in which amodal propositional attitudes are active and where they enter into inferences. Rather, such attitudes remain below the surface, determining priorities for entry into working memory as well as motivating and guiding the selection of action-schemata for mental rehearsal. Hence our attitudes, themselves, are not "inferentially promiscuous." Rather, their effects on the contents of working memory underwrite a similar degree of cognitive flexibility, and sequences of such effects can play some of the roles of inference, as we will see in section 4. Even the capacity for free recombination of concepts (captured in the so-called "generality constraint") is probably parasitic on the capacity to generate items of inner speech (Carruthers 2009).

It follows that humans and other animals share very similar kinds of minds. Humans rely on the same workspace of globally broadcast attended sensory representations as do other primates, while perhaps differing in the extent to which they use and exert active control over the contents of that workspace.

4. Dual Systems for Reasoning

Although the position defended in section 3 is problematic for many philosophers' views of the unique nature of the human mind, it does not yet follow that humans fail to possess a mind that differs qualitatively from the minds of non-human animals. For there remains the other possibility canvassed in section 1, that so-called "System 2" forms of thinking and reasoning amount to the possession of a novel form of (conscious) mind, which is not shared by other animals. This possibility will be critiqued briskly here, since the case against it has already been developed more fully elsewhere (Carruthers 2011).

Scientists who study human reasoning have found that it is liable to notorious biases and fallacies. But not everyone fails at these tasks. A small subset of people succeed, and it tends to be the same people who succeed across tasks (Stanovich and West 2000). One factor that is predictive of success is fluid *g* (or IQ), a construct that overlaps heavily with the efficiency of people's working memory system (Colom et al. 2004; Jaeggi et al. 2011; Demetriou et al. 2013).[5] But even with IQ controlled for, two additional factors are predictive of success. One is a feature of personality that can roughly be characterized as *reflectiveness* (called by psychologists "need for cognition"). People who are disposed to stop and think following the presentation of a task (for example, by asking themselves in inner speech "Is this as simple as it looks?"—thereby evoking knowledge relevant to a solution that they actually possess) are more likely to succeed. But the second factor is the presence of culturally acquired beliefs about norms of good reasoning, which Stanovich (2009) calls "mindware." When presented with a conditional reasoning task, for example, those who have taken a course in logic might recall (if they reflect) that in order to evaluate a conditional, one should look for a case where the antecedent is true while the consequent is false.

System 2 is thus a set of abilities that depend on the active use of sensory-based working memory, drawing on culturally acquired behavioral procedures that can be rehearsed internally (think, here, of one's knowledge of the multiplication tables, or the procedures for adding together two numbers), together with beliefs about norms of good reasoning. This much can be agreed upon. The real question is whether System 2 constitutes a distinct *mind* that only humans possess, as Frankish (2004, 2009) and Evans (2010) both claim. This means that it must contain a distinct set of propositional attitudes like belief and desire, which do not exist in System 1, and that interact with one another in System 2 forms of reasoning and decision making. I shall argue that it does not have the properties of a mind.[6]

Frankish is admirably clear-headed about what is necessary for sensory-involving events in System 2 to acquire causal roles somewhat *like* those of a propositional attitude, at least. Generally speaking, this requires a meta-cognitive belief occasioned by the sensory-involving event in question, combined with a source of meta-cognitive motivation. For example, confronted with a conditional reasoning problem, one might token in inner speech the sentence: "To evaluate a conditional, one should look for a case where the antecedent is true and the conclusion is false." Under interpretation, this event is *heard as* expressing a *judgment* that one should look for such a case, or as being a *commitment* to look for such a case. If one also has a standing desire to do what one believes one should do, or a desire to fulfill one's commitments, then one will go on to behave just as if one had *judged* that to evaluate conditionals, one should look for cases where the antecedent is true and the consequent false. According to Frankish (2009), the event in inner speech thereby *becomes* a (System 2) belief with such a content. For the event has acquired the right sort of causal role to constitute such a belief.

One might wonder about the need for this kind of account. For why would one entertain the sentence about evaluating conditionals unless one antecedently *believed* it? And if one does believe it, why can't this belief issue in the appropriate behavior without needing to rely on the meta-cognitive judgment that one has such a belief, or that one has made an appropriate commitment? But this is to miss the point that such beliefs are *not* spontaneously drawn upon in our unreflective behavior, and the only way in which they can gain access to the global workspace is by giving rise to a sensory event with an appropriate content (either a sentence in inner speech or a visual image of the truth-table for the conditional, perhaps). Moreover, the underlying belief is not active *in* the sensory event. Rather, it contributes to the causation of it, and the latter has to be interpreted by linguistic comprehension and mind-reading systems in the normal way in order to be assigned a content.[7]

Frankish (2009) is mistaken, however, in claiming that sensory-involving episodes in inner speech can acquire the appropriate causal roles to count as propositional attitudes. This will be easiest to see in the case of (alleged) System 2 decisions, so let me switch to an example of that sort. (For an extension of this argument to demonstrate the non-existence of System 2 judgments and other attitudes, see Carruthers 2011.) Suppose that after a period of System 2 activity, one tokens in inner speech the sentence: "I shall go to the bank now." Under interpretation, this is heard as expressing a decision to go to the bank now, or as expressing a commitment to do so. And these, combined with a standing desire to do what one has decided to do, or a desire to execute one's commitments, issues in bank-going behavior. The question is whether, as a result, the event in question *is* a (System 2) decision to go to the bank.

The distinctive thing about a decision for the here-and-now, however, which serves to distinguish it from mere hopes or suppositions, is that it should *settle* what one does, issuing in action without the intervention of any further practical reasoning (Bratman 1987, 1999). But the System 2 event above fails these conditions. Saying to oneself "I shall go to the bank now" does *not* settle anything by itself, and it only issues in bank-going behavior following some subsequent practical reasoning. For example, *believing* that one has decided to go to the bank and *wanting* to execute one's decisions, one forms the *decision* to go to the bank. This is the real decision, which occurs (unconsciously) downstream of the initial System 2 event.

This point generalizes to alleged System 2 judgments and other attitudes. None have the right sort of causal role to *be* a propositional attitude of the appropriate kind, although they have effects on behavior somewhat like those of an attitude. System 2 therefore lacks the defining properties of a mind. It does not contain any beliefs, desires, or decisions. (Or rather, it does not contain any attitudes that don't also figure in the working memory of other primates, such as episodic memories and affective feelings directed at objects or states of affairs.) The real attitudes underlying distinctively human System 2 activity occur unconsciously, operating beneath the surface.

Thus, while humans may *use* their working memory abilities in ways that differ markedly from other primates, issuing in significant differences in behavior, both groups share essentially the same kind of mind. Architecturally, their minds are the same, and both groups possess propositional attitudes of the same general sort built out of component concepts.

5. Conclusion: Explaining Human Uniqueness

I have argued that animal minds are real, and that animal minds are the only minds that humans possess. It is not true that the minds of animals contain mere proto-concepts and proto-attitudes, whereas human minds contain *real* concepts and *real* attitudes. (Or if they *do* only contain proto-attitudes, the same is true of humans, and there are no such things as real concepts and real attitudes.) Nor is it true that animal minds are organized around a sensory-based global workspace, whereas human minds contain an amodal workspace in which propositional attitudes themselves can figure. Neither is it true that humans have, in addition to the sort of mind that they share with non-human animals, a uniquely human System 2 mind.

How, then, are we to explain the massive differences in overt behavior that separate humans from other animals, which we canvassed at the outset? No doubt the extra control that humans can exert over their own working memory activities (together with a chronic disposition to do so) are one part of the story; and no doubt the fact that only humans can activate and manipulate speech representations in working memory is another. But in addition, we probably need to appeal to a suite of cognitive adaptations that emerged over the evolution of the hominin line, and which interact in such a way as to result in the differences that we observe (Carruthers 2013). One is an enhanced mindreading faculty, together with a drive to share mental states with other agents (Tomasello et al. 2005). Another consists in a capacity for normative thinking and distinctively moral forms of motivation. A third consists of greatly enhanced abilities for skill learning and fine-grained control of action (especially involving the hands). And there are probably more (Carruthers 2013). Just as there are multiple physiological differences that distinguish the human body from the bodies of chimpanzees, so are there multiple cognitive and motivational differences. But none of these, either singly or collectively, constitutes the presence of a distinctive *kind* of mind, in the strong sense that has concerned us here.

NOTES

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1. Note that although McDowell thinks that the human capacity for spontaneity is language-dependent, the dependence is intended to be developmental rather than constitutive. It is by being inducted into

a community of language-users that we acquire the capacity to consider reasons and to reflect on the evidence for our beliefs and the reasons for our decisions. But the thought and reflection itself is not linguistic in nature, even if it is often linguistically expressed.

2. Compare Peacocke's (1986, 1992) claim that concept possession requires an appreciation that certain inferential moves are *primitively compelling*. This, too, makes grasp of inferential norms into a condition of genuine concept possession, and hence of belief properly so-called.

3. Barsalou (1999) thinks otherwise, of course. But I propose to set aside sensorimotor accounts of concepts for purposes of the present discussion. See Carruthers (2011) for some brief further discussion and critical references.

4. Note that it is fully consistent with these claims that concepts themselves should be amodal representations that can figure in inferences of a local sort without needing to be sensorily embedded, and that amodal concepts can get bound into sensory representations in distinct sense modalities.

5. Note that the finding that measures of fluid *g* and of working memory tap into the same underlying capacity is evidence that humans do *not* possess an amodal working memory system in addition to the sensory-based one shared with other animals. For if they did, then one would expect variability in the properties of this system would be needed to explain some component of inter-individual variations in fluid *g*.

6. Notice that it appears to be a curious consequence of my opponents' position that only a minority of human subjects even *possess* a System 2 mind. For recall that the System 1/System 2 distinction was introduced to explain success in a large battery of reasoning and decision-making tasks, and that a majority of subjects systematically fail at such tasks.

7. Note that I say, "contributes to the causation of it" rather than "determines it." This is because speech (even inner speech) is an *action*, and is thus always subject to multiple influences. And in fact the literature in social psychology is rife with cases where people sincerely express beliefs they do not really have, resulting from the influence of goals other than the bare expression of belief. See Carruthers (2011) for extensive discussion.

REFERENCES

Baars, Bernard J. 1988. *A Cognitive Theory of Consciousness* (Cambridge: Cambridge University Press).

———. 2002. "The Conscious Access Hypothesis: Origins and Recent Evidence," *Trends in Cognitive Sciences*, vol. 6, no. 1, pp. 47–52.

Barsalou, Lawrence W. 1999. "Perceptual Symbol Systems," *Behavioral and Brain Sciences*, vol. 22, no. 4, pp. 577–660.

Bird, Christopher D., and Nathan J. Emery. 2009. "Insightful Problem Solving and Creative Tool Modification by Captive Nontool-Using Rooks," *Proceedings of the National Academy of Sciences*, vol. 106, no. 25, pp. 10370–10375.

Brandom, Robert B. 1994. *Making It Explicit* (Cambridge, MA: Harvard University Press).

———. 2000. *Articulating Reasons* (Cambridge, MA: Harvard University Press).

Bratman, Michael E. 1987. *Intentions, Plans, and Practical Reason* (Cambridge, MA: Harvard University Press).

———. 1999. *Faces of Intention* (Cambridge: Cambridge University Press).

Bräuer, Juliane, and Josep Call. 2011. "The Magic Cup: Great Apes and Domestic Dogs (*Canis familiaris*) Individuate Objects according to Their Properties," *Journal of Comparative Psychology*, vol. 125, no. 3, pp. 353–361.

Brewer, Bill. 1999. *Perception and Reason* (New York: Oxford University Press).

Buckner, R., J. Andrews-Hanna, and D. Schacter. 2008. "The Brain's Default Network: Anatomy, Function, and Relevance to Disease," *Annals of the New York Academy of Sciences*, vol. 1124, pp. 1–38.

Buttelmann, David, Josep Call, and Michael Tomasello. 2009. "Do Great Apes Use Emotional Expressions to Infer Desires?," *Developmental Science*, vol. 12, no. 5, pp. 688–698.

Buttelmann, David, Malinda Carpenter, Josep Call, and Michael Tomasello. 2007. "Enculturated Chimpanzees Imitate Rationally," *Developmental Science*, vol. 10, no. 4, pp. F31–38.

Camp, Elisabeth M. 2004. "The Generality Constraint, Nonsense, and Categorical Restrictions," *Philosophical Quarterly*, vol. 54, pp. 209–231.

Carruthers, Peter. 2004. "On Being Simple Minded," *American Philosophical Quarterly*, vol. 41, no. 5, pp. 205–220.

———. 2006. *The Architecture of the Mind* (New York: Oxford University Press).

———. 2009. "Invertebrate Concepts Confront the Generality Constraint (and Win)," in *The Philosophy of Animal Minds*, ed. Robert W. Lurz (Cambridge: Cambridge University Press), pp. 89–107.

———. 2011. *The Opacity of Mind* (New York: Oxford University Press).

———. 2013. "The Distinctively Human Mind: The Many Pillars of Cumulative Culture," in *The Evolution of Mind, Brain, and Culture*, ed. G. Hatfield and H. Pittman (Philadelphia: Penn Museum Press), pp. 325–345.

———. Forthcoming. "On Central Cognition," *Philosophical Studies*.

Cheng, Ken. 1986. "A Purely Geometric Module in the Rat's Spatial Representation," *Cognition*, vol. 23, no. 2, pp. 149–178.

Clayton, Nicola S., Joanna Dally, James Gilbert, and Anthony Dickinson. 2005. "Food Caching by Western Scrub-Jays (*Aphelocoma californica*) Is Sensitive to the Conditions at Recovery," *Journal of Experimental Psychology: Animal Behavior Processes*, vol. 31, no. 2, pp. 115–124.

Colom, Roberto, Irene Rebollo, Antonio Palacios, Manuel Juan-Espinosa, and Patrick C. Kyllonen. 2004. "Working Memory Is (Almost) Perfectly Predicted by *g*," *Intelligence*, vol. 32, no. 3, pp. 277–296.

Coolidge, Frederick L., and Thomas Wynn. 2009. *The Rise of Homo Sapiens* (Oxford: Wiley-Blackwell).

Correia, Sérgio P. C., Anthony Dickinson, and Nicola S. Clayton. 2007. "Western Scrub-Jays Anticipate Future Needs Independently of Their Current Motivational State," *Current Biology*, vol. 17, no. 10, pp. 856–861.

Damasio, Antonio R. 1994. *Descartes' Error* (London: Papermac).

Dehaene, Stanislas. 1997. *The Number Sense* (London: Penguin Press).

Demetriou, Andreas, George Spanoudis, Michael Shayer, Antigoni Mougi, Smaragda Kazi, and Maria Platsidou. 2013. "Cycles in Speed–Working Memory–G Relations: Toward a Developmental–Differential Theory of the Mind," *Intelligence*, vol. 41, no. 1, pp. 34–50.

Dennett, Daniel. 1991. *Consciousness Explained* (London: Penguin Press).

———. 1996. *Kinds of Minds* (New York: Basic Books).

Dickinson, Anthony, and Deborah J. Charnock. 1985. "Contingency Effects with Maintained Instrumental Reinforcement," *Quarterly Journal of Experimental Psychology*, section B, vol. 37, no. 4, pp. 397–416.

Dickinson, Anthony, and David Shanks. 1995. "Instrumental Action and Causal Representation," in *Causal Cognition*, ed. Dan Sperber, David Premack, and Ann James Premack (New York: Oxford University Press), pp. 5–25.

Emery, Nathan, and Nicola S. Clayton. 2004. "The Mentality of Crows: Convergent Evolution of Intelligence in Corvids and Apes," *Science*, vol. 306, no. 5703, pp. 1903–1907.

Evans, Gareth. 1982. *The Varieties of Reference* (New York: Oxford University Press).

Evans, Jonathan St. B. T. 2008. "Dual-Processing Accounts of Reasoning, Judgment, and Social Cognition," *Annual Review of Psychology*, vol. 59, pp. 255–278.

———. 2010. *Thinking Twice: Two Minds in One Brain* (New York: Oxford University Press).

Evans, Jonathan St. B. T., and David E. Over. 1996. *Rationality and Reasoning* (Hove, East Sussex, UK: Psychology Press).

Flombaum, Jonathan I., Justin A. Junge, and Marc Hauser. 2005. "Rhesus Monkeys (*Macaca mulatta*) Spontaneously Compute Addition Operations over Large Numbers," *Cognition*, vol. 97, no. 3, pp. 315–325.

Flombaum, Joanthan I., and Laurie R. Santos. 2005. "Rhesus Monkeys Attribute Perceptions to Others," *Current Biology*, vol. 15, no. 5, pp. 447–452.

Fodor, Jerry A. 1983. *The Modularity of Mind* (Cambridge, MA: MIT Press).

———. 2000. *The Mind Doesn't Work That Way* (Cambridge, MA: MIT Press).

Frankish, Keith. 2004. *Mind and Supermind* (Cambridge: Cambridge University Press).

———. 2009. "Systems and Levels," in *In Two Minds*, ed. Jonathan St. B. T. Evans and Keith Frankish (New York: Oxford University Press), pp. 89–107.

Gallistel, Charles R. 1990. *The Organization of Learning* (Cambridge, MA: MIT Press).

Ganis, Giorgio, Julian Keenan, Stephen M. Kosslyn, and Alvaro Pascual-Leone. 2000. "Transcranial Magnetic Stimulation of Primary Motor Cortex Affects Mental Rotation," *Cerebral Cortex*, vol. 10, no. 2, pp. 175–180.

Gilbert, Daniel T., and Timothy Wilson. 2007. "Prospection: Experiencing the Future," *Science*, vol. 317, pp. 1351–1354.

Gould, James L., and Carol Grant Gould. 1994. *The Animal Mind* (New York: Scientific American Library).

Grush, Rick. 2004. "The Emulation Theory of Representation: Motor Control, Imagery, and Perception," *Behavioral and Brain Sciences*, vol. 27, no. 3, pp. 377–442.

Hanus, Daniel, Natacha Mendes, Claudio Tennie, and Josep Call. 2011. "Comparing the Performances of Apes (*Gorilla gorilla, Pan troglodytes, Pongo pygmaeus*) and Human Children (*Homo sapiens*) in the Floating Peanut Task," *PLoS One*, vol. 6, e19555, pp. 1–13.

Hare, Brian, Josep Call, Bryan Agnetta, and Michael Tomasello. 2000. "Chimpanzees Know What Conspecifics Do and Do Not See," *Animal Behavior*, vol. 59, no. 4, pp. 771–785.

Hare, Brian, Josep Call, and Michael Tomasello. 2001. "Do Chimpanzees Know What Conspecifics Know?," *Animal Behavior*, vol. 61, no. 1, pp. 139–151.

———. 2006. "Chimpanzees Deceive a Human Competitor By Hiding," *Cognition*, vol. 101, no. 3, pp. 495–514.

Hermer, Linda, and Elizabeth Spelke. 1996. "Modularity and Development: The Case of Spatial Reorientation," *Cognition*, vol. 61, no. 3, pp. 195–232.

Hermer-Vazquez, Linda, Elizabeth Spelke, and Alla S. Katsnelson. 1999. "Sources of Flexibility in Human Cognition: Dual-Task Studies of Space and Language," *Cognitive Psychology*, vol. 39, no. 1, pp. 3–36.

Hurley, Susan. 2006. "Making Sense of Animals," in *Rational Animals?*, ed. Susan Hurley and Matthew Nudds (New York: Oxford University Press), pp. 139–174.

Jaeggi, Susanne M., Martin Buschkuehl, John Jonides, and Priti Shah. 2011. "Short- and Long-Term Benefits of Cognitive Training," *Proceedings of the National Academy of Sciences*, vol. 108, pp. 10081–10086.

Jeannerod, Marc. 2006. *Motor Cognition* (New York: Oxford University Press).

Kahneman, Daniel 2011. *Thinking, Fast and Slow* (New York: Farrar, Straus, and Giroux).

Kahneman, Daniel, and Shane Frederick. 2002. "Representativeness Revisited," in *Heuristics and Biases*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman (Cambridge: Cambridge University Press), pp. 49–81.

Kirk, Robert. 1994. *Raw Feeling* (New York: Oxford University Press).

Koenigs, Michael, Aron K. Babey, Bradley R. Postle, and Jordan Grafman. 2009. "Superior Parietal Cortex Is Critical for the Manipulation of Information in Working Memory," *Journal of Neuroscience*, vol. 29, no. 47, pp. 1490–14986.

Kosslyn, Stephen M. 1994. *Image and Brain* (Cambridge, MA: MIT Press).

Kosslyn, Stephen M., William L. Thompson, Mary J. Wraga, and Nathaniel Alpert. 2001. "Imagining Rotation by Endogenous versus Exogenous Forces," *NeuroReport*, vol. 12, no. 11, pp. 2519–2525.

Köhler, Wolfgang. 1927. *The Mentality of Apes* (San Diego, CA: Harcourt Brace).

Lamm, Claus, Christian Windischberger, Ulrich Leodolter, Ewald Moser, and Herbert Bauer. 2001. "Evidence for Premotor Cortex Activity during Dynamic Visuospatial Imagery from Single Trial Functional Magnetic Resonance Imaging and Event-Related Slow Cortical Potentials," *Neuroimage*, vol. 14, no. 2, pp. 268–263.

Mason, Malia, Michael Norton, John Van Horn, Daniel Wegner, Scott Grafton, and C. Neil Macrae. 2007. "Wandering Minds: The Default Network and Stimulus-Independent Thought," *Science*, vol. 315, pp. 393–395.

McDowell, John. 1994. *Mind and World* (Cambridge, MA: Harvard University Press).

Melis, Alicia P., Josep Call, and Michael Tomasello. 2006. "Chimpanzees (*Pan troglodytes*) Conceal Visual and Auditory Information from Others," *Journal of Comparative Psychology*, vol. 120, pp. 154–162.

Menzel, Randolf, Andreas Kirbach, Wolf Dieter Haass, Bernd Fisher, Jacqueline Fuchs, Miriam Koblofsky, Konstantin Lehmann, et al. 2011. "A Common Frame of Reference for Learned and Communicated Vectors in Honeybee Navigation," *Current Biology*, vol. 21, no. 8, pp. 645–650.

Mulcahy, Nicholas J., and Josep Call. 2006. "Apes Save Tools for Future Use," *Science*, vol. 312, pp. 1038–1040.

Peacocke, Christopher. 1986. *Thoughts* (Oxford: Blackwell).

———. 1992. *A Study of Concepts* (Cambridge, MA: MIT Press).

Povinelli, D. 2000. *Folk Physics for Apes* (New York: Oxford University Press).

Richter, Wolfgang, Ray Somorjai, Randy Summers, Mark Jarnasz, R. Menon, J. Gati, A. Georgopoulos, et al. 2000. "Motor Area Activity during Mental Rotation Studied by Time-Resolved Single-Trial fMRI," *Journal of Cognitive Neuroscience*, vol. 12, no. 2, pp. 310–320.

Santos, Laurie R., Jennifer L. Barnes, and Neha Mahajan. 2005. "Expectations about Numerical Events in Four Lemur Species (*Eulemur fulvus*, *Eulemur mongos*, *lemur catta*, and *Varecia rubra*)," *Animal Cognition*, vol. 8, no. 4, pp. 253–262.

Santos, Laurie R., Aaron G. Nissen, and Jonathan A. Ferrugia, J. 2006. "Rhesus Monkeys (*Macaca mulatta*) Know What Others Can and Cannot Hear," *Animal Behavior*, vol. 71, no. 5, pp. 1175–1181.

Sanz, Crickette, Dave Morgan, and Steve Gulick. 2004. "New Insights into Chimpanzees, Tools, and Termites from the Congo Basin," *American Naturalist*, vol. 164, no. 5, pp. 567–581.

Sloman, Steven A. 1996. "The Empirical Case for Two Systems of Reasoning," *Psychological Bulletin*, vol. 119, no. 1, pp. 3–22.

———. 2002. "Two Systems of Reasoning," in *Heuristics and Biases*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman (Cambridge: Cambridge University Press), pp. 379–396.

Stanovich, Keith E. 1999. *Who Is Rational?* (London: Erlbaum).

———. 2009. *What Intelligence Tests Miss* (New Haven, CT: Yale University Press).

Stanovich, Keith E., and Richard F. West. 2000. "Individual Differences in Reasoning: Implications for the Rationality Debate?," *Behavioral and Brain Sciences*, vol. 23, no. 5, pp. 645–726.

Tarsitano, Michael, and Richard Andrew. 1999. "Scanning and Route Selection in the Jumping Spider *Portia labiata*," *Animal Behavior*, vol. 58, no. 2, pp. 255–265.

Tarsitano, Michael, and Robert R. Jackson. 1994. "Jumping Spiders Made Predatory Detours Requiring Movement Away from Prey," *Behavior*, vol. 131, nos. 1–2, pp. 65–73.

———. 1997. "Anareophagic Jumping Spiders Discriminate between Detour Routes That Do and Do Not Lead to Prey," *Animal Behavior*, vol. 53, pp. 257–266.

Taylor, Alex H., Douglas Elliffe, Gavin R. Hunt, and Russell D. Gray. 2010. "Complex Cognition and Behavioral Innovation in New Caledonian Crows," *Proceedings of the Royal Society B: Biological Sciences*, vol. 277, no. 1694, pp. 2637–2643.

Tomasello, Michael, Malinda Carpenter, Josep Call, Tanya Behne, and Henrike Moll. 2005. "Understanding and Sharing Intentions: The Origins of Cultural Cognition," *Behavioral and Brain Sciences*, vol. 28, no. 5, pp. 675–691.

Wolpert, Daniel M., and Zoubin Ghahramani. 2000. "Computational Principles of Movement Neuroscience," *Nature Neuroscience*, vol. 2, pp. 1212–1217.

Wolpert, Daniel M., and Mitsuo Kawato. 1998. "Multiple Paired Forward and Inverse Models for Motor Control," *Neural Networks*, vol. 11, nos. 7–8, pp. 1317–1329.