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Two Minded Creatures and Dual-Process Theory

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Biography

Mugg works on the cognitive architecture of human reasoning, the nature and ethics of belief, and the import of these two areas for philosophy of religion. He did his graduate work at York University in Canada, and is now a Visiting Lecturer at Indiana University Kokomo.

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Abstract

How many minds do you have? If you are a normal human, I think only one, but a number of dual-process theorists have disagreed. As an explanation of human irrationality, they divide human reasoning into two: Type-1 is fast, associative, and automatic, while Type-2 is slow, rule-based, and effortful. Some go further in arguing that these reasoning processes constitute (or are partly constitutive of) two minds. In this paper, I use the *Star Trek* 'Trill' species to illuminate the condition for the existence of "two minds in one brain" (Evans 2010, 3). After carefully outlining the two dominant versions of dual-process theory (default-interventionism, espoused by Evans, Stanovich, and Kahneman, and parallel-competitive theory, espoused by Sloman, Frankish, and Carruthers) and contrasting each with a one-system alternative, I argue that these three views should be understood as existing on a continuum: there are some theories that could plausibly be characterized as either one-system or default-interventionist, and the distinction between default-interventionism and parallel-competitive theory is not as clean-cut as usually assumed. I then argue, using the conceptual claims I defended using the science fiction cases, that default-interventionist dual-process theory is not compatible with the claim that humans have two minds (contra Evans and Stanovich).

Keywords

Dual-Process Theory, Two-System Theory, Two-Mind Theory, Cognitive Architecture, Human Reasoning, Belief

1. Introduction

A reoccurring strategy for explaining irrationality is that of dividing the mind into separate parts. This strategy goes back at least as far as Plato, who, in the *Republic*, argued that the soul is divided into reason, desire, and appetite because "the same thing will not...undergo opposites in the same part of itself, in relation to the same thing, at the same time" (436c, Grube translation).¹ Dual-process theory is the latest iteration of this strategy. According to the Standard View of dual-process theory, reasoning problems cue two very different kinds of processes: Type-1 processes are fast, evolutionarily old, associative (or heuristic), and automatic, while Type-2 processes are slow, evolutionarily new, rule-based, and controlled (or effortful). Some theorists argue Type-1 and Type-2 processing are carried out by two different kinds of systems, System 1 and System 2.

1. I will not attempt to trace the various iterations of this strategy throughout western philosophy (for an overview see Frankish & Evans, 2009).

2, respectively (Carruthers, 2009, 2013; De Neys, 2006, 2012; Kahneman & Frederick, 2002; Sloman, 1996, 2014). Others are agnostic as to how many systems there are and emphasize only Type-1 and Type-2 processing to the exclusion of System 1 and System 2 (Evans, 2008, 2009; Evans & Stanovich, 2013).

The most radical version of dual-process theory has it that humans possess two *minds*, one corresponding to Type-1 or System 1, the other to Type-2 or System 2. As Evans puts it, humans have, “in effect, two minds in one brain” (2010, 3, see also Frankish, 2004; Stanovich, 2011). Furthermore, these theorists are not referring to split-brain patients or subjects with multiple-personalities; they are making a claim about normal adult humans. Frankish (2010) claims that “if our judgments and actions” are generated by one of two distinct mental systems, “then many traditional philosophical questions will need to be recast to allow for this duality, with implications for debates about agency, autonomy, responsibility, rationality and knowledge, among other topics,” adding that this is “likely to be fertile area for future research” (923. For examples to do just this, see Fiala, Arico, & Nichols, 2011; Mallon & Nichols, 2011; Nagel, 2011). Understandably, dual-process, two-system, and two-mind theories are not without their opponents (see Keren & Schul, 2009; Kruglanski, 2013; Kruglanski & Gigerenzer, 2011; Mugg, forthcoming, 2013; Osman, 2004).

My purpose in this article is to assess the relation between the two dominant versions of dual-process theory and the two-mind theory, arguing that one of these versions (default-interventionism) is incompatible with two-mind theory. To do so, I first use the *Star Trek* ‘Trill’ species to illuminate the conditions for the existence of two minds in one brain (Section 2). Examining science fiction examples offers a method of examining conceptual possibilities, and offers how-possible models. That is, science fiction helps us understand what the structure of human cognition *might be*. Conceivability is our guide to possibility, since a state of affairs is possible if and only if it contains no contradictions. However, we must conceive in a maximally possible way to check for contradictions. Doing so is difficult. Certain genres of fiction, namely those that do not loosen conceptual constraints, can be fruitful in aiding our conceiving in a maximal way. Of course, the actual nature of human cognition is a matter for empirical investigation, but having how-possible models illuminates how to empirically investigate the structure of human cognition. In section 3, I turn to three empirically motivated positions of the cognitive architecture of human reasoning: parallel dual-process theory (according to which two reasoning systems operate at the same time and in direct competition with one another), default-interventionist dual-process theory (according to which one system is the default, but can be overridden by a second system), and one-system

theory (according to which there is one reasoning system that operates in many modes). Against the standard way of thinking about these accounts, I argue that we may see these three views on a continuum, and that there may be borderline cases, especially between one-system and default-interventionist theories—the more integrated the two systems are, the less plausible it is that they are genuinely distinct systems. I then apply the conditions gleaned from science fiction in Section 2 to these dual-process theories (Section 4), arguing that default-interventionist dual-process theory is not compatible with the stronger two-mind theory (contra Evans and Stanovich).

2. Distinguishing Systems, Distinguishing Minds

In this section I will outline the conditions on humans possessing two minds using the *Star Trek* ‘Trill’ species.² Let me start with a few details about the Trill. They are a humanoid species very much like humans. However, a small percentage of the species are unique: they are ‘joined’ with a symbiont. While a humanoid Trill’s natural lifetime is about the same as that of a human, the symbiont’s is much longer, and the symbiont is passed from host to host. Each new host gains all the memories, experiences, and even (to some degree) personality traits of the former hosts. This is why, when Jadzia-Dax, a joined Trill (Jadzia is the host, Dax the symbiont), has her symbiont stolen, she says that she “feels so empty” (‘Invasive Procedures’). The symbiont, under normal conditions, is integrated into the Trill’s nervous system. Indeed, after the two are joined for 94 hours, it would kill the host if the symbiont were removed for longer than a few hours (see ‘Dax’ and ‘Invasive Procedures’). Thus, the symbiont and host are two biological systems that can operate fairly independently. Dr. Bashir says they are “like two computers linked together” (‘Dax’), but, under normal conditions, they depend on each other in important ways: the symbiont is dependent on the host for nutrition and life support, and (after being joined) the host is dependent on the symbiont to continue living (though Jadzia can survive for a short time without Dax).

Two distinct humans have distinct minds. The fact that they are distinct, biological, minded creatures is sufficient for their minds to be not identical. I will call this the Organism condition:

2. I will focus on the *Deep Space Nine* version of the Trill, in which the resulting host and symbiont are a blend. However, I must note that in the original appearance of the Trill, in *The Next Generation* ‘The Host,’ the resulting symbiont-and-host aggregate’s personality was entirely that of the symbiont. The relation between the two was more like the relation between body and mind on Platonic dualism (at least in the *Phaedo*).

Organism Condition: If X and Y are minded organisms and X is not identical to Y, then X and Y have distinct minds.

The above conditional should not be replaced with a bi-conditional, since, if being distinct organisms were a necessary condition on two-mind theory, then it would be metaphysically impossible that humans possess two minds. It is at least metaphysically possible that humans possess two minds. Thus, I will leave the Organism Condition as a conditional.

Now, Jadzia-Dax is not a single organism. She is an aggregate of two organisms: Jadzia, the humanoid Trill, and Dax, the symbiont. In 'Dax', an arbitrator must decide if Jadzia-Dax is the same person as Curzon-Dax. Toward the end of the episode, she tells Jadzia-Dax "You are either 200 years older than I am, or you are about the same age as my great-granddaughter. At first I wondered which of those you were, now I am bothered by the likelihood that you may be both." This idea is reinforced throughout the series: Jadzia-Dax are two distinct creatures linked together.

The fact that Jadzia and Dax are distinct creatures—indeed, members of different species—is sufficient for them to possess distinct minds. On its own, the Organism Condition does not shed much light on the dialectic between one and two-mind theory, since the putative two minds in the human case would belong to a single organism. However, the Organism Condition does establish that Jadzia-Dax has two minds, and can assuage some immediate worries about the two-mind theory.

First, one might object to Jadzia-Dax's having two minds on grounds that all of Dax's behavior is mediated through Jadzia's body. In reply, notice that Jadzia and Dax's minds are dissociable. Dax can, and eventually does, live in another body. Also, when Dax is taken away from Jadzia, Jadzia can talk, think, and reason. Granted, she is not able to do this for long, since a joined Trill will die without her symbiont, but the point is that Jadzia's cognition can continue (for a time) without Dax's. Thus, they are dissociable. Indeed, Jadzia and Dax's minds are doubly dissociable. The implication for the two-mind theorist is that it is a conceptual possibility that two minds could share one body (though in the human case the minds must be distinguished in some way other than the Organism Condition).

Second, one might object to Jadzia-Dax's having two minds on grounds that Jadzia and Dax are too neurologically integrated to have two minds. Jadzia feels Dax's pain and *vice versa*. However, notice that, in some cases of joined twins, the two children can feel what is happening to the other's body. However, the joined twins have distinct minds. One might object to my counterexample by claiming that joined twins have only

one body. I am not convinced that joined twins have one body (in the relevant sense), but suppose my interlocutor is right. If so, we have an instance of two minds (that are somewhat integrated) existing in one body. Thus, replying that the joined twins share a body actually supports my claim that Jadzia-Dax has two minds. The upshot is that it is a conceptual possibility that humans have two minds in one brain.

Jadzia-Dax has two minds. What are some further ways we might be able to tell that she has two minds? In one episode, 'Equilibrium', Jadzia-Dax discovers that one Trill, who formerly possessed Dax, named Joran-Dax, has long been repressed in Dax's cognition. Joran was a violent man, and murdered the previous possessor of Dax (Torias-Dax). Jadzia did not have access to the information that Dax had been involved in a murder. However, Dax did have access. Inaccessibility is not sufficient for distinguishing distinct *minds* (though it may be sufficient for distinguishing cognitive systems, especially modules). I do not have direct access to the process by which I see the screen I am currently looking at, but my lack of access does not imply that the perceptual process is not part of my mind. Something further is going on in the case of Jadzia and Dax's access to information concerning Joran. I suggest that Jadzia and Dax differ in their beliefs: Jadzia believes that Dax has not engaged in criminal activity, but Dax believes that Dax has engaged in criminal activity. Thus, Dax and Jadzia hold contradictory beliefs at the same time, and these beliefs may enter into separate reasoning processes simultaneously. Jadzia and Dax have distinct 'belief boxes.' It is not simply that Jadzia has an explicit belief which Dax implicitly denies. They have distinct dispositional and explicit beliefs. We all sometimes explicitly aver one thing but act in some other way, as in the case of implicit racism. This, on its own, should not imply that we have two minds. If it did, the two-mind theory would be banal, since it would amount to the claim that humans are not perfectly rational or do not always act in accordance with their explicit beliefs. Thus, what is crucial to these simultaneous contradictory beliefs is that they are maintained *as the same kind of belief* (i.e. dispositionally, implicitly, explicitly, etc.). I will put this more formally below. Let belief_k mean belief of some specific kind (i.e. dispositional, implicit, explicit, etc.).

Belief-K Condition: If a subject believes_k that p, then that subject does not believe_k that not-p, unless that subject has two belief boxes.³

Steven Sloman, who endorses the two-system theory, while denying the two-mind theory (2014, 69; 1996, 3), has posited what he calls Criterion S, according to which, if a

3. In order for it to be possible for 'dispositional beliefs' to be contradictory, one would have to distinguish sharply between dispositional beliefs and dispositions to believe (see Audi, 1994).

subject simultaneously believes contradictory propositions in responding to a reasoning problem, then there must be more than one reasoning system. Sloman takes this claim to be tautological. I will put this claim a bit more formally as follows:

Simultaneous Contradictory Belief (SCB) Condition: A token reasoning process cannot decompose into two sub-processes operating simultaneously which result in *the generation of simultaneous contradictory beliefs*.

Elsewhere, some have argued that the SCB Condition is a way of distinguishing one-system accounts of human reasoning from parallel-competitive accounts of human reasoning (Osman 2004; Mugg 2013), but here I want to make a stronger point. The SCB Condition gives us a way to empirically distinguish one and two mind theories. Consider the following conditional:

Mind and Belief (MB): If a thing has beliefs, then it is a minded thing.

If MB is true, then the SCB Constraint is as much about minds as it is about processes. Thus, if a cognitive system possesses beliefs, that cognitive system would constitute a mind.

If humans possess two minds in virtue of both the SCB Condition and MB being met, then both minds would be at the personal level. This is not trivial, since Frankish (2009) defends his two-mind theory by associating one mind with the personal level and the other with the sub-personal level. The issue of the relation between the personal/subpersonal distinction to the two mind theory is worth exploring in some detail here.

Frankish (2009) attempts to situate the System 1/System 2 distinction within the subpersonal/personal distinction. Briefly, a personal level/state/process/event is one that is ascribable to the person or creature as a whole (Dennett, 1987). A sub-personal level state/process/event is one that is not ascribed to the person or creature as a whole, but instead is ascribed to a part (or a subsystem) of that person or creature.⁴ Frankish suggests that we identify S1 with sub-personal level attribution and S2 with personal level attribution. He gives us the following examples for personal and sub-personal reasoning. Suppose you are asked what is 21,582 divided by 11. If you are a math whiz, the answer may just come to you (1962). You would not, however, know how you

4. 'Person' should be understood in a very minimal sense. Personal-level states are not sufficient for personhood, and do not themselves constitute the 'self.' Frankish is clear that he does not wish to imply otherwise (2009, 91).

worked out the answer. The process of determining the answer would be entirely sub-personal. However, most of us need to get out a pencil and paper and work through a series of steps. This process is personal, even though some steps along the way might be sub-personal (e.g. what is 22 divided by 11). The “defining feature” of personal reasoning is intentionality, by which Frankish merely means acting for reasons (2009, 92). Personal reasoning requires the use of working memory and is “therefore conscious” (2009, 93). However, the beliefs and desires motivating a particular instance of personal reasoning need not be conscious (i.e. they can be implicitly held).

Assuming that the sub-personal/personal distinction maps neatly onto the S1/S2 distinction, Frankish notes some important implications. First, S2 would not be a neural system in its own right, but is, rather, a virtual system “constituted by states and activities of the whole agent” (2009, 97). It is constructed out of sub-systems (2009, 99). He calls this an action-based view of S2 (2012, 42). Second, S2 is causally and instrumentally dependent on S1: instrumentally because S2 will use S1 subsystems to engage in autostimulation, whether it be inner speech, action simulation, or something else, and causally dependent because S1 (the sub-personal systems) generates the intentional actions used by personal reasoning. Lastly, S2 depends on S1 “to make its *outputs* effective” (2009, 97). That is, sub-personal “metacognitive attitudes make personal decisions effective” (2009, 98).

The difficulty for Frankish is that beliefs are personal level entities. *My brain* does not believe; *I* believe. *My reasoning system* does not reason; *I* reason. However, if two-mind theorists wish to use contradictory beliefs to argue for their position, then their claim would be that the two systems are the possessors of the contradictory beliefs. Minds that have reasoning systems have beliefs. So each mind has beliefs. Thus, once you endow certain cognitive systems with belief possession, they ‘graduate’ from being at the cognitive level to the agential level.

It is natural to interpret Jadzia and Dax as possessing beliefs at the personal level. Jadzia and Dax are two distinct systems *possessing* distinct beliefs, and as such we regard them as distinct minds at the personal level. In ‘Dax’, Odo and Sysco consider whether Curzon-Dax could have committed a murder he is accused of. Sysco, who knew Curzon-Dax for years, explains that Curzon could not have done it: he “knew the man.” Odo replies “but did you know the symbiont inside the man?” Sysco and Odo characterize Jadzia, Curzon, and the Dax symbiont at the personal level. We are comfortable with distinguishing them at the personal level partly because they are distinct organisms, but my point here is that, if the SCB Condition or Belief-K Condition are supposed to aid in an argument for the two-mind theory, then the two-mind theorist must admit that the

distinction between the two minds is not merely at the sub-personal (or cognitive) level. Instead, it is at the personal (or agential) level.⁵

So far, I have been offering sufficient conditions for Jadzia and Dax having two minds. I now turn to a necessary condition. Jadzia and Dax have some reduplication of parts. That is, Jadzia and Dax both have phenomenal states, propositional attitudes, and cognition. It is not as though Jadzia contains all the propositional attitudes and Dax possesses all the phenomenal states. If this were the case, then (plausibly) Jadzia and Dax would possess different *parts* of one mind rather than possessing distinct minds.

The two-mind theory operates at a higher level than dual-process theory or two-system theory. A mind can be a collection of systems. Evans explains:

“[My] version of the two minds theory (Evans 2010b) makes the strong claim that there are two distinct forms of learning, memory and cognitive representation underlying the operations of the intuitive and reflective minds. There are implicit, procedural and habit learning systems in the old mind which can regulate our behavior without intervention by working memory, and which register no more than emotional or metacognitive feelings in consciousness” (Evans 2011, 91)

The idea is that there is a duplication of the various kinds of systems—humans possess two systems for learning, two for memory, two for mindreading, and (perhaps) even two for perceptual domains like vision. The two-mind theory is meant as a way to unify these dual-process and two-system accounts from various domains of psychology. The old mind has its own form or system of learning, memory, mindreading, and reasoning and the new mind has its own. If humans did have two minds, we should expect to find just such a duplication—just as in the Jadzia-Dax case. Thus, duplication of systems is a necessary condition on the two-mind theory.

5. The forgoing discussion is not the case for two-system theorists wishing to make use of merely the SCB Condition. The two-system theorist denying the two-mind theory can say that it is misleading to say that, according to the dual-process theorist, beliefs are held at the Type-1 level, or to say that System 1 or System 2 *believe* anything. Supposing that there are two distinct processes, the picture, as they would have it, is that Type-1 and Type-2 processes (subpersonal and personal reasoning respectively) both issue a response, and these responses can be in contradiction with one another. However, both of these responses must be attributed to the *organism as a whole*, given that they are beliefs. That is, they are attributed at the *personal* level. Two-system theorists wishing to deny that the two-mind theory can simply reject the claim that the beliefs are stored separately.

Furthermore, there is good reason to think that duplication is a sufficient condition as well—that Jadzia-Dax possesses two reasoning systems, two perceptual systems, two mindreading systems, etc. seems to imply that Jadzia-Dax has two minds. However, we must be careful not to assume that the existence of a duality in one domain will correspond to the duality in another. It is crucial to the duplication in Jadzia-Dax’s case that the duplicated systems cluster—one reasoning system is Jadzia’s, the other is Dax’s, one perceptual system is Jadzia’s, the other is Dax’s. That is, if the two-mind theory is true, then the two systems of various domains of psychology should not cross-cut one another. Furthermore, all the system’s of Jadzia’s interact with a much higher frequency than they interact with Dax’s systems—Jadzia is one cognitive system, Dax is another. Call this the Duplication Principle:

Duplication Principle: X has two minds, M_1 and M_2 , if and only if there is a duplication of systems such that for each duplicated system S_1 and S_2 , S_1 is a system of M_1 and S_2 is a system of M_2 .

Thus, we have four ways that two-mind theorists could argue for their account. First, they might find evidence for a double dissociation between the two minds. Second, they could argue that the beliefs of the same kind are maintained simultaneously by single subjects (Belief-K Condition). Third, they could accept the SCB Constraint combined with MB and argue that simultaneous reasoning processes generate contradictory beliefs, which are maintained by separate systems. Finally, and most importantly, humans have two minds if and only if human cognitive faculties are duplicated. Having gotten clear on what it would take for there to be two minds, we may now turn to empirically motivated accounts of human reasoning.

3. One-System, Default-Interventionism, and Parallel-Competitive Theories

Here I will outline two versions of dual-process theory and contrast them with a one-system alternative, arguing that they should be understood as a continuum with borderline cases rather than admitting of sharp boundaries. I will begin with one-system accounts. There have been a number of models suggested. Human reasoning might be entirely rule-based, consisting of a complex structure of heuristics (see Kruglanski & Gigerenzer, 2011), or human reasoning might exist along a continuum, rather than as a bifurcation. Osman’s (2004) one-system alternative is an extension of Cleeremans and Jimenez’s (2002) dynamic graded continuum (DGC) theory of learning. On this connectionist account, implicit, automatic, and explicit processing form a continuum. Implicit reasoning, when they encounter novel reasoning problems, “involves making

a set of abstractions or inferences without concomitant awareness of them” (995, see also 996). In contrast to implicit (but not automatic) reasoning, subjects have awareness in *explicit reasoning*, and this awareness “can be expressed as declarative knowledge” (995). Finally, automatic reasoning is “deliberately acquired through frequent and consistent activation of relevant information that becomes highly familiarized” (995). On her account, explicit processes may become automatic (in her sense) over time. However, automatic and explicit processes do not become implicit over time. That is, an explicatable process may become highly familiarized, but does not eventually occur outside awareness.

Dual-process accounts come in two varieties. First, according to default-interventionism, subjects default to one kind of processing and only sometimes use the second kind. Default-interventionism is the most common dual-process position (held by Kahneman, Frederick, Stanovich, and Evans). Second, on parallel-competitive accounts, the two processes operate at the same time and are in direct competition with one another. Because Type-1 processing is faster than Type-2 processing, it “always has its voice heard” (Sloman 1996, 3). The two processes are like racing horses, but the slow and steady Type-2 does not generally win the race.⁶

Parallel-competitive accounts might seem qualitatively distinct from default-interventionist accounts, since the two processes operate independently and at the same time on parallel-competitive models. There is indeed a position to be had here. However it is one that is 1) is an extreme version of parallel-competitive (and implausible given the empirical data), and 2) is a theoretical position that no one actually holds. Instead, parallel-competitive theorists think that the two processes causally interact in important ways. In fact, two parallel-competitive theorists, Frankish (2004; 2009; 2012) and Carruthers (2009; 2011), argue that System 2 is a virtual system that is realized in the cycles of System 1. That is, the processes that System 1 carries out are *constitutive* of the processes carried out by System 2.⁷ On virtual system parallel-competitive accounts,

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6. Some have argued that parallel-competitive accounts cannot account for instances where Type-2 does win out, but this is a misunderstanding of the position. Parallel-competitive theorists can say that although Type-1 processing will end first, the subject may ‘hold off’ in responding until Type-2 processing has generated a response. Since Type-1 processing is automatic, as long as the stimulus is present, it will continue generating its response. Thus, when Type-2 processing completes the task, there is a fresh Type-1 response to compete with it.
 7. Frankish and Carruthers have an internal debate as to whether or not System 2 possesses its own mental states. Carruthers thinks that all the causal work is done by S1, and so S2 has no states of its own. Frankish disagrees, arguing that S2 has *sui generis* belief states.

System 2 is fully dependent on System 1. However, System 1 is not dependent on System 2. Now, the more the two processes interact, the closer the parallel-competitive model moves to a default-interventionist account. Thus, parallel-competitive and default-interventionist accounts are not sharply distinguished. Some accounts are border-line.

Now compare one-system accounts and default-interventionism. Again, the question is how integrated the two processes are. Suppose all processing initially is Type-1 processing, and only sometimes does Type-2 processing even come online, though when it does Type-1 processing shuts down completely. Perhaps this is different in a principled way from one-system accounts. However, suppose that Type-2 is dependent on Type-1 processing for its input (as Evans [2011, 94] and Stanovich [2011, 62] claim). Then it is less clear why we should regard these as distinct processes rather than parts of a more general process (see Kruglanski, 2013 for a similar point). Thus, we run into the infamous grain problem (Atkinson & Wheeler, 2003; 2004). As it applies here, the question is whether there is some level of description under which it is plausible (but not trivial) that there are reasoning processes that are distinct and not mere parts of a larger process. There are two related worries: first, how to determine whether two token processes are in fact sub-processes of a coarser-grained token process (call this the 'token grain-problem'); second, how to determine whether two types of processes are in fact sub-processes of a coarser-grained type of process (call this the 'type grain-problem'). If the grain-problem cannot be resolved, then default-interventionism and one-system accounts admit of vagueness.

The SCB Condition provides a principled way of distinguishing reasoning processes. One reason to think that the two processes are not parts of a more general *reasoning* process is that they can produce SCB. However, it is not clear that default-interventionism is compatible with the existence of SCB. Evans and Stanovich (2013) disagree with Sloman's "contention that simultaneous contradictory belief is a necessary condition for the existence of dual processes in conflict (his Criterion S)" (227). This disagreement should not be surprising, since default-interventionism does not conceive of the two processes in direct competition with one another. Rather, subjects default to Type-1 processing, which is sometimes overridden by Type-2 processing.⁸ Thus, default-interventionists need some other way to solve the grain problem if they are to be distinguished from one-system accounts.

8. If default-interventionism is not compatible with simultaneous contradictory belief, then the SCB Condition can empirically distinguish parallel-competitive accounts from both one-system and default-interventionist accounts

Default-interventionist accounts have moved increasingly toward one-system accounts, rather than more sharply distinguishing themselves from such one-system accounts. Recently Evans and Stanovich (2013) offered a revision of their accounts in response to criticisms. Evans's model has it that Type-1 reasoning automatically generates a response, but that then Type-2 reasoning reflects on this response, and (in conjunction with the amount of cognitive resources available and motivational factors) sets the amount of effort that the subject will use in assessing the response. As a result, all reasoning responses go through *both* kinds of processing. Why regard these as separate reasoning processes, rather than one reasoning process? I grant that there is nothing inconsistent with regarding them as distinct processes, but Evans gives us no reason to think that his revised account is still a dual-process account rather than a fleshed out one-system theory. In fact, Kruglanski (2013), in his commentary on Evans and Stanovich (2013), points out that Evans's account is remarkably similar to Gigerenzer's one-system account, according to which subjects have a toolbox of rule-based heuristics. Thus, there are accounts that are on a borderline between default-interventionism and one-system theory, such as Evans and Stanovich's (2013).

Are there borderline cases between parallel-competitive and one-system accounts? I think not. According to parallel-competitive accounts, not all reasoning results in Type-2 processing. Furthermore, the two processes are in competition with one another, which seems to give us a principled reason for distinguishing the processes. Finally, parallel-competitive theorists can use my SCB Constraint to distinguish their accounts from one-system accounts. Frankish and Sloman (but not Carruthers) accept the existence of SCB arising from the distinct processes (and, in their case, systems). Thus, there are principled ways of distinguishing parallel-competitive and one-system theories.

4. Two-Mind Theory cannot be Default-Interventionist

Philosophers and psychologists in the dual-process literature generally assume that both default-interventionism and parallel versions are compatible with two-mind theory. For example, Frankish, a parallel-competitive dual-process theorist, is a two-mind theorist, as are Evans and Stanovich,⁹ both default-interventionist theorists. I will argue that default-interventionism is not compatible with the strong two-mind theory. If I am

9. Stanovich is actually a 3-mind theorist. On his account there is the collection of module-like systems, (The Autonomous Set of Systems, or TASS), the algorithmic mind, and the reflective mind. TASS carries out only Type-1 processing, while the other two minds carry out both Type-1 and Type-2 processing. See Stanovich 2011, 62 for details concerning the relation between these minds.

right, then Stanovich and Evans must either become parallel-competitive theorists or reject the two-mind theory.

In section 2, I replied to an objection that Jadzia-Dax does not have two minds because the two are too integrated. I replied that the Jadzia and Dax's cognition is doubly dissociable, and neither is dependent on the other. As Selin Peers (a Trill expert) puts it, the process "is a joining. It is a total sharing, a blending...Neither is suppressed by the other" ('Dax'). However, as we examine default-interventionism, we find that the two systems/processes are too integrated to be partly constitutive of distinct minds.

In the previous section, I argued that the distinction between default-interventionism and one-system theory is vague. However, no vagueness arises between one-mind theory and two-mind theory, and the one-system theory is incompatible with the two-system theory (by the Duplication Principle). Therefore, default-interventionism is not compatible with two-mind theory.

Here is another way to see the objection. Sloman rightly claims that for something to be a system, "a set of cognitive processes and representations must have some individual autonomy; they must operate and compute independently enough that they can be held responsible for critical aspects of behavior" (2014, 71). If systems must have some individual autonomy and operate fairly independently, then the same can be said for minds. A mind is, after all, a kind of system. However, on Evans's account, all reasoning goes through both Type-1 and Type-2 processing. Type-1 generates a response, then Type-2 determines whether to simply accept that response or undergo further Type-2 processing that would potentially override the Type-1 response (see Evans 2011, 94). Thus, neither process can, on its own, be responsible for some critical aspects of behavior.

Default-interventionism is incompatible with Belief-K Condition being met or the SCB Condition combined with MB being met. First, note that default-interventionism has it that Type-1 and Type-2 responses are generated at different times: first the Type-1, then (sometimes) the Type-2. Thus, they cannot use the SCB Condition, since the SCB Condition require that the beliefs are *generated* simultaneously. Second, default-interventionism has it that Type-2 processing (sometimes) *overrides* or *intervenes* on Type-1 responses, rather than generating responses all on its own in addition to Type-1 responses. If the intervention is successful, then the Type-2 response replaces the Type-1 responses. Thus, subjects will not have contradictory beliefs of the same kind at the same time: the Belief-K Condition will not be met if default-interventionism is true. Of course, Belief-K Condition, SCB Condition, and MB are only sufficient conditions for two-system theory. So it does not follow from my argument here that default-

interventionism is incompatible with the two-mind theory. However, it does imply that default-interventionists will have to argue for the two-mind theory in some other way.

There is another, deeper problem for the combination of default-interventionism and the two-mind theory: default-interventionism cannot satisfy the Duplication Principle. Above I said that it is not as though Jadzia and Dax divide their labor: Jadzia doing all the perceptual work and Dax doing all the cognitive work, say. Instead, there is a duplication of system types. Remember, that two-system and dual-process accounts exist in the various domains does not, on its own, imply that they are all gesturing at the same two minds. It may be that the two-system and dual-process accounts in various domains of psychology are merely *employing a similar strategy* for explaining complex data rather than pointing to different parts of the *same* two minds. If humans possess two minds, then the dual-process and two-system accounts from diverse domains of psychology should fit well together. This is what we would expect if we could empirically investigate Jadzia-Dax: Jadzia's cognitive systems would align, and so would Dax's. Thus, if the two-mind theory is true, we should find organizational and structural similarities between the dual-process and two-system theories in each domain.

Let us turn to the empirical literature. Our question is to what extent the old/new mind distinction cross-cuts the various two-system and dual-process accounts of the domains of psychology. Unfortunate for Evans, it seems that there is a fair bit of cross-cutting. The kind of cross-cutting I have in mind here differs from the cross-cutting offered against dual-process theories of reasoning, according to which the *properties* used to distinguish Type-1 and Type-2 reasoning cross-cut each other (see Carruthers, 2013; J. S. B. Evans, 2008; Keren & Schul, 2009; Kruglanski & Gigerenzer, 2011; Mugg, forthcoming). Here the claim is that the various system 1/system 2 or Type-1/Type-2 processes of theories from different domains cross-cut one another. Thus, there is good reason to think that the dual-process and two-system accounts across the subfields of psychology are not pointing to the same two minds. From the above section, we already have a good handle on dual-process accounts within reasoning. In the remainder of this section, I will outline dual-process theory within social cognition and mindreading and argue that the duality in these areas do not correspond to alleged Type-1 and Type-2 processing in reasoning.

4.1 Social cognition (Smith and DeCoster)

Social psychologists have proposed many dual-process models to explain *specific* tasks, and some have gone further in attempting to develop a *general* dual-process

account of social cognition that accommodates these specific dual-process models. I will focus on Smith and DeCoster's (2000) influential account, which Evans and Stanovich both cite frequently. Smith and DeCoster (2000) draw heavily on the associative/rule-based distinction, arguing that associations and rules are "two separate memory systems" (Smith & Collins, 2009; 200). They write, "in brief, what we term the *associative processing mode* is based directly on the properties of the slow-learning system...in contrast, the *rule-based processing mode* uses symbolically represented and culturally transmitted knowledge as its 'program'" (110). Smith and DeCoster aim to unify several dual-process theories from social cognition. Their account seems to be parallel-competitive, rather than default-interventionist, since they "assume that the two processing modes generally operate simultaneously rather than as alternatives or in sequence" (Smith and DeCoster, 112). However, they also "do not see that distinction [between default-interventionist and parallel-competitive accounts] as very clear-cut" (Smith & Collins 2009; 205). They emphasize conscious control and effortfulness as a common theme in rule-based processing across dual-process theories of social cognition (125).

Problematically, Evans and Stanovich are clear that the associative/rule-based distinction must be discarded, as they concede to Kruglanski and Gigerenzer (2011) that putative associative processes can always be captured by rules. As Evans (2006) puts it, "I am not sure it is wise to describe System 2 as 'rule-based'...if only because it implies that System 1 cognition does not involve rules" (204, quoted in Evans and Stanovich (2013), 231). Smith and DeCoster (2000) are aware that

"associations sometimes have been termed 'rule', [but] for clarity it is important to preserve the distinction between associations (which are built up through repeated experiences over time and are not necessarily interpersonally shared or symbolically encoded) and rules (which can be explicitly learned on a single occurrence and are symbolically represented and often interpersonally shared)" (111)

Thus, Smith and DeCoster conceive of associations and rules as *qualitatively* distinct kinds of processing, and this forms the basis of their conciliatory dual-process account of social cognition. Since Evans and Stanovich reject a characterization of Type-1 and Type-2 processing using the associative/rule-based distinction, it is unlikely that these theories are gesturing toward the same two minds.

There are other problems for grouping Smith and DeCoster's (2000) account with Evans and Stanovich's accounts. According to Smith and Collins (2009), rule-based processing can "*effortlessly override* the automatic activation of stereotypes by

accessing and considering their relatively more favorable ‘personal beliefs’ about the group’s characteristics” (199, emphasis mine). This is in direct contradiction to Evans and Stanovich, who claim that Type-2 processing is *necessarily effortful* and that Type-1 is *necessarily not effortful*. Furthermore, according to Smith and DeCoster, when rule-based processing occurs, it “generally gives rise to a higher level of perceived validity of the conclusion or judgment and to more long-lasting effects” (201). Although they deny the ‘quick and dirty’ characterization of associative processing (since biases can result from “motives, by priming, or by other factors (e.g. current mood” (206)) it is not the case that using rule-based processing will result in less biases. In fact, they claim that “research in social psychology demonstrates that intentional efforts to correct bias may even lead to further bias” (207) (see Wegener & Petty 1997). This is in sharp contrast to most default-interventionists, who claim that the feeling of rightness is generated by Type-1 reasoning (Thompson, 2009, 176). Kahneman goes so far as to say that after he adopted a new policy of marking in order to avoid the anchoring effect when grading tests he was “less happy with and less confident in [his] grades...but...recognized that this was a good sign, an indication that the new procedure was superior” (2011, 84). To put it in default-interventionist, theory-laden terms, lacking a feeling of rightness implies that the result is not generated by Type-1 processing, and as such, must have come from Type-2 processing, which generates no feeling of rightness.

As I have argued above, key to seeing whether an account is really dual-process or single system is the interaction between the putative two systems or processes. Smith and DeCoster’s account, at times, look remarkably similar to Osman’s (2004) one system account, which is supposed to be a rival to dual-process theory. Smith and DeCoster (2000) are clear that repeated symbolic rule use can “create the conditions for associative learning...With enough practice, therefore, the answer to such a problem just pops into consciousness” (115-116). These points are repeated in Smith and Collins (2009), who write that “repeated use of symbolic rules creates the conditions for associative learning, so eventually the same answer that is generated by the rule-based system can be retrieved by pattern-completion in the associative system” (202). Conversely, associative information can become symbolic rules: “people can reflect on their own past experiences and summarize them, perhaps in the form of a symbolically represented rule” (Smith and DeCoster 2000, 116).¹⁰

10. Smith and DeCoster (2000) seem to admit the existence of simultaneous contradictory belief, following Sloman (1996). The existence of SCB would be incompatible with Osman’s (2004) account, as she herself says (though she and others have argued that Sloman has failed to support the existence of SCB (see also

Recall that, on Osman's one-system account, explicit processes may become automatic (though not implicit) over time. Smith and DeCoster's (2000) account seems similar in that rule-based processing may become associative processing just as explicit processing may become automatic. Such transitions would be less likely on Evans and Stanovich's accounts, where the Type-1 processing is carried out by module-like systems.

I admit that Smith and DeCoster's account might fit well with some dual-process theories in cognitive psychology (particularly parallel-competitive accounts like Sloman's (1996). See Smith and DeCoster (2000), 123). However, it is not the case that Smith and DeCoster's account fits well with Evans and Stanovich's account. To be sure, Smith and DeCoster's account bears some resemblance to Evans and Stanovich's accounts, but, then again, Smith and DeCoster's account also bears some resemblance to Osman's account as well. Thus, it is unlikely that Smith and DeCoster's associative and rule-based modes correspond to the default-interventionist's two minds.

4.2 Mindreading (Apperly and Butterfill)

Apperly and Butterfill have developed a two-system account of mindreading—the ability to attribute mental states to others. The difficulty philosophers and psychologists face when interpreting the empirical data is that there is evidence that nine-month old humans attribute mental states (based on looking-time paradigms. See, e.g., Onishi & Baillargeon, 2005), but children are unable to pass false-belief tasks (such as the Sally-Anne Test) until three or four years (Wellman, Cross, & Watson, 2001; Wimmer & Perner, 1983). Responses to this seemingly contradictory evidence in the literature tend “to be polarized: Infants [and] nonhuman animals...either employ mental concepts such as perception or belief or get by exclusively with behavioral rules” (I. A. Apperly & Butterfill, 2009, 966). This polarization “might be resolved in one of two ways: either one set of evidence would prove to be unsound, or the apparent contradictions actually reflect genuine diversity in” human mindreading (Apperly, 2011; 133). Apperly clearly takes himself to be employing a *strategy* for resolving complex data similar to dual-process theorists in other domains, rather than gesturing at a two-mind architecture:

“These dual requirements [for solving the problem of unbounded information processes (i.e. the frame problem)] are not unique to mindreading, and for topics as diverse as social cognition (e.g. Gilbert, 1998), number cognition (e.g., Feigenson, Dhane & Spelke, 2004), and

general reasoning (e.g., Evans, 2003), there is strong evidence that both kinds of solutions are employed. I suggest that the same is true for mindreading (see Apperly and Butterfill, 2009)” (133)

Thus, introducing two systems is not intended as gesturing to the *same two systems* (or minds) found in other areas of psychology. Instead Apperly and Butterfill are employing a strategy found in other areas of psychology for explaining how a processing in a domain can “be both flexible and efficient” (Apperly and Butterfill 2009, 957). Apperly and Butterfill write that they “advocate a view based on *lessons* from another domain” (2009, 953, emphasis mine). However, they make no effort to say how their account fits with these other theories, and admit that the details of the various theories differ. How much do they differ? I will argue that Apperly and Butterfill’s account differs from Stanovich and Evans’s two mind account in ways that indicate that they are not implicating *the same two minds or systems*.¹¹

On Apperly’s (2011) account, there is a low and high level of mindreading. The lower level is present in infants and non-humans and does not involve language. Low level mindreading is fast, and it uses a distinct set of concepts, which can *track* goals, beliefs, and desires without representing them as goals, beliefs, and desires, *as such*. High level mindreading is the full-blown mindreading measured by false-belief tasks like Sally-Anne. It tends to be language involving (but does not appear to be “critically dependent on the availability of grammatically structured language” (159)), is more flexible, and is slower. Apperly claims that high and low-level mindreading are “at least partially dissociable” (167), given evidence from autistic subjects, since their “high-level mindreading abilities might not be atypical” (167).

Some of the properties Apperly uses are certainly familiar from dual-process theories of reasoning—the fast/slow and the evolutionarily old/new distinctions in particular. However, there are some major differences. First, notice that low level mindreading is supposed to lack language. However, in dual-process theories of reasoning, both Type-1 and Type-2 processing are language involving. Otherwise Type-1 processing would not be implicated at all in cases like the conjunction fallacy or belief-bias. Second, high and low level mindreading are supposed to be “at least partially dissociable” (167). However, on default-interventionism, Type-2 processing is dependent upon Type-1 processing for its input. Thus, they will be dissociable only in that Type-1 processing can

11. This is not meant as an objection to any of these theories as such, or to the compatibility of these theories. My claim is merely that Evans and Stanovich’s Type-1/Type2 distinction and Apperly and Butterfill’s low/high level mindreading are not governed by the same systems or minds.

occur without Type-2 processing. Type-2 processing cannot occur without at least some Type-1 processing. Thus, the relation of the two kinds of mindreading and two kinds of reasoning differ.

A point of commonality between Evans and Stanovich's accounts and Apperly and Butterfill's accounts is the importance of working memory or executive functioning. Recall that Evans and Stanovich (2013) claim that the distinction between Type-1 and Type-2 processing is the distinction between a process being autonomous or working-memory involving. Consider cognitive decoupling, which Stanovich and Evans both emphasize in their accounts: subjects make a copy of a representation, which is kept separate from one's beliefs (i.e. in working memory) such that it can be manipulated. This task of keeping the two separate is cognitively taxing (Leslie 1987). That is, it takes executive functioning. Similarly, executive function plays a central role in Apperly's account. He writes:

“unlike the cases of language there is equally clear evidence that executive function continues to have a significant role in the mindreading abilities of adults...However, there is also good evidence that some mindreading processes are much less effortful and resource demanding...and there is evidence that adults can implicitly and automatically calculate what someone else sees (Level-1 visual perspective-taking)” (111)

Working memory and executive functioning are distinct, but closely related. Working memory is that which temporarily stores and manipulates information. For example, subjects use their working memory to remember the pattern in a dot matrix (De Neys, 2006). Executive functioning, in contrast, is that which inhibits or suppresses action tendencies or mental states. For example, bilinguals of audible languages use their executive function when they speak—they must suppress their non-active language (Bialystok & Viswanathan, 2009; Moreno et al., 2011).

One might think that the close relationship between working memory and executive functioning and the important role that it plays in these theories is evidence that dual-process accounts in these two domains are converging. However, the automatic/working-memory distinction alone is not sufficient for showing a robust convergence. The difficulty is that if the two-mind theory amounts to the claim that some processes involve working memory whereas others do not, then the two-mind theory is banal. Any one-system theorist would agree that not all cognitive processes involve working memory or executive functioning (see Mugg, forthcoming). Thus, even if we ignore all the other

ways in which dual-process theories in reasoning and mindreading do not converge, working-memory/executive function involving is little evidence for a convergence.

4.3 Conclusion

If the two-mind theory is true, then there should be a duplication of systems—two mindreading systems, two reasoning systems, two perceptual systems, etc. However, default-interventionism, at least of Evans and Stanovich's kind, relates the processes too tightly to suggest a clear bifurcation of systems. Furthermore, we do not find a deep commonality between the dual-process theories across domains of psychology. Evans himself seems aware of the problem of mapping his own dual-process account onto his own two mind account. He admits that "there are Type-1 processes operating within both the old and new minds" (2011, 93). So, as it turns out, even his own default-interventionist account does not perfectly line up with his two-mind theory.¹²

5. Conclusion

I have argued that the typical way of understanding the relation between the various dual-process and two-mind theories is mistaken in two ways. First, although I agree that dual-process theories divide into parallel-competitive and default-interventionist versions, I have argued that these two lie on a continuum with one-system accounts (especially the one-system dynamic-graded continuum account). Second, given the conditions gleaned from the two-minds of Jadzia-Dax, it is clear that default-interventionism is incompatible with the two-mind theory for three reasons. First, default-interventionists deny the possibility of simultaneous contradictory belief (as many one-system theorists do). Thus, they cannot use the combination of the SCB Condition, Belief-K Condition, and MB Condition to support their claim that humans have two minds. Second, default-interventionism cannot meet the Duplication Principle—which is necessary and sufficient for the two-mind theory. Third, default-interventionist accounts of human reasoning (such as Evans and Stanovich's) do not fit with dual-process theories in other domains of psychology (such as mindreading and social cognition). It is implausible that the theories

12. A two-mind theorist might reply that the various dual-process theories do have *some* resemblance. Namely, they all draw some properties from the 'standard menu.' However, Evans and Stanovich have recently abandoned the standard menu as a way of distinguishing the two processes because of the existence of cross-cutting. The standard menu did serve to unify the various dual-process accounts, but that recourse is not available to Evans and Stanovich (see Mugg, forthcoming).

from these diverse areas of psychology are gesturing at the same two minds. More likely, they are merely employing a similar explanatory strategy.

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