

## Notes on Evans and Stanovich

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What follows is a careful engagement with the claims made by Evans and Stanovich in “Dual-Process Theories of Higher Cognition: Advancing the Debate,” *Perspectives on Psychological Science*, 8, 3 (2013), pp. 223-41.

In section 1, I critique their interpretation of Dual Process Theories.

In section 2, I discuss the evidence for what they are now calling Dual Process Theories.

Overall Evaluation: It is my contention that these new theories have relatively little connection to the theories they introduced and defended for twenty-five years under the “Dual Process” label. To prevent misinterpretation, Evans and Stanovich should have said in this article that the Dual Process approach is incorrect or false, and they should now present themselves as pursuing a distinct hypothesis or set of hypotheses, not best conceptualized as advocacy for two processes, much less two systems.

### Section 1

(1) The distinction between two kinds of thinking, one fast and intuitive, the other slow and deliberative, is both ancient in origin and widespread in philosophical and psychological writing.

Comments: Is fast thinking different “in kind” from slow thinking? Isn’t it better to say that many mental processes—e.g. deliberation, calculation, recall, puzzle solving—can be performed at varying speeds? Notice that if you distinguish “fast” arithmetical calculation from “slow,” you’re imposing a fairly arbitrary dichotomy on the range of speeds at which people calculate a given solution as speed is represented with numbers. It is possible that for some  $n$ , arithmetical calculation done at speeds of  $n$  and below is (typically?) housed in one neurological structure (System 2), but if you speed up your arithmetic, this involves a transference of activity to a surgically distinct region (System 1). That might be a two systems hypothesis with regard to arithmetic. In the book, I remain as agnostic as possible with regard to all modularity hypotheses. As I said in class, I think surgical dissociability is the paradigm of modularity within a subject. (It’s a priori possible that subjects differ with regard to modularity so defined.) Fodor proposed a number of criteria, which Carruthers and others have tried to relax. There is an enormous literature on this in perceptual science, which has had a great deal of discussion of top-down effects: the influence of expectation on experience and the sense in which

this is (or is not) incompatible with the modularity of vision and other forms of sense perception.

The phenomenology: When you have to focus on a calculation and think hard, you calculate more slowly with a feeling of effort. When you calculate a simple sum, you do it more quickly with less effort.

A little bit of theory: Given that the mind is the nervous system, we should expect these phenomenological facts to have some underlying neural reality. So there should be a detectable difference (perhaps in blood flow detectable with fMRI) between a person's easy and hard calculations once she's learned these operations sufficiently well.

First questions: Is this difference itself what is meant by a two processes theory of calculation? Is a dual process account vindicated if enough processes have faster and slower varieties, where difference in speed has some neurological reality? Why talk of two kinds of processes rather than several processes that can be performed at different speeds? Doesn't talk of two calculative processes suggest that they're realized in surgically distinct structures? Does this distinction distort our thinking about the mind?

Question: There is a two systems theory for mathematical representation that argues representations of quantity are realized in a structure distinct from cardinality. And numbers 3 and below are supposed to be represented in distinct structures than those for cardinalities greater than 3. See Stan Dehaene, *The Number Sense*, for a popular presentation of this research. How does the dual process theory of arithmetical calculation interact with these fissures within a subject's overall "number sense" or numeracy?

**Main questions going forward:** (1) How should we define or interpret the idea that there are two cognitive processes or even two systems involved in a given domain of cognition? (2) What's the evidence for the dual process theory of arithmetic computation or the dual process approach to any other mental process once we've interpreted it as it is meant to be understood?

(2) Our particular interest is in dual-process accounts of human reasoning and related higher cognitive processes, such as judgment and decision-making.

Criticism: These aren't cognitive processes in their own right but exceedingly general terms for various kinds of process. Think of all the different aesthetic, social, moral, perceptual, memorial and introspective judgments you make on any given day. There is incredible diversity in both content and phenomenology here. There is no reason at all to think, in advance of measuring blood flow, that there is a surgically distinct region dedicated to this hodge-podge of judgment generating processes. The same goes for decision-making. And calling them "higher" is an evaluation that has no basis at all in science. It's just used to put down young children and other animals. We can name the processes without ranking them in "elevation." Science is supposed to eschew this kind

of evaluation. Maybe Evans and Stanovich mean something non-evaluative by “higher.” But then they should say what they have in mind.

(3) As the popularity of dual-process and dual-system theories has increased, so too have the voices of criticism, as illustrated in the opening quotations. Critics have pointed to the multitude of dual-processing accounts, the vagueness of their definition, and the lack of coherence and consistency in the proposed cluster of attributes for two- system accounts. They have questioned the evidence on which such claims are made and have argued that single-process accounts can explain the data (Gigerenzer & Regier, 1996; Keren & Schul, 2009; Kruglanski et al., 2003; Kruglanski & Gigerenzer, 2011; Osman, 2004). Here we collaborate for the first time to respond to these various critiques. It is important that we do so, as although a number of these criticisms have some force to them (and have been acknowledged in our own recent writing), we believe that the dual-processing distinction is nonetheless strongly supported by a wide range of converging experimental, psychometric, and neuroscientific methods. ....we do not set ourselves the impossible task of defending some generic received version of dual- process theory that the critics apparently have in mind. In fact, we agree that many of the problems they discuss do, indeed, apply to a number of applications of dual-process theories. Instead, our purpose is to show that there is a clear empirical basis for a **dual-process distinction** in the fields of reasoning and decision making that can withstand the various arguments that are being set, by implication, against it.

Question: What is meant by “a dual processing distinction”? Are there several? What makes a distinction a dual process distinction? Does anyone who distinguishes calculation from, say, imagination count as endorsing the dual process theory because that theory just entails that we engage more than one kind of cognitive process when thinking and engaging in motor activity? Memory search differs from imagination and calculation. So does linguistic interpretation. Evans and Stanovich admit that there are many cognitive processes. If they also admit that the operation of each such process can be classified in terms of speed, automaticity, control, affective salience etc., and they admit that each of these qualities admits of degree so that distinctions between e.g. “fast” and “slow” are less informative than the quantitative scales on which they’re imposed, what is left for “dual process” to denote? They even admit that the terminology is bad. Isn’t that another way of saying that the whole approach was misguided from the start? (Note that they do not say this.)

(4) Authors have proposed that two forms of processing are competing or combining in order to produce the behavior observed. We shall call these

Type 1 and Type 2 processes here, corresponding roughly to the familiar distinction between intuition and reflection.

Criticism: Why not just then say that there is such a thing as intuition and there is such a thing as reflection and that reflection and intuition are not the same thing? What is added by saying that there are type 1 and type 2 processes? This isn't even shorthand for the folk psychological distinction between an initial intuition or intuitive response to some question or problem and reflection on that response and its coherence, adequacy etc. Instead, holding on to talk of "dual processes" obscures the folk psychological distinction on which it is grafted with needless terminology that is in fact connected in the minds of those who have been reading this literature to the clustering theory (e.g that automaticity goes with hot affect and animal thought and reflection with cold affect and uniquely human discursive or linguistic thought). The authors can't just shrug off the history of these terms as Evans, Stanovich and others first introduced them. I know that in moral psychology, where Jon Haidt has introduced a dual systems theory, that most readers and authors haven't gotten the news that Evans, Stanovich (and as I say in the book) Kahneman have all given up on these clusters. **Why don't Evans et al say there aren't two systems but there is a distinction to be drawn between the processes that yield intuitive judgments and those that yield reflective judgments?** Is it because this distinction is already a common place in the history of western thought and so something for which they cannot claim credit? All the philosophers in the canon distinguish intuition from reflection. It has become part of common sense.

(5) Some authors have gone further, suggesting that there are two evolutionarily distinct brain systems responsible for these two types of processing (see especially Epstein, 1994; Evans, 2010b; Evans & Over, 1996; Reber, 1993; Stanovich, 1999, 2004).

Comment: Notice that Evans and Stanovich are citing themselves here.

Such theories generally inherit the Type 1 and 2 feature lists but add additional characteristics, such as the idea that there is an evolutionarily old and animal-like form of cognition and also a recently evolved and uniquely (or distinctively) human system for thinking. Following Stanovich (1999), these are often referred to as Systems 1 and 2 or sometimes as an old and new mind (Evans, 2010b; Stanovich, 2004). For a glossary summarizing the meaning of several terminological distinctions used in this article, see Table 2.

Comment: Compare with Frankish's table on Zak's handout.

In this article, we will focus our discussion on the main list of Type 1 and 2 processing features shown in Table 1, which are also referred to by

some authors as System 1 and 2 attributes. However, the discussion of the more broadly based two-minds hypothesis and the additional features shown at the bottom of Table 1 is beyond the scope of the current article.

Comment: Note that Evans is now abandoning the more ambitious claims and he and Stanovich cite above. So this article does not defend the two systems approach endorsed by Frankish and used by Frankish to introduce his theory of mind and supermind, which is in turn used to distinguish human belief from animal (quasi) belief. Note that Frankish hasn't said "Evans and Stanovich no longer believe in two systems so I am now changing the philosophy of mind I predicated on their science. I, Frankish, no longer believe in the mind/supermind distinction." More cautiously, I do not know of any such retraction on Frankish's part. And Evans and Stanovich revert to positing two systems at various points in this essay, and they end up trying to posit a distinction in kind between human minds and other animal minds, so their retraction is partial

(6) Over a decade ago, in order not to show a preference for one particular theory, Stanovich (1999) used the generic terms *System 1* and *System 2* to label the two different sets of properties. Although these terms have become popular, we both have recognized problems with this terminology in our recent writing (e.g., Evans, 2010a; Stanovich, 2011). First, the term *dual systems* is ambiguous as it can sometimes act as a synonym for a two-minds hypothesis but has been used by other authors to convey little more than a distinction between two types of processing (e.g., Kahneman, 2011; S. A. Sloman, 1996). Second, this terminology may appear to suggest that exactly two systems underlie the two forms of processing, which is a stronger assumption than most theorists wish to make. For these reasons, we both have recently discontinued and discouraged the use of the labels System 1 and 2 (e.g., Evans, 2010a; Stanovich, 2004, 2011).

Comment: This is a major concession and (as I argue above and in the book manuscript where I focus on Kahneman because he is best known) it may rob the theory of its extra-intuitive or extra-folk-psychological content. We all distinguish mental and physical tasks in terms of effort, control, automaticity, etc. That tasks differ in this way is a tenet of folk psychology. When it's weakened in response to criticism, how does the Evans/Stanovich picture differ from the folk psychological one? Is it instead just that they're arguing that these folk psychological truisms have some neurological basis? Why not then say that? What does talk of two types of thinking add to commonsense views about control, attention etc and their relation to judgment?

**LET'S TALK ABOUT THIS NEXT PASSAGE:**

(7) We also believe it is essential to avoid confusion between dual *types* and dual *modes* of thinking (Table 2; see Evans, 2010a). Modes of processing are cognitive styles and are manifest within the domain of what we regard as Type 2 thinking. Unlike types, they typically represent two poles of a continuum of processing styles. The confusion between modes and types is at the core of one of the main criticisms of dual-process theories, which we discuss later.

Comment: This is interesting. Evans and Stanovich seem to be saying that any cognitive process that admits of degree in terms of effort, occupation of attention, etc (i.e. whatever piece of their previous cluster they choose to pick) is therein to be considered a type 2 process. So you can listen more or less attentively. Your interpretation of what someone has said can be more or less automatic or effortful. So that would imply that linguistic comprehension is type 2. And that would signal a break with Kahneman, who in his recent work says that the cognition subserving “small talk” is type 1. This is a point at which Evans and Stanovich really do make a claim that goes above and beyond common sense or folk psychology. But it seems pretty unintuitive as stated. Almost every type 1 process seems to admit of degrees of effort and automaticity. E.g. you ordinarily see things just by looking toward them in good light, but sometimes you have to strain to make out a figure or disambiguate a shape. We talk of seeing something “with effort”. Are Evans and Stanovich really denying that there is an underlying neurological reality to this? That would require a major “error theory”.

(8) A change in terminology is not the only corrective we have recommended for dual-process theories.

The change in terminology is hard to distinguish from a change, indeed a complete abandonment, of the theory as initially proposed and elaborated for twenty years or so.

(9) We are aware that what we call the “received” or generic form of dual-system theory clusters attributes (see Table 1) in ways that are not always sustainable. We will argue that only the features italicized in Table 1 are defining characteristics of the two types of processing. Specifically, Type 2 processing is distinguished from autonomous Type 1 processing by its nature—involving cognitive decoupling and hypothetical thinking—and by its strong loading on the working memory resources that this requires....Evans has maintained that Type 2 thinking engages a singular central working memory resource, whereas Stanovich has emphasized that a decoupling operation involved in all tasks with substantial Type 2 processing is highly correlated with fluid intelligence....The assortment of autonomous processes that fail to meet these definitions are described as Type 1. Hence, Type 2 processing has a more consistent and coherent

definition, whereas the nature of Type 1 processing can vary considerably between different dual-process theories and applications.

**Criticism 1:** This is a completely different theory than that initially proposed by the authors. And it is hard to see why it deserves to be called a “dual process theory.” Nor does it bear an obvious connection to the theory as it was originally propounded and taken up by subsequent authors to become the dominant paradigm in social and cognitive psychology. I think the authors should just admit their theory was false and that they now want to propose a distinct explanation of the data. That would be courageous.

**Criticism 2:** The new theory draws a connection between several theoretical concepts. It is entirely unclear how it relates to observation and folk concepts. We need theories of cognitive decoupling and working memory in order to evaluate the defining claim that these phenomena mark a kind of thinking that is distinct “by nature” from thinking which involves neither working memory nor cognitive decoupling. And we need to know something about what the authors have in mind by “distinct in nature” if this is not to entail surgical dissociability. I wonder if their main claim is like that described in quote 7 above: that utilization of working memory does not come in degree or that cognitive decoupling (division of attention) does not come in degree.

(10) We are, in fact, very concerned that casual assumptions about the attributes of Type 1 and 2 thinking by even sympathetic authors may be damaging to the progress of dual-process research (for recent examples of our comments on this, see Evans, 2012; Stanovich, West, & Toplak, 2011). ...We agree that the proliferation of dual-process labels has not been helpful. Not only are there many such labels— for example implicit/explicit, associative/rule-based, impulsive/reflective, automatic/controlled, experiential/ rational, nonconscious/conscious, intuitive/reflective, heuristic/analytic, reflexive/reflective, and so on—but each carries with it some semantic baggage. Reading such a list tempts readers to align all of these so that, for example, it seems that one kind of thought process must be conscious, controlled, reflective, and rule-based, whereas another is nonconscious, automatic, impulsive, and associative. We agree that this is the “received view” shared by a number of supporters as well as critics of the paradigm. This received view seems to have arisen inadvertently from the attempt by various authors, including previously ourselves, to group various dual-process theories together (Evans, 2003; Smith & Collins, 2009; Smith & DeCoster, 2000; Stanovich, 1999). Although this seemed a good idea at the time, we can see now the problems that seeking a family resemblance has caused. We agree with the critics that the proliferation of dual-process theories and labels has been confusing and that many of the distinctions are hard to

pin down when examined closely. That is why neither of us have relied on such labels or distinctions in our recent writings as defining characteristics of the two types of processing.

**Criticism:** Isn't the best way to fix this to explicitly disavow the two systems theory given its initial formulations, which continue to command adherents? If the authors admit the terminology is misleading and the content of the theory largely false, why not represent themselves as abandoning it for another theory? In a more philosophical vein: what are the criteria with which we individuate one theory from another? Are there any reasonable criteria on which the neurological reality of a distinction between processes that use working memory and processes that don't is itself vindication of some "dual process" distinction given the history and current use of this term? Isn't it less confusing to say that there are many cognitive processes and they utilize "working memory" in different ways and to different degrees? What's then left for talk of "dual processes" to denote?

(11) It may be convenient for critics to give the impression that all dual-process theorists appeal to the same two systems (especially Keren & Schul, 2009), but this is simply not true. A true dual-process theory that distinguishes two *types* of process will, by our definition, imply the engagement of distinct cognitive and neurological systems. However, this does not mean that all dual-process theories are appealing to the same underlying systems with the same proposed cluster of attributes. Both of us have argued against the sustainability of the System 1 and 2 distinction (Evans, 2006; Stanovich, 2004) prior to many of the critical reviews (e.g., Keren & Schul, 2009; Kruglanski & Gigerenzer, 2011; Osman, 2004). Moreover, some so-called dual-process theories are really concerned with what we have defined as dual modes of processing (see Table 2).

**Criticism:** This is uncharitable to Keren and Schul. They do not single out Evans and Stanovich. They point to many theorists who do defend these clusters. And their critique is aimed at the family of theories, neither Evans in particular nor Stanovich in particular. Of course, we should give Evans and Stanovich some credit for realizing the mistakes in the theories they defended for 20 years, and that came to predominate in the discipline as a whole – but as I argue above, they would deserve much more credit were they to admit that dual process theories are false. They can then say they have a new theory (about the relative role played by working memory in various cognitive processes) that they now want to defend. The new theory is too dissimilar from the theory they defended and disseminated to be appropriately conceptualized as the same theory with a few tweaks here and there. Keren and Schul did a great service in criticizing a set of theories that still dominates the scene in my own specialization (moral psychology). Evans and Stanovich should give Keren and Schul the credit due them for their critique.



(12) Critics (see especially Kruglanski & Gigerenzer, 2011) do, indeed, talk as though all correlated features of dual processes discussed by theorists must be necessarily and invariably observed together and that any observed counterexample will provide a falsification of (apparently) any dual-process theory. There are two reasons for regarding this as a straw-man argument (Stanovich & Toplak, 2012).

Comment: I agree with this, which is why I say in the book that the issue is whether clustering failures are the exception to the rule or not. But the entire section of this article labeled “Defining versus correlated features” is written from an aggrieved perspective as if Evans and Stanovich were not themselves responsible for introducing these clusters and arguing for them. Again, if they really want to stop the next generation of theorists from adopting the working assumption that these feature-clusters delimit two distinct systems or process types, they should just say that the dual systems and dual process theories are false. We can then evaluate their new theories regarding the role of working memory in various cognitive processes. **You don’t get special credit for admitting your presentation was misleading when you continue to represent yourself as having been largely (if not exactly) right all along.**

(13) But all of these dichotomies were never necessary to establish the two types of processing. The only thing needed is at least one dichotomous property that is necessary and sufficient. In a later section of this article, we discuss our preferred candidates for the defining features of Type 1 and Type 2 processing.

A CHANGE I AM MAKING: I say in my book manuscript that several dual process theorists now reject the clusters and focus on just one or two of the initial set of dichotomies and then I go on to discuss Kahneman’s recent theorizing along this line. I do not cite this article by Evans and Stanovich, nor do I say that they join Kahneman in having changed their approach in this way. **And I definitely should do so. So I thank Seyed for correcting that omission by quoting from this article in our last meeting.**

(14) The fact is that some authors (including both of us) have recognized the distinction between defining and correlated features in their writing, whereas others have not.

Comment: This is naïve. The authors need to acknowledge that no such distinction can be drawn a priori, because the analytic/synthetic and essential/accidental distinctions are themselves matters of degree. See Quine, Two Dogmas of Empiricism for the classic presentation of this critique.

(15) Perhaps the most persistent fallacy in the perception of dual-process theories is the idea that Type 1 processes (intuitive, heuristic) are

responsible for all bad thinking and that Type 2 processes (reflective, analytic) necessarily lead to correct responses.

Comment: Yes. This is incorrect as Kahneman and others have long allowed that intuitions are often more reliable than judgments reached through effortful, attention-consuming reasoning or reflection. Perhaps the most effective advertisement for this idea was Malcolm Gladwell's best-seller "Blink." I have never accused two systems theorists of this error, though I will say that this way of thinking has been promoted by many dual systems theorists who cast aspersions on intuition: e.g. Jon Haidt's way of presenting his research on the role of disgust in moral judgment. Evans and Stanovich actually criticize Gibbard here.

(16) Thinking dispositions [e.g. care in evaluating evidence] are not expected to be differentially associated with Type 1 or Type 2 processing, as implied in some writings.

Comment: Yes, which is why I do not go into this proposed distinction in the book.

(17) We agree that all behavior attributed to Type 1 and 2 processes by dual-process theorists can be described using rules and modeled by computer programs. But no, we do not agree at all that this means there is no basis to the claimed differences between the two kinds of processing.

Comment: Yes, which is why I do not go into this proposed distinction in the book.

## Section II

Evans and Stanovich devote the last 5 pages of the article to the evidence. Let's look at it.

(1) Kruglanski and Gigerenzer (2011) claimed that research in the belief bias paradigm simply shows rule conflict and provides no evidence for dual processing. What Kruglanski and Gigerenzer overlooked, however, is the kind of evidence that does, in fact, make the case for qualitatively distinct types of processing in this paradigm. This has actually been shown using all three major types of methods. For example, in the experimental approach, belief bias has been shown to be increased and logical accuracy decreased when people operate under time pressure (Evans & Curtis-Holmes, 2005) or concurrent working memory load (De Neys, 2006b), both of which are assumed to inhibit Type 2, reflective reasoning. If these manipulations were simply making the task more difficult, then we might expect guessing and random error.

Criticism: Huh? Why "might" we expect random guessing when the task grows more difficult? That makes no sense at all. Why not expect use of evolved heuristics as Gigerenzer et al have long maintained?

**Background:** Deductive validity and invalidity are technical concepts introduced in studies of formal logic. As you know, a valid argument can be really “bad” in the ordinary sense of that term. Psychologists have shown that people are more likely to regard deductively invalid arguments (in the technical sense of invalidity) as valid (in the technical sense) when these arguments have believable conclusions. This is called “belief bias.”

**Moreover:** Studies show that belief bias is greater when people are forced to evaluate arguments more rapidly or are distracted with another stimulus or task while evaluating these arguments.

**Critique:** How does this support the claim that there are two distinct processes that we can engage to evaluate an argument? Isn't it compatible with the view that the more attention you devote to the evaluation of an argument, the better you can bring your (technical, learned, academic) understanding of deductive validity to bear on the task? It is mysterious to me why Evans and Stanovich think this body of result supports the Dual Process view over one which invokes degrees of attention to the question asked and control over the subject's response to it. Introspectively, this is what is going on. You can catch the trick if you focus carefully on the question (Is the argument valid rather than “good” in a more generic sense?) and control your response (so as not to label it invalid because it “sounds like crap reasoning” despite its lovely formal features).

(2) De Neys (2006a) showed in one experiment that participants making the conjunction fallacy on the famous Linda problem (Tversky & Kahneman, 1983) responded quicker than those who did not. In a second experiment, they showed a sharp decrease in correct responding on this task when a concurrent working memory load was used. Also, on the Wason selection task, the intuitive “matching bias” (Evans, 1998), which accounts for typical responding (see Fig. 2), is found to be increased by use of speeded tasks (Roberts & Newton, 2001) or concurrent working memory loads (De Neys, 2006a).

**Background:** In the Linda task, Linda is described as a left wing philosophy major and people are asked to evaluate the probability of Linda's being a bank teller and the probability of Linda's being a bank teller and a political activist. A large number rank the probability of the first statement lower than the probability of the latter especially when they are mixed in with a bunch of other statements. According to (normative) probability theory this is impossible as a conjunction cannot be more probable than its conjuncts. On Kahneman's diagnosis, this error occurs because people substitute representativeness for probability — Linda is more like your average feminist bank teller than your average bank teller even though Linda's being both a feminist and a bank teller cannot be more probable than her being a bank teller. Kahneman and Tversky hypothesize—quite reasonably and in accord with phenomenology—that thinking in terms of representativeness is easier than thinking in terms of probability.

**Criticism:** Same as above. How is this evidence for two types of process? Intuition differs from reflection. And you need reflection to bring to bear your academic,

technical, learned knowledge of probability theory. When you don't do this—because your attention is divided or speed is required—you answer on the basis of representativeness. How do Evans and Stanovich reason from this to the dual process theory on either its former or current interpretations? You need to keep your knowledge of the case in mind to render any verdict at all. So it would be weird for them to say that working memory is absent when you render the intuitive (normatively incorrect) response. But it's intuitive that you need more background knowledge (about probability theory) to correct intuition. The case certainly helps motivate a distinction between intuition and reflective response. But, again, that's a folk psychological distinction not accurately described as a vindication of any sort of dual process theory.

As Evans and Stanovich write,

It has been known for some years that instructions to reason in a deductive or pragmatic manner can have a big influence. For example, in drawing classical conditional inferences, such as Modus Ponens and Modus Tollens, participants are influenced by the degree to which they believe the conditional statement, often leading them to withhold a valid inference when it is unbelievable (e.g., George, 1995; Stevenson & Over, 1995). However, belief-based responding is clearly attenuated when strong deductive reasoning instructions are used. Belief biases are observed to be less commonly manifest in those of higher cognitive ability (Evans, Handley, Neilens, Bacon, & Over, 2010; Stanovich & West, 1997), who are, by the theory, more able to engage effective Type 2 thinking. But those of higher ability will reason better only if motivated and disposed to do so (Stanovich, 2011). Accordingly, an important interaction has been demonstrated: Higher ability participants will suppress belief biases only when specifically instructed to reason logically and draw necessary conclusions (Evans et al., 2010).

Comment: I agree with some of this, but we need to be very careful in our analysis of measures of higher IQ or higher intelligence or “higher ability.” Is it possible that scoring higher on these tests “increases the probability” that you will learn logic or probability theory and therein become less susceptible to these “framing effects”? Also, notice that nothing about dual processes was said to explain what is going on here. Higher IQ is not a process. IQ tests measure a suite of abilities: i.e. those involved in reading, interpreting, reasoning, imagining, intuiting, reflecting and whatever else goes into a subject's answering the question posed on an IQ test. It is misleading that Evan and Stanovich then introduce the type 1 and type 2 labels to explain related results without arguing that this is helpful much less necessary to explain subjects' responses to the Linda cases etc.

Similarly, De Neys, Schaeken, and d'Ydewalle (2005a, 2005b) have shown that although participants of higher working memory capacity are better able to retrieve counterexamples to all conditional inferences, they use these selectively to block fallacies but not valid inferences when instructed to reason logically. Type 2 reasoning may also be biased by beliefs but in a different manner from that affecting Type 1 processing. Although the latter kind of processing produces a response bias to endorse believable conclusions, Type 2 processing motivates selective search for supporting and refuting models of the premises (Evans et al., 2001; Klauer et al., 2000)

Comment: Of course I predict we, as philosophers, will welcome this analysis. If coming up with counter-examples is the test of general IQ, Gettier is Einstein and philosophy is the best route to “greater ability.” But come on. There’s no reason to privilege this capacity in the way proposed.

(2) Neural imaging is an increasingly popular method for testing dual-process hypotheses in both the psychology of reasoning (Goel, 2008) and social cognition (Lieberman, 2007a, 2007b). Although the studies are still relatively few in number, they generally provide strong support for the claims of the dual-process theorists. Again, belief bias has received particular attention, and studies support the qualitative distinction between belief and reason-based responding.

Critique: Unlike surgical dissociability, differences in blood flow cannot support the hypothesis that there is a difference in kind or system rather than a difference in degree. One can say that the more blood flow of the relevant sort is symptomatic of focusing more attention or exerting more control over a process. There’s nothing “dual” about this claim.

(3) Neural imaging studies have shown (a) that belief–logic conflict is detected by the brain and (b) that when reason-based responses are observed, different brain areas are activated than when responses are belief-based (De Neys, Vartanian, & Goel, 2008; Goel & Dolan, 2003; Tsujii & Watana- bee, 2009) than when they are responsive to the logic of the problems. ... These findings are entirely consistent with default-interventionist forms of dual-process theory, which we discuss further below.

Critique: This suggests that reflection utilizes areas (eg PFC etc) that are underutilized when rendering intuitive judgment. Again, this is neurological vindication of a folk psychological distinction between answering with the first thought that comes to mind and reflecting on the answer and evaluating it against the rest of what one knows. Is this all that it takes to support a “two systems” hypothesis? **Consistency with dual process theories is not evidence for dual process theories. When they imply otherwise, Evans and Stanovich are using the oldest trick in the social science book.**

(4) For example, McClure, Laibson, Loewenstein, and Cohen (2004) reported that distinct neurological systems were associated with monetary decisions made on the basis of immediate or deferred reward. In our dual-process theories, the latter would involve mental simulation of future possibilities and hence require Type 2 processing.

Critique: There is a folk psychological, intuitive distinction between (a) calculating long term costs and benefits and choosing on the basis of this calculation, and (b) choosing what seems best here and now. A vindication of the neurological reality of this common sense distinction is compatible with all psychological theories that minimally respect introspection or folk psychology until it is shown incoherent or demonstrably false. Hence the demonstration of the neurological reality of this distinction cannot be used to favor dual process theories over other academic theories. **Note that Evans and Stanovich do not describe alternative theories and argue that the evidence favors**

**their theory over these others. They therein fail to observe important canons of scientific argumentation.**

(5) Similarly, in a study of decision making involving moral dilemmas, Greene, Nystrom, Engell, Darley, and Cohen (2004) found that when consequentialist moral reasoning overrode deontological reasoning, participants took an inordinately long time to make their responses. More important, Greene and colleagues found that the areas of the brain associated with overriding the emotional brain—the dorsolateral prefrontal cortex and parietal lobes—displayed more activity on such trials. What was happening with these individuals was that they were using Type 2 processing to override Type 1 processing coming from brain centers that produce emotion.

Critique: This is my central area of research as I have actually taught Greene’s work and written on it a little bit. I don’t want to go into details here but I think this is a grossly inaccurate depiction of what is known about the neurology of moral judgment. It is not in general true that consequentialist reasoning is less affective than deontic. Instead, damage to vmPFC is correlated with heightened retributivist emotions and lessened sympathy.

(6) In a recent essay, Lieberman (2009) has made an important theoretical argument for the reality of the dual- processing distinctions supported by these studies. In common with many other social psychologists, he uses the questionable nonconscious-conscious distinction, but we believe that the logic of his argument nevertheless applies to the Type 1 and 2 debate. He suggests that if Type 2 thinking (which he associates with conscious processing) were epiphenomenal and actual processing based on a unitary mechanism, this might be indicated in a couple of ways. For example, (a) people might become conscious of an activity when the same neural regions were activated to larger degree; or (b) it could be that regions associated with consciousness might be activated independently of other regions that did the actual work on the tasks. But neither hypothesis is supported by his studies and those he reviews. Instead, activities described as involving implicit social cognition (e.g., stereotypical thinking) involve activation of different neural regions than those associated with conscious reasoning. Earlier, we cited evidence that this is the case also in the belief-bias paradigm. Lieberman reviewed evidence from a wide range of different tasks in the cognitive and social literatures that provide parallels, even providing evidence for mutual inhibition when one kind of processing—and associated neural structures—takes over from the other.

Criticism: Eh? Evans and Stanovich are moving the goal posts. First, the relevant alternatives to dual process theories are not limited to epiphenomenalism regarding reflection or “conscious thought.” Second, Lieberman is arguing for **two systems**, which Evans and Stanovich said they are not trying to support here. Obviously we’d have to read Lieberman to assess his case for this hypothesis.

(7) After describing how some people do reason in the normatively “correct” way described by logic and probability theory, Evans and Stanovich write,

Earlier, we argued that normativity is not a defining feature of Type 2 processing. However, the dual-process theories that we support do predict that it will be a strong

correlate in experiments using tasks that are hard to solve directly from previous experience or from previously stored cue validities.

**Question:** How is that? How do these theories secure this “prediction” without an analytic tie between type 2 processing and normative correctness?

(8) Explicit processing effort and hypothetical thinking (or cognitive decoupling) are generally required for success. It follows that those who are better able (by cognitive ability) or better motivated (by thinking dispositions) will be more likely to find the normatively correct answers. And that is generally what the evidence shows.

**Critique:** This is common sense, not evidence for two types of thinking unless that is itself just marking a distinction between intuition and reflection on it.

(9) What has been found, more often than not, is that intelligence displays positive correlations with the response traditionally considered normative on the task and negative correlations with the modal response (Stanovich & West, 1998b, 1999; Toplak, West, & Stanovich, 2011; West & Stanovich, 2003; West, Toplak, & Stanovich, 2008).

**Critique:** This is unsurprising given that tests of intelligence are generally tests of reflective intelligence: i.e. questions are intentionally constructed by their authors so that their correct answers do not align with immediate intuition.

(10) In a large range of tasks, the modal and “thoughtless” response (Kahneman, 2011) is a systematic intuitive bias of some kind (see Stanovich, 2011, for a systematic taxonomy of many such tasks). A unimodel theorist might retort that these are lower effort “rules” (Kruglanski & Gigerenzer, 2011) to which their single-system resorts when the high-effort strategy is blocked, for example, by a speeded task or working memory load. However, we are aware of too much specific evidence of qualitative differences between reasoned and intuitive responding to find this argument plausible (see, for example, Kahneman, 2011). Also, when given the opportunity, most participants can explain the reasoning that led to a correct answer, but we are not aware of a single instance of a participant reporting an established bias like belief bias or matching bias (Evans, 1998) as the basis for a wrong one. On the contrary, participants giving a matching response on the Wason selection task are known to rationalize their answer with reference to the logic of the task (Evans & Wason, 1976; Lucas & Ball, 2005; Wason & Evans, 1975). And, as already mentioned, the two kinds of answers are associated with different neural regions and differentially correlated with cognitive ability.

**Questions and criticism:** I am having a tough time figuring out what is going on here. More specifically, (A) why do Evans and Stanovich think that the dual process theory predicts that normative errors won’t be random, and that other approaches don’t have this prediction? I can’t see anything in their old or new definition of “dual process distinction” that bears this out. (B) Since they no longer utilize the clusters, and they no longer define system 2 in terms of introspective awareness of process, they cannot use the fact that people can introspectively identify the source of their reflective answers but not

their intuitive responses to argue for a dual process interpretation of cases in which intuition yields error unless corrected by introspectible, effortful reflection and reasoning. The alternative I like is that suggested by Gigerenzer and other evolutionary psychologists who are critics of dual process theory. We have evolved a large set of heuristic processes that yield intuitive judgments along with capacities for reflection and discursive reasoning. Intuitions have a number of different sources and are adaptive and largely accurate in their proscribed domains. Knowledge of normative logic and probability theory requires language and discursive thought and its use to correct intuition in situ requires effortful reflection on intuition. Is this just a version of the dual process account? Not according to Gigerenzer, but it's hard to tell now that Evans and Stanovich have redefined the theory in theoretical terms that have little relation to their original formulations. At any rate, I don't think this view of the mind can be described as a "dual process theory" without courting miscommunication. There is nothing "dual" about it except for its distinguishing reflection from the processes that yield the intuitive responses we reflect upon and check for coherence.

(11) The large literatures on working memory and executive function (Baddeley, 2007) have established that there is a general purpose system used in many higher cognitive functions and that the capacity of this system varies reliably between individuals.

**Criticism:** Even advocates of the concept of working memory as a unitary system admit that the jury is still out. And most researchers have abandoned use of "executive function" as too vague and general to be useful. People do differ in their capacity for **reflection** and their propensity to reflect, which propensity varies with context. (We reflect in philosophy seminar more than we do on the athletic field.) This is all highly intuitive and deeply embedded in common sense or folk psychology.

(12) It is the engagement of this system specifically that Jonathan Evans (e.g., 2008, 2010a) has emphasized in the definition of Type 2 processing and which underlies many of its typically observed correlates: that it is slow, sequential, and correlated with measures of general intelligence. He has also suggested that Type 2 thinking enables uniquely human facilities, such as hypothetical thinking, mental simulation, and consequential decision making (Evans, 2007a, 2010b).

**Criticism 1:** The jury is still out on whether the other animals have knowledge of each others minds and use counterfactual thinking to solve challenges in their ecological contexts. See octopuses, ravens etc for evidence against what Evans and Stanovich say here. And how slow is slow? Is there a speed at which we shift from one "kind" of process to another when calculating, etc? What does this even mean once distinctness is divorced from surgical dissociability? The other animals don't construct sentences and lack whatever capacities this ability has brought with it. Let's see what the other animals do before we decide they lack this or that capacity or propensity.

**Criticism 2:** We differ from the other animals in linguistic or discursive ability and propensity. Evans and Stanovich also say we differ from them in our use of working memory or capacity and propensity for reflection and correction of intuitive response or



control of attention if this is not just the definition of working memory. **It is a substantive hypothesis that discursive ability clusters with control of attention and propensity for reflection on and correction of intuitive response. Are they now committed to this cluster? I argue in the book that discursive processes do not invariably require higher levels of attention and control than comparable processes utilized by the other animals. I take this to be an argument against the cluster Evans and Stanovich implicitly assert here.**

(13) Keith Stanovich, together with his collaborator Rich West, has focused much of his research program on individual differences in both cognitive ability (linked with IQ) and thinking dispositions, showing selective correlations with responses on a wide range of reasoning and decision-making tasks (Stanovich, 1999, 2009b, 2011; Stanovich & West, 2000). ... Because working memory capacity and general intelligence are known to be highly correlated, this framework is easily reconciled with Evans's emphasis on the engagement of working memory in Type 2 processing. Stanovich (Stanovich, 2011; Stanovich & Toplak, 2012) has also strongly emphasized the features that he calls "cognitive decoupling" in his definition of Type 2 processing. This is again compatible with Evans's (2007a, 2010b) view that such processing is necessary for hypothetical thought. In order to reason hypothetically, we must be able to prevent our representations of the real world from becoming confused with representations of imaginary situations. The so-called cognitive decoupling operations are the central feature of Type 2 processing that makes this possible according to Stanovich (2009b, 2011).

Criticisms: Yup. As I said in class, this dual process approach goes back to IQ tests and attempts to show that there is such a thing called general intelligence and it is highly correlated with accurately deploying (academic) understandings of validity in deductive argumentation, (academic) understandings of probability etc. What has been correlated is normative and technical on all sides of the proposed correlation and definition: general intelligence and working memory are correlated and used to define type two processing which is tested in terms of answers you give when you have learned the cultural achievements we call "model theoretic semantics" and "probability theory." This is all very suspicious. Note that no experiments are described here, as the relation of observation to equations and definitions drawn with technical terms in this way is highly indirect. Is it even falsifiable? Only if we can mount an argument for rejecting this entire paradigm in favor of another. That's one of things I'm trying to do with my attempts to revive James' pragmatism.

(14) We both agree that the defining characteristic of Type 1 processes is their autonomy. They do not required "controlled attention," which is another way of saying that they make minimal demands on working memory resources.

Comments/Criticisms: Okay, now we actually get a definition of working memory in terms of controlled attention. And I agree that there are cognitive processes that you execute without needing to attend (much) to the stimuli or exert (much) control over your response to them. Is that enough for me to accept the existence of type 1 processes? If so, I believe in them, though I continue to insist that this terminology is misleading and

doesn't add anything to the folk psychological description onto which it is grafted. **But I thought Evans and Stanovich were insisting on something more here. For any given type 1 process so defined, they have claimed above that there is no distinction to be made between the focus of more or less attention to the stimuli that initiate that process nor the exertion of greater or lesser control over the response to that stimuli the process delivers. And I am very suspicious of that claim given the existence of effortful perception etc. But do Evans and Stanovich even stand by this claim of difference in kind rather than degree? No. They immediately walk it back.**

(15) These disparate categories make clear that the categories of Type 1 processing have some heterogeneity— encompassing both innately specified processing modules or procedures and experiential associations that have been learned to the point of automaticity. The many kinds of Type 1 processing have in common the property of autonomy, but otherwise, their neurophysiology and etiology might be considerably different. For example, Type 1 processing is not limited to modular subprocesses that meet all of the classic Fodorian (Fodor, 1983) criteria or the criteria for a Darwinian module (Cosmides, 1989; Sperber, 1994). Type 1 processing also encompasses (general) processes of implicit learning and conditioning. Also, many rules, stimulus discriminations, and decision- making principles that have been practiced to the point of automaticity (Kahneman & Klein, 2009; Shiffrin & Schneider, 1977) are processed in a Type 1 manner.

**Question/Criticism:** What if you're mid-way in the process of, say, learning your multiplication tables by rote? Is multiplying at this point type 1 for you or type 2? I think this is a bad question that only seems to make sense because of the bad theory in which it is couched. The real underlying distinction is one of degree in terms of two somewhat disparate phenomena: focusing attention on the task and exerting control over your response to the multiplication question posed. You need less attention and control as you get better at it but there is no point at which it requires **no** attention or control. E.g. if we load on distracting tasks, (driving, knitting, talking on the phone, adding, etc) there will be a point at which you can no longer multiply whereas you will continue to breathe, beat your heart and so on for all the fully autonomic neurologically controlled activities you perform at that time. Are Evans and Stanovich denying this when they say type 1 doesn't involve working memory, which they in turn define in terms of controlled attention?

(15) Although rudimentary forms of higher order control can be observed in mammals and other animals (Toates, 2006), the controlled processing in which they can engage is very limited by comparison with humans, who have unique facilities for language and meta-representation as well as greatly enlarged frontal lobes (Evans, 2010b).

**Criticisms:** Here we go with the higher and the lower and all that. Let's drop all this evaluative talk and just look at what the animals do, shall we?

(16) We are in agreement that the facility for Type 2 thinking became uniquely developed in human beings, effectively forming a new mind (in the sense of Dennett, 1996), which coexists with an older mind based on instincts and associative learning and

gives humans the distinctive forms of cognition that define the species (Evans, 2010b; Evans & Over, 1996; Stanovich, 1999, 2004, 2011).

**Criticism:** At least they're coming clean here about their motivations. Humans have a supermind that sets them "above" the other animals. We have "higher" forms of thinking etc. Come on. This is anthropocentrism that has no place in a science of the mind.

(17) Quite obviously, no other animal can engage in the forms of abstract hypothetical thought that underlie science, engineering, literature, and many other human activities. More basically, we propose that other animals are much more limited in their metarepresentational and simulation abilities (Penn, Holyoak, & Povinelli, 2008), thus leading to limitations (compared with humans) in their ability to carry out forms of behavior that depend on prior appraisal of possible consequences. Thus, a key defining feature of Type 2 processing—the feature that makes humans unique—is cognitive decoupling: the ability to distinguish supposition from belief and to aid rational choices by running thought experiments.

**Criticism:** I of course agree that humans differ from other animals in lots of ways. But it has more to do with language and communication than anything else. I agree too that language allows for symbolic thought of the sort not evidenced in other animals and that symbolic thought augments counterfactual reasoning and some of the other capacities Evans and Stanovich mention. I just think that none of this speaks in favor of a dual processes approach, unless linguistic or communicative ability is one of the two systems or process types proposed and then there are many not just two so why talk of "dual" processes.

(18) Our joint view is that reasoning and decision-making sometimes requires both (a) an override of the default intuition and (b) its replacement by effective Type 2, reflective reasoning. The disposition to override intuitions is a function of several factors, including the meta-cognitive feeling of rightness in the initial intuition (Thompson, 2009; Thompson, Turner, & Pennycock, 2011). The evidence shows that when people are confident of an initial intuitive answer, they are less likely to spend time rethinking it or to change their answer after reflection (Thompson et al., 2011). This applies on tasks where there is no relation at all between confidence and accuracy (Shynkarkuk & Thompson, 2006). Another factor, already mentioned, is the existence of measurable thinking dispositions that are inclined toward rational thinking and disinclined to accept intuitions without checking them out (Stanovich, 2009b, 2011). The evidence suggests that cognitive ability is also involved in the ability effectively to intervene with Type 2 reasoning and solve the problem.

**Comment:** Yes, I agree with this Spinozan view of the mind. Stimuli induce belief automatically or as the default unless checked with effort. But this is not a sufficient vindication of dual processes, unless Spinoza, Hume et al are supposed to have endorsed dual process theory.