A second topic that N&S do not highlight is the role of emotions in decision making and whether this involves unconscious influences. There is a considerable literature that illustrates how emotional states affect judgments of risk and even risky decision making (Andrade & Ariely 2009; Slovic & Peters 2006). For example, in one research program, my colleagues and I used experience sampling to collect judgments of mood and emotion as well as assessments of risk (Hogarth et al. 2011). We found that emotional states explained variability in risk judgments over and above rational factors of probabilities and magnitudes of potential losses. We did not attempt to determine whether participants were aware that their emotional state was impacting their risk judgments. However, from an N&S perspective, future studies could clearly do this. My hypothesis is that people are not always aware of how emotions influence their decisions in the same way that these might be affected by, for example, relative states of hunger (Danziger et al. 2011).

A third point deals with a difficulty in interpreting the differences that researchers and participants in experiments have concerning whether a variable has had a *causal* influence on a decision. An example given in a seminar some 30 years ago by Richard Nisbett illustrates the point. (Incidentally, although I like and remember the scenario, I do not recall the specific point that Nisbett was illustrating!)

Imagine that a social psychologist is conducting a study on the influence of lighting in restaurants on romantic attachment. Couples are recruited for blind dates involving a meal at a restaurant, and there are two experimental conditions to which couples are randomly assigned. In one, the restaurant is fully illuminated; in the other, the lights have been dimmed. The dependent variable is the proportion of couples who decide to meet again after the meal. Now imagine that this variable is significantly greater for couples in the dimmed lighting condition. What does this mean? For the social psychologist, the inference is that dimmed lighting fosters romantic attachment. After all, this was the variable that was manipulated experimentally, and there was an effect.

Now imagine that you ask the couples whether the lighting in the restaurant influenced their decisions to meet again. Almost certainly, they would deny that this had played any role.

So who is "correct" – the social psychologist or the couples? It is possible to make an argument that both are correct. What differs between the two is the definition of the causal background – or "field" – against which the causal inference is made (Einhorn & Hogarth 1986; Mackie 1965; 1974). For the social psychologist, the causal field involves both experimental groups (with and without dimmed lighting), and the difference in the levels of lighting is a "difference-in-the-field" and thus a potential causal factor. The causal fields of the experimental participants, however, contain no such difference. The experience for each couple consists entirely of dimmed or full lighting, and they never experience the differences between the two conditions. For the couples, therefore, there is no way that they can assign cause to the level of lighting. For each couple, lighting is a constant and thus not causally relevant.

Advocates of influences of unconscious effects on decisions would undoubtedly agree with the social psychologist. However, this conclusion only holds at one level of analysis (i.e., causal field). In general, we should be clear at which levels we wish to draw conclusions.

Is the unconscious, if it exists, a superior decision maker?

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Abstract: Newell & Shanks (N&S) show that there is no convincing evidence that processes assumed to be unconscious and superior are indeed unconscious. We take their argument one step further by showing that there is also no convincing evidence that these processes are superior. We review alternative paradigms that may provide more convincing tests of the superiority of (presumed) unconscious processes.

In their short abstract, Newell & Shanks (N&S) state: "Recommendations to 'stop thinking' and rely on 'gut instincts' reflect widely held beliefs that our decisions can be influenced by unconscious processes." (N&S) predominantly focus on the second part of this phrase and show that there is no convincing evidence these processes are indeed unconscious. We take their argument one step further by addressing the first part of their phrase. That is, we discuss whether there is evidence that these decisions, presumably based on the unconscious, are superior to those based on thinking.

To determine whether presumed unconscious decisions are superior to conscious ones, we first need to define what constitutes a good decision. To this end, we use the distinction between compensatory and non-compensatory decisions. In compensatory decisions, options are compared on their probability weighted sum of all attributes, in which probability and attributes are evaluated objectively or subjectively (e.g., Tversky & Kahneman 1992). Non-compensatory decisions, however, are not based on a weighted sum of all attributes. For example, in Dawes' strategy (e.g., Bröder & Schiffer 2003a) decisions are based on the number of positive attributes, and in a lexicographic strategy (e.g., Tversky & Slovic 1988), decisions are based on a sequential comparison of attributes, in which a decision is made if options differ sufficiently on an attribute under consideration. There seems to be general consensus that compensatory decisions are superior to non-compensatory ones, as all attributes are taken into account (yet see Payne et al. 1988 for an interesting counterexample).

Dual-process theories (e.g., Kahneman 2011; Stanovich & West 2000) posit that non-deliberative processes often yield non-compensatory decisions, whereas deliberative processes generate compensatory ones. This hypothesis is supported by evidence showing that non-compensatory decisions are common in case of mental overload, which is assumed to hinder full reliance on the deliberative system (Bröder & Schiffer 2003b; cf. Pohl et al. 2013). Interestingly, proponents of unconscious decision making argue the opposite: They state that the non-deliberative system facilitates compensatory decisions, whereas the deliberative system facilitates non-compensatory ones (e.g., Dijksterhuis et al. 2006b). In the following we determine whether the two decision-making paradigms discussed by (N&S), the Iowa Gambling Task (IGT) and the paradigm of Unconscious Thought Theory, the Unconscious Thought Paradigm (UTP), offer the possibility to test this alternative claim.

In the IGT, decision makers presumably relying on unconscious processes would opt for the two options (C & D) with the highest expected value (Bechara et al. 1994); that is, they would use an objective compensatory strategy. However, IGT studies often do not allow for a test of this claim, as choices for specific options

are generally not reported. The few studies that did include an analysis of specific options support a different conclusion (e.g., Duijvenvoorde et al. 2010; Horstmann et al. 2012; Lin et al. 2012). That is, decision makers generally prefer options with low probability of losses (B & D), and some, but certainly not all, decision makers gradually develop a preference of D (low losses, low gains) over B (high losses, high gains) (Huizenga et al. 2007). It is not very likely that the latter decision makers adopted a compensatory strategy, as they did not prefer both optimal options (C & D). It is more likely that these decision makers adopted a non-compensatory lexicographic strategy, in which they first considered probability of losses and then losses themselves. These findings show that in the IGT, participants using non-compensatory and compensatory strategies may arrive at similar decisions. We therefore conclude that the IGT is not suitable to differentiate decision strategies.

According to Unconscious-Thought Theory (Dijksterhuis et al. 2006b), decision makers who presumably rely on unconscious processes would prefer the option with the highest compensatory value over all attributes. However, using importance ratings of attributes, it was shown that the compensatory strategy, Dawes's strategy, and a lexicographic strategy all converged on the same choice (Huizenga et al. 2012). Therefore we conclude that the UTP also does not allow for a differentiation of decision strategies.

The evidence reviewed above suggests that the IGT and UTP are not suited to identify decision strategies and therefore are not suited to test whether presumably unconscious decision processes facilitate compensatory decision making. To test this claim of compensatory decision making, the field requires new paradigms that allow assessment of decision strategies, namely, paradigms in which compensatory and non-compensatory strategies result in different decisions. Fortunately, both within, as well as outside, the IGT and UTP literature, paradigms are being developed that suit this purpose. In the IGT-related field there exists a paradigm that allows a further study of lexicographic versus compensatory strategies (Lin et al. 2009). In the UTP literature, there are paradigms to delineate Dawes and compensatory strategies (Payne et al. 2008; Usher et al. 2011) and to delineate lexicographic and compensatory strategies (Huizenga et al. 2012). Outside these fields it has been shown that process-tracing techniques (Bröder & Schiffer 2003a; Payne et al. 1988) provide valuable tools to study decision strategies. In addition, it has been shown that modern statistical techniques like mixture analyses offer the possibility to differentiate decision strategies (Duijvenvoorde et al. 2010; Jansen et al. 2012).

To conclude, the evidence in favor of the superiority of unconscious decisions is not convincing, as paradigms like the IGT and UTP do not allow for an assessment of decision strategies. However, there do exist new paradigms, experimental approaches, and statistical techniques that provide a detailed assessment of decision strategies and therefore allow for a more convincing test of the superiority of – presumed– unconscious processes.

Neuroscientific evidence for contextual effects in decision making

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Abstract: Both internal and external states can cause inconsistencies in decision behavior. I present examples from behavioral decision-making literature and review neuroscientific knowledge on two contextual influences: framing effects and social conformity. The brain mechanisms underlying these behavioral adjustments comply with the dual-process account and simple learning mechanisms, and are weak indicators for unintentionality in decision-making processes.

Newell & Shanks (N&S) criticize prior work on unconscious influences in decision making for providing insufficient assessment of awareness, leading the authors to question whether unconscious influences should be incorporated as prominent factors in decision theories. While I appreciate their methodological concerns, I am cautious to refute a large body of literature on automatic processes in decision making (Chaiken & Trope 1999; Kahneman 2011; Sloman 1996). I will explore the possible role of unconscious processing in decision making by discussing contextual influences in judgment and choice.

There is a discrepancy between rational decision making, as described by economic theory, and actual choices (Thaler 1980). Both internal and external states (such as visceral factors, framing, and social context) can induce inconsistencies in choice behavior (Cialdini & Goldstein 2004; Loewenstein 1996; Tversky & Kahneman 1981). Danziger et al. (2011a) report that, prior to food breaks, judges in parole boards less frequently give favorable decisions than after food breaks. The framing effect is manifested, for instance, in the behavior of a majority of consumers who prefer a "75% lean" ground beef product over one having 25% fat, even though there is no difference in the actual product (Levin et al. 1985). Finally, related to the primes-to-behavior literature reviewed in the target article, descriptive social norms are so powerful in directing behavior that people are even willing to increase their own energy consumption to match the consumption level of their neighbors (Schultz et al. 2007).

These examples raise many questions about the awareness and intentionality of the decision maker. Why is consumer preference affected by the positive or negative presentation of a piece of information? Why would one use more energy than needed – and pay for it – just because others use a lot of energy? And can judges sleep at night peacefully knowing that someone else is behind bars because they were hungry when they made their parole decision? Economically, these choice biases do not make sense, and based on the discussion following the publication by Danziger et al. (2011a), the legal community objects to the idea that meal breaks influence judicial decisions (Danziger et al. 2011b; Weinshall-Margel & Shapard 2011).

Recent neuroscience literature has shed light on the underlying mechanisms of framing effects in situations where subjects choose between a positively or negatively framed risky lottery versus a sure outcome. This research suggests that framing effects are mediated by emotional brain areas (amygdala), whereas resisting these effects co-occurs with activation in the anterior cingulate cortex (ACC), a brain region related to conflict detection (De Martino et al. 2006). These findings are consistent with the expectations of dual-process theories, as they suggest an interplay between initial emotional reactions (System 1) and suppressing control processes (System 2) in the formation and resistance of framing effects, respectively (Kahneman & Frederick 2007). Two further experiments have strengthened these claims. First, individuals with a certain gene variant have a stronger coupling between the ACC and amygdala and are able to resist framing effects better than other individuals (Roiser et al. 2009). Second, people with autism spectrum disorder do not show the same pattern of emotional (skin conductance) responses to positive and negative frames compared with control subjects; they also exhibit weaker susceptibility to framing effects (De Martino et al. 2008). Taken together, this research indicates that largely inborn characteristics can influence the strength of framing effects.

The tendency to follow the behavior of others has been proposed to be driven by error detection and subsequent adjustment (Montague & Lohrenz 2007). Klucharev et al. (2009) tested this hypothesis with functional magnetic resonance imaging in the context of facial attractiveness estimation and found that