Two Systems of Judgement and Decision Making?

PSYC201: Cognitive Psychology

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Week 10

Cognitive Reflection Test (Kahneman & Frederick, 2002)

Consider the following question:

> If a bat and a ball cost $1.10 in total and the bat costs $1 more than the ball, how much does the ball cost?

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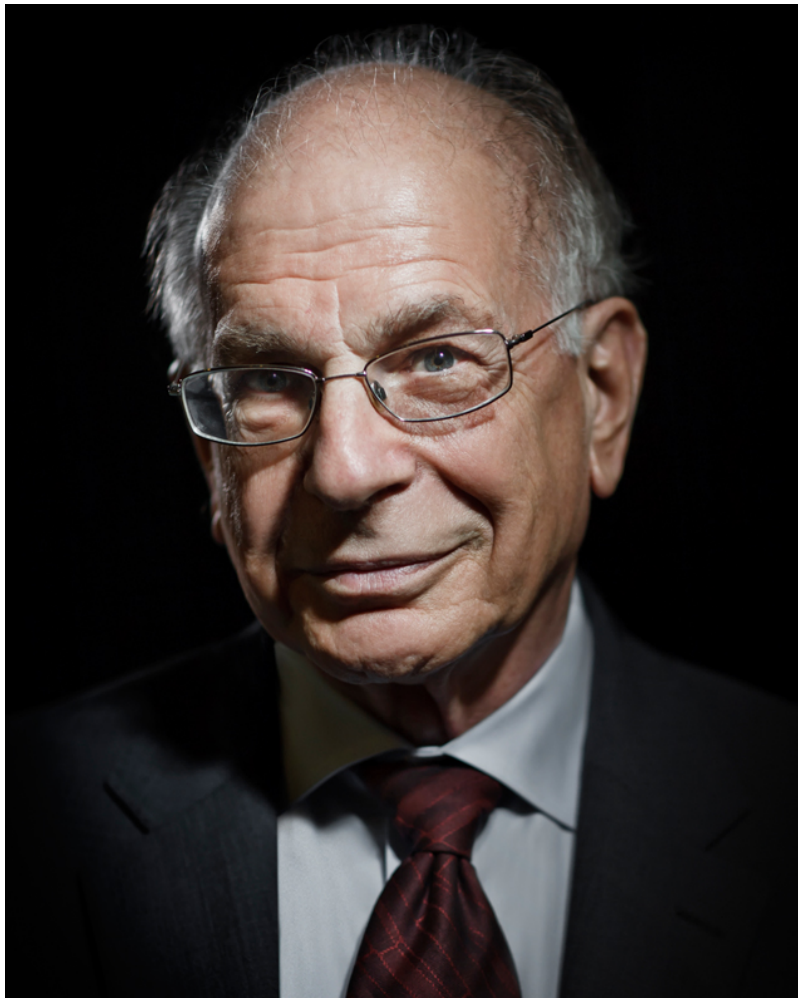
> If a bat and a ball cost $1.10 in total and the bat costs $1 more than the ball, how much does the ball cost?

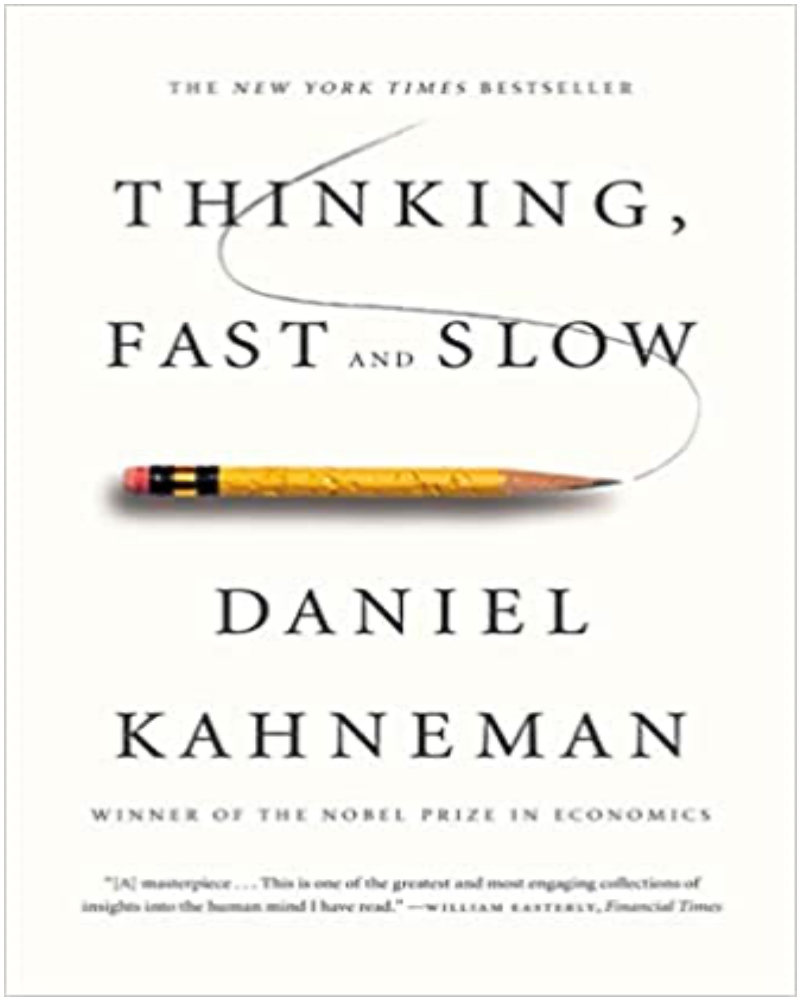
If you are like most people, your immediate answer would be 10 cents. You'd be wrong. Think a little more and you'll see why.

Dual-System Perspective on Judgement and Decision Making

- One of three similar items in the so-called 'cognitive reflection test' (Frederick, 2005)
- Measures people's ability to inhibit an initial response and engage in additional deliberation ('cognitive reflection')
- Thought to provide evidence for two types of thinking:
  1. System 1: fast and intuitive
  2. System 2: slow and deliberative
- Intuitive answers provided by System 1 ('The ball must cost 10 cents')
- System 2 monitors System 1, and if necessary, can over-ride it ('It can't be, because the total would be $1.20')

Thinking Fast and Slow (Kahneman, 2011)





Evans and Stanovich (2013)

Dual-Process Theories of Higher Cognition: Advancing the Debate

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Abstract
Dual-process and dual-system theories in both cognitive and social psychology have been subjected to a number of recently published criticisms. However, they have been attacked as a category, incorrectly assuming there is a generic version that applies to all. We identify and respond to 5 main lines of argument made by such critics. We agree that some of these arguments have force against some of the theories in the literature but believe them to be overstated. We argue that the dual-processing distinction is supported by much recent evidence in cognitive science. Our preferred theoretical approach is one in which rapid autonomous processes (Type 1) are assumed to yield default responses unless intervened on by distinctive higher order reasoning processes (Type 2). What defines the difference is that Type 2 processing supports hypothetical thinking and load heavily on working memory.

Keywords
dual processes, dual systems, rationality, individual differences, working memory

Characteristics of The Two Systems (Evans & Stanovich, 2013)

System 1 *(intuitive)*	System 2 *(deliberative)*
Working memory independent	Working memory dependent
Autonomous	Mental simulation
Fast	Slow
Effortless	Effortful
High capacity	Capacity limited
Non-conscious	Conscious
Biased responses	Normative responses
Contextualised	Abstract
Automatic	Controlled
Associative	Rule based
Independent of cognitive ability	Correlated with cognitive ability

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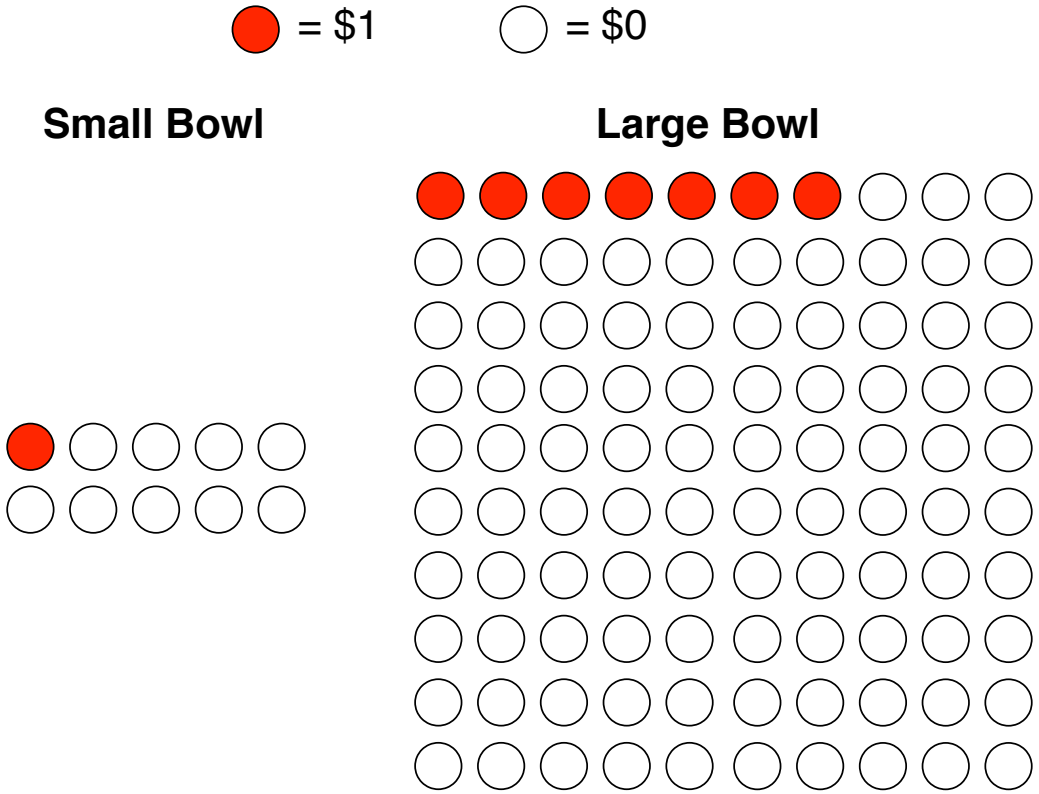
Ratio-Bias Task (Bonner & Newell, 2010)



Which bowl would you choose from?

Ratio-Bias Task (Bonner & Newell, 2010)

- Participants given a series of choices in which the ratio of winning beans to the total in the bowl varied across trials:
  1. conflict trials: ratios were in 'conflict' with each other, as in the preceding case where the bowl with the higher numerator (7/93) conflicts with the bowl with the better chance of winning (1/10)
  2. harmony trials: the numerator and the chance were in 'harmony', such as in a choice between a bowl offering a 21/100 chance with one offering a 2/10 chance
- Measured accuracy of choices and response times
- Dual-process perspective $\rightarrow$ RT(harmony trials) < RT(conflict trials)

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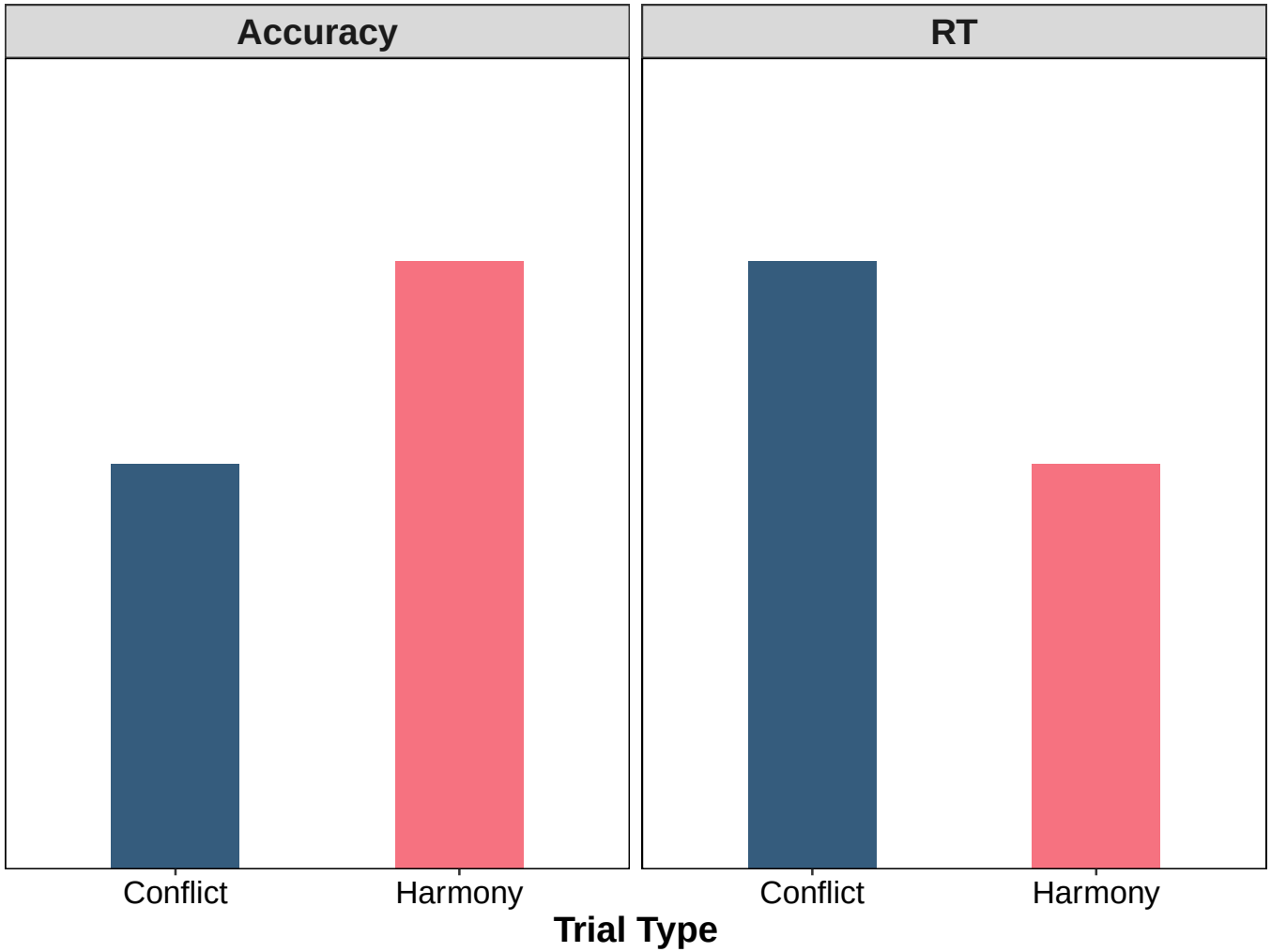

Competing Systems: How Is Conflict Resolved?

- How is the conflict between systems resolved?
  1. Serial models: intuitive processes are default and these are only intervened upon if conflict is detected
  2. Parallel models: heuristic and analytic processes occur simultaneously leading to a constant and effective monitoring
  3. Hybrid two-stage models: a 'shallow analytic monitoring process' is accompanied by an 'optional deeper processing stage' to accompany the ever-present intuitive processing
- Are interacting systems necessary?
- Increased RT for conflict relative to harmony trials could be because two possible answers are apparent on conflict trials, but only one is apparent on harmony trials

Evidence For Two Systems or Theoretical 'Stone Soup'?

There is an old folktale about a person who teaches a 'fool' how to make a delicious soup from nothing but a soup stone. Apparently, all one needs is to place the soup stone into boiling water, but to make the soup tastier one should add some vegetables, some meat, salt and pepper, and so on. Keren (2013) argues that:

> *inspecting the different labels proposed and the various terminologies employed to characterise the presumed two systems and their corresponding alleged processes strongly suggest that it has become a stone soup where everything goes.*

The Best Evidence For Dual-Process Theories

- Proponents of the dual-process view take the following as the 'best evidence' for the two systems (Evans & Stanovic, 2013):
  1. experimental manipulations designed to selectively affect System 1 or System 2
  2. neuroscientific evidence that claims to show differential involvement of brain regions in System 1 and 2 processes
  3. selective correlations between System 2 processes and cognitive ability

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Experimental Manipulations Designed To Selectively Affect System 1 or System 2

- Participants who made the classic conjunction fallacy error when given the Linda problem responded more rapidly than those that did not make the error (De Neys, 2006):
  - those that committed the error used the faster System 1; those that didn't used the slower System 2
- When a concurrent working memory load was introduced, the number of correct responses on the Linda problem dropped:
  - concurrent working memory load caused the capacity of System 2 to be exceeded
- Different systems/processes or different quantity of processing?

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Neuroscientific Evidence of Distinct Brain Regions For System 1 and 2 Processes

- Responses based on 'deliberation' reveal different areas of activation compared to responses based on 'intuition'
- Decisions about immediate or delayed rewards involve different neurobiological systems (McClure et al., 2004)
- Delayed decisions lead to activation of prefrontal cortex (executive functioning?), whereas immediate ones associated with limbic system (emotional responses?)
- Evans and Stanovich claim delayed decisions involve System 2 $\rightarrow$ thinking about future consequences
- Activation of prefrontal cortex supports dual-process theories $\rightarrow$ deliberative processes thought to be domain of this brain centre

Neuroscientific Evidence of Distinct Brain Regions For System 1 and 2 Processes

- However, there are significant difficulties in drawing such conclusions
- **Reverse inference problem** (Poldrack, 2006) $\rightarrow$ presence of a cognitive process inferred from a pattern of brain activity
- Decisions about delayed rewards may activate prefrontal cortex, and numerous executive control tasks may also activate this region
- It does not follow from this that decisions about delayed rewards engage executive control processes
- Must be careful to rule out differences in tasks, procedures, and instructions before claiming differences in brain activation reflect recruitment of different cognitive processes

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Selective Correlations Between System 2 Processes and Cognitive Ability

- Individuals who respond with the 'System 2' answer have higher levels of intelligence and working memory capacity
- People who give the right answer to the bat-and-ball problem, tend to display higher cognitive ability on standard intelligence tests (Toplak, West & Stanovich, 2011)
- Evans and Stanovich proposed a simple dichotomy in which 'System 1 = irrational or non-normative' and 'System 2 = normative' is inaccurate
- System 1 can lead to correct answers and System 2 to incorrect ones in some circumstances
- If one abandons the idea that System 1 processing is less normative, one can't argue correlations between intelligence and System 2 processing are strong evidence for the dichotomy (Kruglanski, 2013)

Awareness, Insight, & Unconscious Influences

- Typically, System 1 is linked with unconscious processes and System 2 with conscious processes
- Dual-systems theorists would claim that everyday notions such as ‘gut instinct’ and ‘intuition’ refer to System 1
- What is the evidence for unconscious processes influencing decision making?

The Legacy of Nisbett and Wilson (1977)

- Established the credibility of research on unconscious influences on decision making
- Argued people often lack insight into their own mental processes
- They falsely report factors that did not influence their performance
- One of the many illustrations of this point is an experiment in which participants chose between (and justified their choice from) four consumer products which were in reality identical

The Legacy of Nisbett and Wilson (1977)

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- Participants never mentioned position when justifying their choice, or denied being influenced by it when asked directly
- Instead, participants mentioned attributes such as the quality of the stockings
- However, asking participants about position fails to tap into the information relevant for the choice the person has made
- It is at best a distal cause, whose influence is mediated via the participant's true decision rule

The Legacy of Nisbett and Wilson (1977)

- In such sequential choice situations, people tend to study the options one at a time, from left to right
- Suppose that the decision rule is that if the current item is no worse in terms of quality than the previous item, then prefer the current item
- After the initial item, each subsequent one is mentally compared with its predecessor and because the items are identical, the resulting final choice is the right-most pair of stockings
- Under such circumstances it is correct for participants to report quality as the basis of their decision, as their decision rule incorporates judgments of quality

Decisions Under Uncertainty But Outside Conscious Awareness?

- In the Iowa Gambling Task (Bechara et al., 1994), there are four decks of cards and 100 selections
- Two of the decks (the 'bad decks') have a reward/punishment schedule which results in a net loss
- the other two decks (the 'good decks') have a schedule that results in a net gain
- A key feature of the design is that the immediate reward associated with the bad decks is higher than that associated with the good decks
- Do people learn to select cards from the good decks?
- Does awareness of the properties of the decks correlate with choice?

Iowa Gambling Task (Bechara et al., 1994)

	Bad Decks		Good Decks	
	A	B	C	D
Gain per card	$100	$100	$50	$50
Loss per 10 cards	$1250	$1250	$250	$250
Net per 10 cards	–$250	–$250	$250	$250

Iowa Gambling Task (Bechara et al., 1994)

- Bechara et al. (1997) claimed participants began to choose advantageously before realising which strategy worked best
- Early in the task, prior card selections were better predictors of deck choice on future trials than responses to open ended questions
- They concluded non-conscious biases guide participants behaviour before conscious knowledge does
- However, this conclusion has been strongly contested by Maia and McClelland (2004)

Iowa Gambling Task (Maia & McClelland, 2004)

- Replicated and extended the Bechara et al. study
- Used a more rigorous assessment of awareness at regular intervals during the task:
  1. participants rated each deck on a numerical scale
  2. explained their numerical ratings
  3. reported what they thought the average net winnings or losses would be if 10 cards were selected from each deck
  4. stated which deck they would choose if they could only select from one deck for the remainder of the game
- Now, conscious reports about the decks were more reliable predictors of choice than overt card selections at all intervals

Deliberation Without Attention? (Dijksterhuis, 2004)

- Can unconscious processes improve decision making?
- Dijksterhuis (2004) examined this questions using a multi-attribute decision task
- Participants are presented with information about three or four objects (e.g., apartments) described by 10 or more attributes (e.g., rental cost) and are asked to choose the best one
- Attribute information about the four options is presented sequentially and typically in a random order
- Following presentation of the attributes, participants are assigned to one of three (or sometimes only two) conditions

Deliberation Without Attention? (Dijksterhuis, 2004)

1. Unconscious thought condition: participants are prevented from making a decision for a few minutes by engaging in some distracting activity such as solving anagrams
2. conscious thought condition: participants are asked to think carefully about their choice for a few minutes
3. immediate condition: participants are simply asked to make their decision as soon as the presentation phase has finished

Deliberation Without Attention? (Dijksterhuis, 2004)

- The key result is that participants who have been distracted make better choices than those in either the conscious thought or the immediate decision conditions
- For example, Dijksterhuis et al. (2006) reported that 60% of participants chose the best car after being distracted, compared to only 25% following conscious deliberation
- Suggests unconscious processing can improve multi-attribute decision making

Newell and Shanks (2014)

- Reviewed the deliberation-without-attention literature and drew the following conclusions:
  1. There are questions marks surrounding the reproducibility of the key result—several studies have failed to replicate it
  2. Studies that show an effect of distraction frequently fail to include the relevant control conditions (e.g., omitting the immediate condition) making it impossible to determine whether distraction was beneficial or deliberation was detrimental
  3. Allowing people to think consciously for as long as they like produces decisions that are superior to those made under distraction

Implications

- There is debate about the explanatory value the dual-systems framework can provide
- Even the 'best evidence' for this approach can be explained without appealing to dual-systems
- A key problem is the plethora of vague and imprecise terms used to describe the systems and a failure to specify how they interact
- Taking 'conscious versus non-conscious' as a characteristic of the two systems does not appear to be a fruitful approach
- The dual-systems approach makes for a good story, but ultimately may be represent theoretical regress rather than progress

Additional Reading

Evans, J. St B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science, 8,* 223-241.

Newell, B. R., & Shanks, D. R. (2014). Unconscious influences on decision making: A critical review. *Behavioral and Brain Sciences, 37,* 1-63.