

THE IMPACT OF COGNITIVE CONSISTENCY AND ASSOCIATIVE REASONING
ON JUDGMENT AND DECISION-MAKING

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The dissertation is composed of three papers, and attempts to unravel the impact of two potential drivers of biases in judgment and decision-making: cognitive consistency and associative reasoning.

The first paper is a literature review of cognitive consistency theories. The seminal paradigm and the major theories it spawned are first described and integrated into a unified framework. In addition, this framework is used to propose a new set of research questions in consumer psychology.

The second paper is a methodological paper, which primes cognitive consistency as a goal and tracks its influence on judgment and decision-making. Three initial studies demonstrate that the developed method successfully activates the goal of cognitive consistency. Three additional studies track the influence of cognitive consistency on three cognitive biases: the desirability bias, the influence of expectations on experience, and selective exposure.

The third paper investigates associative reasoning as another driver of biases in judgment and decision-making. A method to prime associative reasoning is proposed. Then four studies observe its influence on four biases in judgment and decision-making: the availability heuristic, the representativeness heuristic, the sunk cost fallacy, and mental model fallacies.

BIOGRAPHICAL SKETCH

Prior to joining the Ph.D. program at Cornell University, Anne-Sophie Chaxel obtained a Master's degree in Management from HEC Paris, and a Master in Research Methods from Paris Dauphine University. Anne-Sophie's research focuses on understanding the processes by which biases in judgment and decision-making arise. For example a paper she published in the *Journal of Consumer Psychology* (2010) demonstrates how an effective TV commercial enhances the apparent value of its target brand by leading consumers to unconsciously bias their evaluation of related product information.

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PAPER 1: COGNITIVE CONSISTENCY THEORIES: FRAMEWORK, PROCESS,
AND IMPLICATIONS IN CONSUMER PSYCHOLOGY

Few people would argue that individuals strive for consistency in its fundamental sense of a coherent understanding of their surroundings. The alternative, some level of chaos, ranges from discomforting to intolerable. Even for basic tasks like survival-oriented prediction in the natural environment of early humans, seeking consistency in their surroundings must have been essential. For intellectual tasks that are commonly faced today, finding consistency between incoming information and what the individual already knows would seem to be essential for interpreting and evaluating that information (Nickerson, 2008; Thagard, 2006).

Consider cognitive inconsistency as the mental analogue of motion sickness. When sensing motion but not seeing it, as in a ship with no windows, the inner ear tells the brain that it senses motion, but the eyes tell the brain that everything is still. As a result of the mismatch between ear and eye, the brain concludes that the individual is hallucinating, something most likely due to poison ingestion (Treisman, 1977). In response, the brain induces vomiting to clear the presumed toxin. What is true for the senses is also true for cognition, albeit in a less extreme form. If two cognitive elements mismatch, an unpleasant state arises and triggers a situation-specific cognitive process whose mission is to eliminate the inconsistency.

The concept of a “cognitive mismatch” can be illustrated by the three consumer situations below:

- (1) You are a loyal consumer of Brand X, and you believe it offers the best value on the market. Then you learn that this same brand uses child labor in Third World countries, a practice you strongly oppose.
- (2) You have been eating Brand Y at breakfast for ages and you have always categorized its manufacturer as a cereal company. Then this company decides to diversify into dog food.
- (3) You believe that Perfume Z is low-end and out of fashion. Then you come across an advertisement for Z portraying its use by an Italian actress you think is beautiful, sophisticated, and trendy.

In each of these cases, how might consumers reconcile the two competing propositions (such as “I don’t like brand Z but I really like the Italian actress who is using it”)? How would such mismatches, if salient, impact how the consumers process new information about the brand?

Cognitive consistency research has focused on two questions, reconciling an observed inconsistency and understanding its downstream impact on subsequent information. Consistency theories presume the existence of an interconnected system of beliefs, that is, a network of beliefs in one or more domains that interact with each other. The simplest system contains only two beliefs, as in the three examples above. Beliefs can complement each other (e.g., “Brand X makes cereals” and “Brand X also makes granola bars”), or conflict with each other (e.g., “Brand X makes cereals” and “Brand X also makes dog food”). When they conflict, cognitive instability arises. This instability is presumed to create a state of discomfort that drives a change in one or both of the beliefs, in order to restore some of the lost cognitive balance within the system.

Cognitive consistency theories emerged in the 1950s and flourished during the next two decades. Yet the number of consistency-related publications declined drastically

thereafter. This decline is more apparent than real, largely due to several shifts in research focus. If the term “cognitive consistency” almost disappeared, it is only because the phenomenon itself was interpreted from different perspectives and given different labels, such as “cognitive dissonance” or “self-consistency”. Our primary objective is to provide a large overview of cognitive consistency theories, without focusing on one specific label or another. In other words, we attempt to synthesize those different perspectives in order to integrate them and raise new research questions. The specific contribution of this paper is thus threefold. We review the cognitive consistency literature and draw from it a potential integrative framework. Using recent findings in social and cognitive psychology, we then extend this framework by proposing a new process by which a desire for cognitive consistency may impact decision-making. Finally, we draw on the above to propose several research directions for consumer psychology.

Cognitive Consistency Theories

The common ancestor of all theories of cognitive consistency is Gestalt theory (Wertheimer, 1922, 1923). It focused on the formation of perceptual units, positing that one of the functional principles of the brain is holism or the requirement that the individual parts form a coherent whole. When they do not, even if due only to a single unusual or unexpected component of the scene, attention is automatically drawn to that component and an active process of comprehension begun. Analogously, cognitive consistency theories have postulated that beliefs are part of a system of dynamic relationships that should be coherent and that a dissonant belief will elicit discomfort, which the individual will try to reduce.

The seminal idea that beliefs are driven toward consistency was manifest, over time, in four main research streams. We label them, in temporal order, the “cognitive consistency

stream”, “the self-theory stream”, the “meaning maintenance stream”, and the “individual differences stream”. They all focus on understanding when inconsistencies occur and how people recover from them. After introducing succinctly the main emphasis of each of these streams, we propose a single integrative framework.

The Cognitive Consistency Stream

Fritz Heider’s Balance Theory (Heider, 1946, 1958), Congruity Theory (Osgood & Tannenbaum, 1955), Symmetry Theory (Newcomb, 1953) and Cognitive Dissonance Theory (Festinger, 1957, 1964) are the major works within the cognitive consistency stream.

Balance, Congruity, and Symmetry Theories all focused on structures of liking and disliking. They demonstrated how people tend to dislike conflict, or even ambivalence, and instead prefer consistent affective representations of social objects. In each of these theories, consistency was seen as a desirable end-state that individuals strive to achieve.

The first of these, Heider’s Balance Theory (Heider, 1946, 1958), described potential relationships within a simple system composed of two people **p** and **o** and a social entity of mutual interest **x**. The resulting triad was said to be consistent if any set of affective relations among **p**, **o**, and **x** is balanced (**p** likes **o**, **o** likes **x**, **p** likes **x**; or **p** dislikes **o**, **p** dislikes **x**, **o** likes **x**; or **p** dislikes **o**, **p** likes **x**, **o** dislikes **x**; or **p** likes **o**, **p** dislikes **x**, **o** dislikes **x**).

Conversely, the triad was said to be inconsistent if the set of relations among elements of the triad is unbalanced by reversing any one of the relationships above. In any of the latter cases, a tension emerges and **p** is driven to restore a state of affective balance by modifying his/her attitude towards **o** or **x**.

This seminal idea was further enriched by both the Congruity Theory of Osgood and Tannenbaum (1955) and the Symmetry Theory of Newcomb (1953). Osgood and Tannenbaum’s domain of interest was persuasion and communication. As a result, Heider’s

triad (**p**, **x**, **o**) was associated in Congruity Theory with an audience, a message source, and a concept. The mechanism is the same as in Heider's theory: An audience that has inconsistent preferences for the message source and the concept (for instance, liking the source but disliking its message) is driven to restore balance. Congruity Theory refined Balance Theory in two ways. First, instead of being only directional (like or dislike), as in Heider's work, the measurement of the attitudes of **p** towards **x** and **o** was quantified on a semantic differential scale. The second change required that, to restore balance, both the attitude towards **o** and **x** change, not only one or the other.

Newcomb (1953) then enabled the extent of attitude change of the individual **p** towards **o** and **x** to depend on the strength of **p**'s liking of **o**. In other words, Newcomb defended the idea that a tension towards symmetry makes the two individuals **p** and **o** defined in Heider's work likely to communicate in order to align their attitudes towards **x**. As a result, the drive to restore consistency within the social (i.e., multiperson) system was predicted to be higher as the bonds between **o** and **p** became stronger.

Last but best known of these seminal stream is Festinger's theory of Cognitive Dissonance (1957), for whom dissonance, an uncomfortable state, is triggered when an individual holds two cognitions that are inconsistent. Four phenomena illustrate this idea. The first is the free-choice paradigm (e.g., Brehm, 1956), in which the positive aspects of a rejected alternative and the negative aspects of a chosen alternative comprise the dissonant elements of a decision. A decision creates commitment to a chosen alternative, which results in a motivational drive to reduce dissonant elements in order to avoid the discomfort associated with dissonance. Second is the belief-disconfirmation paradigm, which observes attitude change, and in particular proselytism, within a group whose beliefs are disconfirmed by an external event (e.g., Festinger, Riwcken, & Schachter, 1956). Third is the effort-justification paradigm (e.g., Aronson & Mills, 1959), which states that dissonance can arise

between the effort invested in a task and its actual outcome (for instance, going through a severe initiation to be accepted within a group that ends up being boring). Individuals would then change their attitude towards the outcome in order to make it consonant with the invested effort (e.g., seeing the group as not boring after all). Last is the induced-compliance paradigm (e.g., Festinger & Carlsmith, 1959), in which participants are asked to behave in a counter-attitudinal way (e.g., writing a counter-attitudinal essay) and then change their attitudes to better fit their required behavior.

While Heider, Newcomb, Osgood and Tannenbaum focused exclusively on affective and social representations, Festinger broadened the scope of consistency theories by explicitly including cognitive representations. Dissonance was not seen only as arising from an affective inconsistency between people and objects/ beliefs, but also from the conflict between two or more beliefs within a same individual. This version of cognitive dissonance became the seminal theory from which all revisions derived.

The Self-Theory Stream

Abelson's 1983 article "*Whatever Became of Consistency Theory?*" noted that, after being a regular topic of the 1960s, cognitive consistency theories disappeared from research in the early 1970s. This apparent disappearance was explained by a reinterpretation of the idea of cognitive consistency through the lens of the self concept, which spawned five major revisions of Festinger's seminal theory. This stream put emphasis on the two following questions. Is cognitive dissonance a motivational state? What is the role played by one's self-beliefs in the experience of dissonance?

Two of the five re-interpretations are extreme and dismiss any motivational underpinnings to the experience of dissonance. According to the self-perception view (Bem, 1967), people infer their attitudes (which are malleable) from their behavior. As a result,

people change their attitudes after a behavior that is discrepant with their previous attitudes not because they experience a need for consistency but because they adjust their attitudes on the basis of their behavior. According to impression management theory (Tedeschi, Schlenker, & Bonoma, 1971), people do not really change their attitude towards the target object in dissonance studies. They do not experience dissonance, they just want to appear coherent to the experimenter. These non-motivational accounts, which totally reinterpret the results of Festinger's original theory have had trouble explaining why arousal mediates the relationship between an inconsistency episode and behavioral consequences (Zanna & Cooper, 1974; Croyle & Cooper, 1983; Elliot & Devine, 1994). Consequently, we do not consider them further.

Three additional re-interpretations are closer to Festinger's (1957) cognitive dissonance theory and received substantial attention, including empirical testing. The self-consistency view (Aronson, 1968) postulated that people think and behave in a way that is consistent with their conception of themselves. The overarching goal is to achieve consistency between well-founded self-beliefs and incoming information (cognitive or affective). Using this basic idea, Aronson (1968) emphasized that cognitive dissonance is more likely to occur when the inconsistency challenges our self-view as stable, competent, and moral. This re-interpretation of cognitive dissonance theory by Aronson (1968) was followed by two related theories, Cooper and Fazio's "new look" theory (1984), and Steele's self-affirmation theory (1988). According to the new look view, dissonance is triggered when a behavior represents a violation of societal or normative standards that drives aversive consequences. According to the self-affirmation view, a discrepant behavior threatens a sense of self-worth. As a result, when dissonance is experienced, people are motivated to restore their personal integrity by focusing on other positive aspects of their self, such as important values and positive social-comparisons.

In subsequent years, researchers focused on understanding how self-beliefs trigger self-expectations about one's thoughts and behavior, which may in turn conflict with an actual state of the self (Thibodeau & Aronson, 1992). The central role of expectations in the experience of dissonance was also highlighted by Stone and Cooper (2001) who proposed a self-expectancy framework that was intended to integrate self-consistency, new look and self-affirmation theories. They proposed that dissonance begins when people exhibit a behavior and then assess the behavior against self-standards. These standards can be personal (self-beliefs in the self-consistency and self-affirmation theories) or normative (as in the new look theory).

The Meaning Maintenance Stream

More recently, the idea that a violation of expectations drives a motivational force for reconciling the perceived mismatch was reinterpreted by Heine, Proulx and Vohs (2006). This stream of research put emphasis on the two following questions. Why do we seek to relate objects to each other and to the self? Why do we keep mental representations that are internally consistent?

To this end, Heine, Proulx and Vohs (2006) introduced a revised consistency model focusing on the maintenance of meaning. In their model people are assumed to expect and prefer a world that is meaningful and predictable. As a result they hold mental representations that are composed of expected relations between elements of thoughts, which are intended to give meaning to the world. When meaning is threatened, individuals work towards its restoration. In other words, if an expected relation is disconfirmed or challenged, such as by an inconsistency between expectations and experience, meaning is threatened. This, in turn, triggers a reaffirmation process, also labeled "*fluid compensation*" (McGregor, Zanna, Holmes, & Spencer, 2001; Steele, 1988). This model shares the same foundation as cognitive

consistency and self theories, yet it places itself in a different domain (the maintenance of meaning).

The Individual Differences Stream

The last stream of the four that we see in the domain of cognitive consistency emphasizes the two following questions. First, are there stable individual differences in the extent to which people strive to reconcile dissonant beliefs, feelings, and behaviors? If so, can those differences be assessed?

A first attempt to assess individual differences in aversion to cognitive inconsistency is the Need for Consistency scale (NfC) developed by Cialdini, Trost, and Newsom (1995). Their scale is comprised of three types of preference for consistency. Private consistency is defined as the need for consistency between values, attitudes, and beliefs (e.g., "I am uncomfortable holding two beliefs that are inconsistent"). Public consistency derives from the desire to appear consistent to other people (e.g., "The appearance of consistency is an important part of the image I present to the world"). Other consistency refers to the need to perceive others as consistent (e.g., "I want my close friends to be predictable").

The Need for Consistency scale has been applied mainly to social phenomena. For instance, one of the consequences of a strong need for consistency is that individuals tend to orient their attention to the past more than to the present, in order to achieve a better match between past behavior and a current choice. Another consequence of a high preference for consistency is a stronger inclination to punish transgressions of laws. For instance, Nail, Bedell, and Little (2003) showed that when preference for consistency was elevated, participants more strongly believed that Bill Clinton should have been prosecuted for perjury after leaving office. In other words, when preference for consistency is elevated, individuals are more responsive to the incoherence between the belief that law applies to everyone and

the fact that Clinton was not prosecuted. In other words, high-NfC individuals give greater weight to prior entry variables (e.g., previous expectations, commitments, choices) and adjust their subsequent responses accordingly. Low-NfC individuals give less weight to the implications of such variables in their judgments.

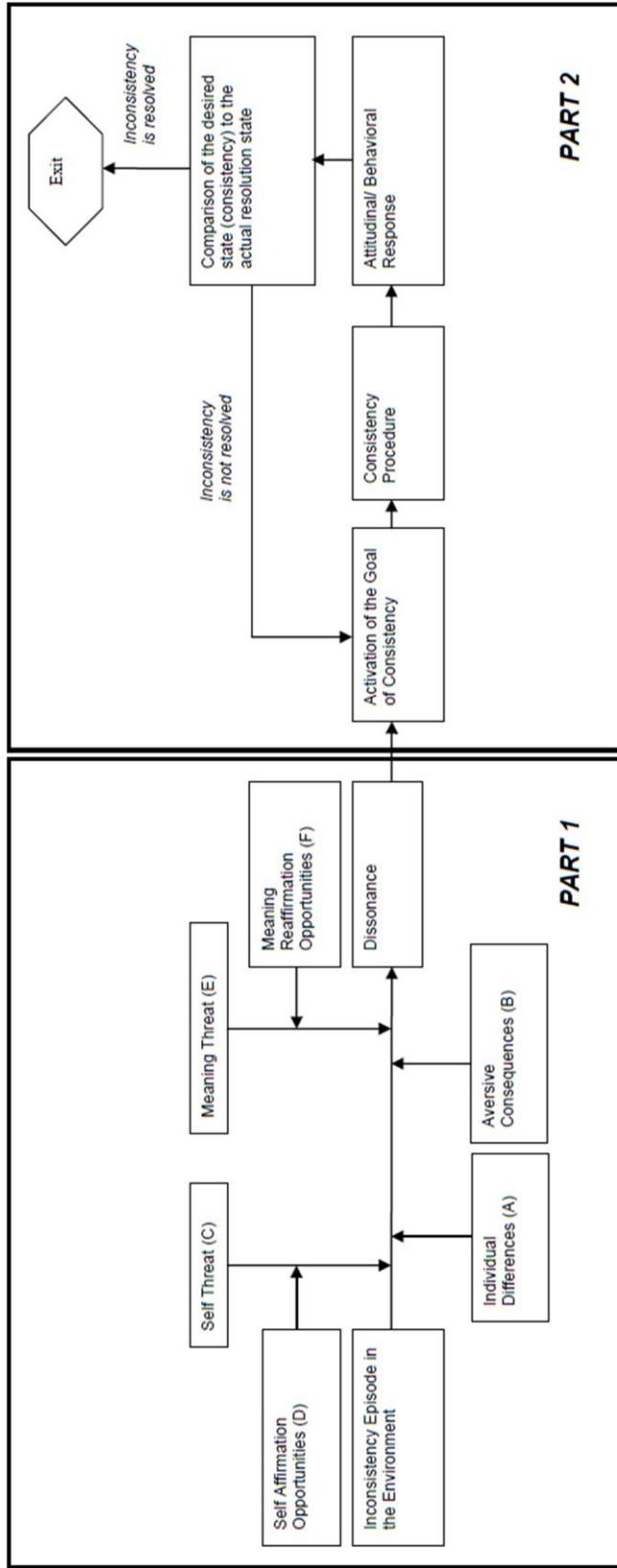
A Unified Framework

We have tried to show that the cognitive consistency theories of the 1950s did not disappear. They evolved through different research streams, each focusing on specific contexts and, partly as a consequence, on specific features of cognitive consistency. We now attempt to integrate the various research streams into a unified framework of cognitive consistency.

Our conceptual framework is depicted in Part 1 of Figure 1. First, an inconsistency between two elements in the environment triggers dissonance, as stated by Festinger in the original statement of the theory of cognitive dissonance. This is a direct effect. Without the presence of an inconsistency in the environment, no experience of cognitive dissonance can indeed occur. We posit that the strength of this effect depends on four other elements, which we conceptualize as moderators (Baron and Kenny, 1986). That is, these four variables affect the strength of the relation between the independent variable (an episode of inconsistency) and the dependent variable (felt dissonance).

We start with one of the most straightforward of those four elements: Individual differences (A), as illustrated by the work of Cialdini (1995). The more individuals are averse to inconsistencies, the more they are likely to experience dissonance when confronted by one. This makes individual differences a straightforward moderator of the relationship between an external inconsistency and an internal state of dissonance.

Figure 1: Conceptual Framework



The second element is the presence of aversive consequences, as advanced by the new look theory. Aversive consequences have been shown to increase the predictive power of cognitive dissonance theory, but they have also been shown not to be necessary (Aronson, Fried, & Stone, 1991; Fried & Aronson, 1995; Stone, Aronson, Crain, Winslow, & Fried, 1994). As a result, it seems plausible to position their presence as a moderator of the strength of the main effect (B).

The third element is the presence of a threat to the self (C), as advanced by the self-consistency theory. This theory has usually been considered an alternative explanation for Festinger's results and, in practice, nearly replaced cognitive dissonance theory. Although Aronson himself (1992) claimed only that his intention was to show conditions under which the predictive power of the original theory was stronger (1992, p. 305), not conditions necessary to the experience of dissonance: *"dissonance is greatest and clearest when it involves not just any two cognitions but, rather, a cognition about the self and a piece of our behavior that violates that self-concept."* In other words, self-beliefs do not need to be involved to experience dissonance, but the impact of the inconsistency episode on the felt dissonance is stronger when it threatens the self. Again, this is the strict definition of a moderator.

This idea had already been advanced by Greenwald and Ronis (1978, p.56), and our contribution is only to place this idea of a threat to the self (C) within a unified framework: *"Perhaps the only victim of the evolutionary process is the original version of dissonance theory, which has effectively been discarded. But has it ever really been proven wrong? Consider the possibility that dissonance researchers abandoned portions of the original theory because their experiments inadvertently tapped self-protective cognitive processing instead of, or in addition to, dissonance reduction. The ego-related cognitive processes, being relatively easy to observe, may have pulled the theory in their direction. Had effort been*

directed instead at achieving more precise methods of testing the original dissonance formulation, perhaps more support for it would have been obtained.”. Furthermore, as already noted by Stone and Cooper (2001) in a framework focused on self-theories, when self-affirmation opportunities (D) are made salient (for instance, by reaffirming core values), the impact of the self-threat on the felt dissonance is weaker. This makes of D a moderator of the impact of self-threat on felt dissonance.

The fourth element is the presence of a meaning threat (E). This is somehow the only genuinely speculative part of the initial framework, because dissonance theories have never been explicitly discussed by Heine, Proulx, and Vohs (2006). The question is whether striving to reduce inconsistency is triggered *only* when meaning is threatened. As mentioned before, in the meaning maintenance model meaning is threatened when experience conflicts with an expected relation. Thus, dissonance is experienced *only* when one of the two cognitive elements in the mismatch is derived from experience, while the other is based on an expectation. These sources disqualify inconsistencies between two cognitive elements such as “I am a smoker” and “smoking causes cancer” from the pool of situations that may trigger dissonance.

It seems fairer to us and more conservative to think that expectations and experience are two types of cognitive elements that may trigger a *stronger* feeling of discomfort than to think that they are necessary to any experience of dissonance. Thus, we also place meaning threat as a moderator of the relationship between inconsistency episode and felt dissonance. Finally, as proposed by Heine, Proulx and Vohs (2006), when opportunities to reaffirm meaning are made salient (F), the impact of the meaning threat on the felt dissonance is weaker. This makes of F a moderator of the impact of meaning-threat on felt dissonance.

In 1992, Aronson (p. 307) stated: *“In the past few years, a plethora of minitheories has sprung up (...). Each of these theories is a worthy and interesting effort at combining*

cognition and motivation, but each has a limited scope; in my judgment, with a little work, every one of them can be contained under the general rubric of dissonance theory.”

In a similar fashion, our model claims that a single direct effect (an inconsistency episode) accounts for cognitive dissonance, as stated in the earlier version of the theory. However, we fully recognize that the strength of the effect may vary with the type of cognitive elements that mismatch, viz., self-beliefs, behavior, attitudes, experience, expectations. Some situations may decrease one's sense of self-worth, produce aversive social consequences, or threatens our sense of meaning, which in turn contributes to trigger a stronger feeling of dissonance.

Given this initial framework and the literature that led us to it, we now turn to extending it. Our approach is to try to understand the process by which consistency influences attitudes and behaviors.

Extending the Framework

As we have seen in the previous section, the existing literature has focused on identifying the conditions under which Festinger's dissonance theory is more likely to occur. As a result, for fifty years it has focused on defining when dissonance would be felt and, in turn, when attitude change would occur.

In this section we attempt to answer three new questions that previous literature didn't emphasize. First, how should cognitive consistency be conceptualized? Second, how does cognitive consistency affect information processing, that is, what is its downstream impact on cognition? Finally, what are the available methods for measuring and manipulating the level of consistency individuals strive for?

To this purpose, we propose to extend the existing conceptual framework (see part 2 of Figure 1) adding a processing framework. First and in response to question 1 above, we propose that consistency may be a cognitive goal (proposition 1). Then, addressing our second question, we claim that activating cognitive consistency may trigger a specific cognitive procedure, or mindset, designed to increase the internal state of consistency (proposition 2). We also propose that social and cognitive psychology offer new methods to elevate and measure levels of consistency (proposition 3). Such methods should enable the empirical test of the first 2 propositions.

Proposition 1: Cognitive Consistency is a Goal

In every theory reviewed above, an inconsistency generates discomfort and a striving to restore consistency. As Tannenbaum (1968, p. 344) stated, “*some degree of consistency and equilibrium (...) [is] essential for reasons of parsimony and economy of effort, as well as to allow for the predictability of, and hence adaptability to, subsequent encounters.*” We posit with our first proposition that this amounts to assume consistency is a desirable end-state or, equivalently, a cognitive goal. When an inconsistency is detected, we engage in cognitive actions to return to a more acceptable level of cognitive consistency (a level that may vary between situations and individuals).

Research over the last 10 years has revealed a great deal about the nature and behavior of goals (e.g., Ferguson & Porter, 2009; Foster, Liberman, & Friedman, 2007). Goals are cognitive constructs represented in memory that motivate and direct action. Although controversy remains over the definition of a goal, we shall adopt the most common view, that a goal is a “*cognitive representation of a desire end-point that impacts evaluations, emotions and behaviors.*” (Fishbach & Ferguson, 2007, p. 491). Goals contain information about their end-states that can vary in abstractness (consistency being an abstract goal) and include a variety of behaviors, plans, and objects that enable one to reach the end-state. For

instance, the achievement goal might include planning behaviors, such as a study schedule for an exam. When a goal is primed, its entire network is activated. Such goal activation also inhibits information that would hamper its achievement (Fishbach & Ferguson, 2007).

Thus, we propose that cognitive consistency is a goal that may contain not only the actual end point of being consistent, but also context-specific strategies to reach this end-point. Strategies may include avoiding disconfirming information, making new information fit previous beliefs, committing to choices, positive affective information, and memories of previous experiences related to consistency (such as instances of brand loyalty or commitment to a choice). In parallel, it may inhibit conflicting goals such as, in certain contexts, the goals of being accurate, of variety-seeking, or other.

Proposition 2: The goal of consistency is associated to a specific cognitive procedure, or mindset of consistency

The research streams reviewed so far all focus on understanding how inconsistencies arise and how people recover from them. Yet, as early as the '60s, a different and entirely parallel stream of research in cognitive psychology emerged, focusing on understanding how a consistency property governed the cognitive system. In 1968 McGuire lamented that the existing cognitive consistency theories studied consistency as an end and not as a means for throwing light on thought processes (as he claimed they should). This disinclination to follow the steps of earlier cognitive consistency theorists did not come from a disagreement with the content of their research, but from a different view on what topic is “*most deserving of attention*” (McGuire, 1968, p. 141): “*I have obviously been rather disappointed and regretful about the main directions which consistency theory has taken ... Where I would have taken the need consistency for granted and used it to map the cognitive system, the subsequent work has largely taken the cognitive system for granted, and tried to clarify the need for consistency. It has sidestepped the cognitive structure question.*”

McGuire's research agenda spawned current cognitive psychology research based on coherence-driven mechanisms of constraint satisfaction (e.g., Read & Miller, 1994; Shultz & Lepper, 1996; Simon & Holyoak, 2002; Spellman, Ullman, & Holyoak, 1993; Thagard, 1989). These models predict how belief systems get modified by incoming information and observe how they eliminate potential inconsistencies. For instance Spellman, Ullman and Holyoak (1993) developed a computational model they labeled Co3, for "Coherence Model of Cognitive Consistency". The demonstration network in their naturalistic study concerned attitudes related to the Persian Gulf War in 1990-1991. It was composed of sub-attitudes towards pacifism, isolationism, the war's legitimacy, Saddam Hussein, terrorism, and an overall attitude toward the Iraq war. They demonstrated that when one sub-attitudes was significantly modified by external information (for instance, newspapers influencing the reader to see Saddam Hussein as a real threat to the United States), it directly contributed to a change in the global attitude of support for the U.S. military's action, which in turn contributed to a modification of other sub-attitudes (for instance, pacifism or isolationism). Thus each cognitive element simultaneously influenced and was influenced by its network, directly or indirectly, until the network reaches an optimal state free of inconsistencies.

In this case, consistency is seen not only as a desirable end-state but also, even foremost as a property of the cognitive system, that is, as a way to organize our current thoughts and to process incoming information. In other words, a cognitive consistency goal is seen as associated to a specific cognitive procedure that eliminate inconsistencies and settles systems of beliefs into consistent states. This conceptualization matches the concept of mindset as a cognitive procedure or sequence of actions¹ (for a review, see Wyer & Xu, 2010).

¹ Alternative types of mindsets are also reviewed by Wyer and Xu (2010).

A mindset is defined as a cognitive or behavioral procedure that is associated with a particular goal. For instance, Xu and Wyer (2008) have already studied the comparison mindset, that is, the cognitive procedure associated with the goal of comparing. A particularity of mindset is that, once activated, it is then more likely to be used subsequently, even in a different domain, and even without the activation of associated goal. Xu and Wyer (2008) have thus shown that comparing animals makes people more likely in a subsequent task to buy a product because they have automatically started to compare those products. Similarly, we propose that the goal of consistency is associated to a specific cognitive procedure, or mindset of consistency, by which disparate elements are connected to form a coherent entity. Furthermore, once activated, it is more likely to remain active in the short term and thereby be used in new domain, such as decision-making, and independently of the activation of the goal of consistency.

Proposition 1 and 2 have implicitly argued that consistency theories rely on two dimensions: a motivational dimension, and a cognitive dimension. The motivational element (goal activation driven by an inconsistency) directly triggers a process stored in memory that can reconcile the inconsistent elements (mindset activation). The process by which the mindset operates then, in turn, drives an attitudinal and/or behavioral change. This change is either sufficient to attain the goal, or not sufficient. In the latter case, the goal remains active and prompts further cognitive actions, until the goal is reached or is abandoned (see part 2 of Figure 1).

These two propositions naturally prompt the question of the relation between the goal and mindset versions of consistency. A mindset is a procedure activated by a goal as a means to achieve it. When a goal is frequently activated, its subsequent mindset becomes closely associated with it. Then this goal-mindset association can be activated bidirectionally so that activating the mindset also activates its associated goal (Wyer & Xu, 2010). This is

necessarily only speculative in the domain of cognitive consistency. However, it need not remain so. We suggest that understanding how the goal and mindset versions of consistency operate may best be achieved empirically.

Proposition 3: Consistency levels can be elevated and measured

Once we move into the empirical realm, much depends on methods. We have just claimed that our first two propositions might be tested empirically. Fortunately, we now have methods that were not available decades ago. We hope that the application of these new methods will help to test the processing framework we are proposing.

Priming consistency as a goal. The most familiar goal activation methods involve some form of semantic priming (Fishbach & Ferguson, 2007). Participants are exposed to words related to the goal, which in turn leads them to engage in goal-congruent behavior. For instance, participants are asked to solve scrambled sentences with words related to hostility, which leads them subsequently to exhibit hostile behavior (Srull & Wyer, 1979). This approach has already been successfully applied in research on consistency (Russo, Carlson, Meloy, & Yong, 2008). However, we note that the power of semantic priming to actually drive a motivational state has recently been questioned (Sela & Shiv, 2009). Using semantic methods may indeed only prime the semantic network associated to one particular goal, without inducing a real motivation to pursue that goal.

The priming of an actual motivational state requires a difference between the actual state and a desired state (Miller, Galanter, & Pribram, 1960; Sela & Shiv, 2009; Zeigarnik, 1967). A behavioral task that triggers such a discrepancy should prime the goal to reduce it. This is behavioral priming of a goal. Note that this is actually what is done in all cognitive dissonance studies. For instance, participants in an induced-compliance paradigm write a counter attitudinal essay, which creates a state of inconsistency that motivates participants to

restore consistency.

If a motivation to reach the goal is successfully primed, then the goal activation increases when a delay frustrates goal attainment (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Troetschel, 2001; Förster et al., 2007). Thus, a manipulation check of goal activation should include two measurement times, one immediately after the priming and one after a delay of a few minutes. The delay condition is expected to yield greater level of activation than the immediate condition, thereby increasing its effect on a dependent measure.

Interestingly, long before the current study of goals and the impact of a delay, Walster and Berscheid (1968) dedicated an entire chapter in “Theories of Cognitive Consistency: A Sourcebook” to the effects of time on cognitive consistency. They highlighted how inserting a delay between the experimental manipulation and the measurement of the dependent variable actually decreased the variability in the data: “A delay between the manipulation of dissonance and the measurement of the resulting dissonance reduction was incorporated into many dissonance studies. Researchers found that such a delay increased their predictive ability. Since time is not itself an independent variable in any of the consistency theories, this delay is not necessary theoretically. But in practice such a delay is often essential.” Without the benefit of what we now know about the temporal pattern of goal activation, frustration, and attainment, Walster and Berscheid seem to have described consistency as a goal.

Priming consistency as a mindset. Activating consistency as a mindset means finding a task that requires the repeated use of a process or procedure that achieves consistency (Wyer & Xu, 2010). Repetition of such a task should build momentum for that consistency-achieving procedure. Then, when subsequently presented with an unrelated task that can be completed by applying a consistency mindset (i.e., procedure), performance in this second task should be elevated. One plausible priming manipulation is a task from standard tests like the SAT, such as completing a sentence by filling in the best fitting word

(e.g., “Today’s small, portable computers contrast markedly with the earliest electronic computers, which were _____; A. effective, B. invented, C. useful, D. enormous”; Kensler, 2009). Alternatively, maybe something as simple as solving a set of anagrams could prime consistency as a mindset while participants repeatedly rearrange letters to make a legitimate word (e.g., EBLTA to TABLE).

The temporal pattern of a mindset’s activation differs from that of a goal. A delay of a few minutes is more likely to cause the activation to dissipate, although at an unknown rate. As a consequence, if two measurement times are included in a study on the nature of cognitive consistency, the delay condition should exhibit weaker results than the immediate (no-delay) condition if consistency is a mindset. We have seen that the reverse pattern, stronger results after a delay, should be observed when consistency is activated as a motivational state. Thus, the temporal pattern of activation may enable to distinguish between goal activation and mindset activation, and in turn, allow for understanding how they relate to each other.

Measuring the activation level of consistency. In addition to the advances in priming methods, we also have at our disposal at least two methods that confirm that consistency has been primed and can follow its activation level over time. Those are reaction times (Abad, Noguera, & Ortells, 2003; de Groot, 1985; Neely, 1991), and the Retrospective Assessment of Goals (RAG) method (Carlson, 2001, 2010; Russo et al., 2008).

Reaction time measurement consists in verifying the effectiveness of a priming method by checking whether participants respond faster to words related to the goal, for instance, orally naming those words. This method relies on the network of concepts associated to the goal. If a goal is primed, then the entire network is activated, which results in faster reaction times to closely connected concepts like related words.

The RAG method requires that decision makers speak their thoughts aloud, in Carlson's case (2001) during a decision making task. These concurrent verbal protocols are audio recorded. Then immediately after finishing their choice, participants use a replay of the recording to prompt the recall their goal activation levels during the choice and to report those levels on "log sheets". Each goal log sheet lists the decision process goals in alphabetical order, with each goal's definition after its name. Individuals report their goal activation levels for each goal on a scale from 0 "not at all active" to 100 "maximally active". Each time segment of the choice process can have its own goal sheet. For example, a binary choice between two options described by six attributes might be partitioned into six segments, with goal activation assessed after each segment (Russo et al., 2008). The replay of the verbal protocol (and possibly other process cues) facilitates goal recall in much the same way that a reproduction of the total context in which an event was encoded into memory (i.e., context-dependent) typically improves recall (Godden & Baddeley 1975; Tulving 1983). What results from the RAG method is a set of activation levels for each goal over the course of the choice or judgment process. This method should enable researchers to confirm the activation of either the mindset or the goal of consistency. A simpler version of the RAG Method was developed by Carlson et al. (2010), one that does not require a concurrent verbal protocol and that can be administered online. The major benefit is that goal activation is assessed during the decision-making process, and not after, and thus does not require the recording of verbal protocols. This recent method was also used successfully to demonstrate that individuals can report automatically activated goals.

Both of Carlson's methods depend on two innovations for detecting goal activation more sensitively than previous methods. First, goal activation is assessed directly by the individual, either during the primary process (Carlson, 2010) or shortly afterwards (Carlson, 2001). Second, the Carlson methods use a continuous scale rather than an all-or-none

response in which participants report a goal as having been active or not. Both innovations seem to be necessary to the sensitive measurement of goal activation and seem to reveal the activation level of goals better than prior methods (Carlson et al., 2010).

Summary.

We have tried to show that cognitive consistency theories rely on both a motivational component (a goal) and a cognitive component (a procedure for attaining the goal, that is, a mindset). Further, these two may work together to reach an internal state of consistency (part 2 of Figure 1). We have also tried to show that work in social and cognitive psychology supplies new building blocks to test those propositions. These may advance research on cognitive consistency and contribute to understanding the process by which an inconsistency in the environment produces attitudinal and behavioral responses. A last objective is to argue that a better understanding of cognitive consistency theories may also help to explain a variety of phenomena in consumer psychology.

Implications for research in consumer psychology

Our extended framework posits the potential existence of a goal of consistency and of an associated cognitive procedure, which prompts numerous questions in consumer psychology. The list of applications that follows is in no way intended to be exhaustive. Our purpose is solely to present selected sample of the research possibilities suggested by our propositions.

Cognitive consistency as a potential process explanation in consumer phenomena

Priming consistency should provide useful evidence of the process underlying at least some common consumer phenomena. In this section we present three such phenomena for which a consistency need has been suggested but without definitive empirical evidence.

Expectations and experience. Cognitive consistency should be one driver of the process by which expectations influence experience. For instance, visual perception is influenced not only see by what is objectively viewed but by our expectations (e.g., Balci et al. & Dunning, 2006). In consumer psychology, numerous studies demonstrate that our expectations directly impact perceptual experiences. For instance, Lee, Frederick and Ariely (2006) demonstrated that taste expectations for a beer directly influence liking. Hong and Kang (2006) highlighted that product evaluations are increased when a product is typical of those manufactured in the country of origin. The expectations derived from the country of origin guide how we perceive the quality of products. Why are we not better at forming accurate perceptions? The role of consistency in this phenomenon has already been proposed but has remained a controversial explanation (see Coppin, Delplanque, Cayeux, Porcherot, & Sander, 2010). We suggest that this controversy may be resolved by using a reliable method for priming the need for consistency.

Social influence. Early research on cognitive consistency was related to consistency within social networks. Social influence is an area in which a pressure to reach consensus can be observed. Peer pressure can be defined as an influence exerted by a group on a peer to follow the norms of the group. The result is often a change in beliefs or behavior to match the norms of the group (Greenspan, 1998). Berns, Capra, Moore and Noussair (2009) used functional magnetic resonance imaging (fMRI) to identify the neural mechanisms associated with social influence among adolescents in the domain of music. They measure judgments of preference and neurobiological responses to clips of songs, with and without the overall

popularity of the song revealed. They find a main effect of popularity on the participant's song attitudes. The fMRI results reveal that a principal mechanism whereby popularity ratings affect consumer choice is through *"the anxiety generated by the mismatch between one's own preferences and others. This mismatch anxiety motivates people to switch their choices in the direction of the consensus. Our data suggest that this is a major force behind the conformity observed in music tastes in some teenagers."* This finding suggests that inconsistency creates anxiety, which further drives a need to match one's preferences to those of one's social group. This result is in line with the hypothesis that social influence follows a consistency principle, and may help explain how and why brand communities are formed and brands valued so highly within those communities.

Motivated Reasoning: Selective exposure and information distortion. Motivated reasoning is the reliance on a biased set of cognitive processes to obtain support for a preferred conclusion (Kunda, 1990). We posit that a goal of cognitive consistency might play a role in this phenomenon. So far the motivated reasoning literature focuses mostly on input-outputs experiments, showing that the motivation to reach a desirable conclusion affects the information we attend to and process. However it lacks a more general and abstract process explanation by which the effect takes place. We propose that cognitive consistency may provide one such explanation.

In consumer research, motivated reasoning has multiple facets. We take two of them as illustrations. First, motivated reasoning can refer to selective exposure to confirmatory information. The selective exposure bias enables *"people to defend their attitudes, beliefs, and behaviors by avoiding information likely to challenge them and seeking information likely to support them"* (Hart et al., 2009). As a result, a defense motivation seems to be a straightforward driver of the selective exposure bias, and has already been linked to cognitive dissonance (Frey, 1986). It seems straightforward to posit that the goal of reaching

consistency is related to a defense motivation. Though, it would be nice to be able to prove it empirically, and our conceptualization might just enable to do such thing. More interestingly, another and unexpected driver of the selective exposure bias is an accuracy motivation, which has been shown to decrease the selective exposure bias when primed before or during the decision-making process, and increase it after the choice has been made. Reasons for this phenomenon are still unclear (Fisher & Greitemeyer, 2010). We note that most choice tasks imply aggregating different pieces of information to reach an overall consistent impression of a product. As a result, it is possible to assume that most choice tasks actually activate a mindset of consistency, which in turn may interact with any accuracy priming done after choice. Though speculative, this hypothesis would contribute to explain inconsistent results in the selective exposure literature.

Second, motivated reasoning can appear as information distortion, which is defined as the biased evaluation of new information to support an emerging preference or belief (Russo, Meloy & Medvec, 1998; Russo & Chaxel, 2010). Specifically, during a choice process, as one alternative naturally emerges as the tentative leader, individuals typically interpret incoming information as favoring this leader more than they should. Russo, et al. (2008) showed that cognitive consistency is a driver of the distortion process. A better understanding of the desire for consistency might further illuminate this finding, and apply it to other motivated reasoning phenomena, such as biased memory (Kunda & Sanitioso, 1989; Sanitioso, Kunda, & Fong., 1990), self-serving attributions of behavior (Pyszczynski & Greenberg, 1987), or the desirability bias (Krizan & Windschitl, 2007).

Natural primings of consistency

The distinctions drawn above between consistency as a goal and as a mindset imply for a search of different naturally occurring sources of activation. A particular context would prime the goal of consistency if it creates a motivational drive to restore consistency. This

drive would last until the goal is fulfilled. Conversely, a situation would prime a mindset of consistency if it activates an associated procedure. This activation would not need any delay to be further activated.

As one example consider consumers who are exposed to information inconsistent with the image of a brand. This should activate the consistency goal, that is, a desire to make the information fit with previous beliefs. That goal should stay activated until its resolution. As a second example of a naturally occurring prime, consider consumers who in their local newspaper are playing mind games such as crosswords or Sudoku. This might activate a consistency mindset that, in turn, would influence how the readers are processing information. Even if highly speculative, this assumption is in agreement with Wyer and Xu's series of experiments (2010) in which priming a mindset in one domain can impact judgment and decision-making in a completely different setting.

Segmentation Strategy

Preliminary evidence by Cialdini (2005) suggests that people differ in their chronic level of consistency activation., Might this individual difference be the basis for a segmentations strategy? That is, could individuals be usefully categorized by their need for consistency? Might such a consistency-based segmentation help to predict their willingness to reconcile disconfirming evidence with their existing network of beliefs?

Recall our first example: "You are a loyal consumer of Brand X, and you believe it offers the best value on the market. Then you learn that this same brand uses child labor in Third world countries, something you strongly oppose." As a result, a first application of a consistency-based segmentation might predict how consumers would react to indisputable evidence of a break in the implicit contract between them and the company, i.e., to a break of trust. One example of such a break is Toyota's large recall in 2009. How was the news

accepted and digested by loyal Toyota consumers? How did it impact their system of beliefs towards the brand, particularly its presumed safety?

Another domain of application would be brand extensions, as briefly mentioned in the introduction. Recall the question: “You have been eating Brand Z at breakfast for ages and you have always categorized it as a cereal company. This same company decides to diversify and invest into dog food”. We argue that, if a consistency drive is strongly activated, it is possible to assume that people in general see unrelated elements as being more similar than they actually are. Would consistency explain why some brand extensions are more successful than others? More precisely, are consumers with a greater chronic desire for consistency more accepting of near brand extensions and more rejecting of far ones?

Finally, we argue that advertising may also benefit from more insights from a cognitive consistency segmentation. What happens when a seller makes a claim that is inconsistent with its brand image? Would an increased activation of the goal of consistency improve its receptiveness? Recall the last example of our introduction: “You believe that the Perfume Y is too strong, low-end, and out of fashion. You come across an advertisement for Y portraying its use by an Italian actress you think is beautiful, sophisticated and trendy”. Would people for whom a goal of consistency is strongly activated incorporate the new image more easily into the core of the brand image?

Conclusion

We hope to have made the point that several insights, theoretical and methodological, from social and cognitive psychology allow for a new look at consistency theories, and the development of new research questions in consumer psychology. Coming back to the fundamentals of cognitive consistency theories and applying new knowledge should allow for

a better grasp of how this need influences information processing, and, *in fine*, our preferences and choices.

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PAPER 2: THE INFLUENCE OF COGNITIVE CONSISTENCY ON JUDGMENT

Cognitive consistency is a fundamental topic with a long history that has begun to return to research prominence (Gawronski & Strack, 2012). The substantial interest it received in the 1960's declined so much that by 1983 Abelson could title an article, "Whatever became of consistency theory?". Yet cognitive consistency continued to play an active role in research, if sometimes under other labels like coherence (Holyoak & Simon, 1999), compatibility (Goertzel, 1994), and balance (Cvencek, Greenwald, & Meltzoff, 2012). The diversity of labels was compounded by a dispersal of interest across several subareas of psychology, such as belief systems (McGuire & McGuire, 1991), interpersonal relations (Walther & Weil, 2010), legal judgments (Pennington & Hastie, 1988; Simon, Snow, & Read, 2004), reasoning (Johnson-Laird, Girotto, & Legrenzi, 2004; Thagard, 2000, 2006), and social cognition (Greenwald, Pickrell, & Farnham, 2002; Heine, Proulx, & Vohs, 2006; Read & Marcus-Newhall, 1993).

The renewed focus on cognitive consistency is motivated by at least two factors. First and fundamental, one can reasonably claim that our ability to organize our understanding of the external environment and, more importantly, to predict its opportunities and risks depends on sensing consistent relations among various cues and consequences. That is, the skill of detecting consistencies is necessary to adapt to the various environments in which we must function. The natural conclusion from the fundamental status of cognitive consistency, is its potential value in explaining a broad range of phenomena such as the list noted above. Even focusing on a single topic like belief systems, cognitive consistency might help to understand their structure (Read & Simon, 2011), the need to maintain a justification for a belief (Nickerson, 1998), and the reconciliation of new information with existing beliefs. For

instance, regarding the last, Nickerson stated, “*Surely everyone would agree that beliefs should be consistent with whatever evidence one has* (Nickerson, 2008, p. 59)”.

A second reason an empirical exploration of the role of cognitive consistency in multiple phenomena is the availability of methods for studying goals. A case can be made that a major reason for the decline in applications of cognitive consistency after the 1960’s was the lack of efficient methods for manipulating the activation of consistency. At that time studying cognitive consistency by activating it in an experimental context often required manipulations that were idiosyncratic to the research task. For instance, in the forced compliance paradigm, priming cognitive consistency typically required a participant to write a counterattitudinal statement, with the consistency-driven consequence being a change in that same attitude (Festinger & Carlsmith, 1959). Instead, the new methods use a manipulation of the activation levels of various goals (i.e., goal priming) that is independent of the subsequent criterion task. In addition, the new methods include ways to assess the activation levels of goals. Such assessments can both validate the success of the priming methods and measure goals’ activation levels across tasks and time. Just as important to the validity of their application, the new priming tactics can be implemented without the experimental participants aware that a goal has been activated, thereby precluding explanations based on demand effects (Custers & Aarts 2010). These methods were not available several decades ago. Their current availability enables tests of the goal of consistency as a driver of judgments that could not have been performed in the past. Their use is essential to the current research.

What is cognitive consistency? This is a question that we don’t propose to answer because there are multiple competing conceptualizations that have not been reconciled and their reconciliation is not our objective. For some cognitive consistency is a “*fundamental principle of information processing*” (Gawronski & Strack, 2012, p. 3) or, equivalently, a

basic property of belief systems (McGuire, 1968). Others see it as a structure of relations among cognitive elements or at least as a characteristic or measurable property of such a structure (Read & Simon, 2011). For a third group of psychologists cognitive consistency is a “*means of disconfirming or refuting a hypothesis or a knowledge claim*” (Kruglanski and Shteynberg, 2012, p. 250). This notion of cognitive consistency as a means to an end is similar to seeing it as a mindset, that is as a procedure learned to achieve a desired goal (Wyer and Xu, 2010). Finally, cognitive consistency is often viewed as a goal in the sense of a desired end-state (Fishbach and Ferguson, 2007). This last is the perspective that we adopt.

Because we treat the desire for cognitive consistency as a goal, our research necessarily builds on work on goals (e.g., Förster, Liberman, & Friedman, 2007; Baumgartner & Pieters, 2008). We note that cognitive consistency is a process goal, those that are confined to the process itself and are satisfied, or frustrated, during that process (Carlson et al., 2008; Van Osselaer et al., 2005). Other examples are conserving effort (Payne, Bettman, & Johnson, 1990) and avoiding negative emotions (Luce, Payne, & Bettman, 2001). Process goals can be contrasted with goals defined by an outcome of the process, such as the response to a problem or the selected alternative in a decision.

The remainder of this report is organized as follows. The first section describes the priming method that was developed to activate the goal of cognitive consistency. The second section describes the research strategy and proposes several phenomena as candidates that are driven, at least in part, by the desire for cognitive consistency. The third section describes the experiments associated with our research strategy.

Priming Consistency as a Goal: Method Development

The most familiar goal activation methods involve some form of semantic priming (Fishbach & Ferguson, 2007). Participants are exposed to words related to a goal that, in turn, lead them to engage in goal-congruent behavior. For instance, when participants are asked to solve scrambled sentences with words related to hostility, they subsequently exhibit hostile behavior (Srull & Wyer, 1979). This approach has already been successfully applied in research on consistency (Russo, Carlson, Meloy, & Yong, 2008). However, we note that the power of semantic priming to actually drive a motivational state is disputed (Forster, Liberman, & Friedman, 2007; Nelissen, Dijk, & de Vries, 2005). The concern is that semantic methods may prime only the semantic network associated with a goal and not the goal itself. The observed impact on behavior might have occurred through an automatic perception-behavior link without needing a real motivational drive to pursue the relevant goal. Because of the uncertainty of semantic methods' efficacy, we chose a different approach to priming the goal of cognitive consistency.

The priming of an actual motivational state requires a difference between the actual state and a desired state (Miller, Galanter, & Pribram, 1960; Sela & Shiv, 2009; Zeigarnik, 1967). A behavioral task that creates such a discrepancy should prime the goal to reduce that difference. This is behavioral priming of a goal. It is a more direct approach than semantic priming and should prove more reliable. Thus, we sought a task in which participants would be faced with an inconsistency between beliefs that was very difficult to resolve. Then the motivation to restore an acceptable level of consistency should carry over to an immediately subsequent (criterion) task.

Several attempts to find such a priming task led us to the use of a conundrum, a problem that requires participants to resolve two seemingly inconsistent facts. One such conundrum is, "Why do we criticize traders for being overpaid but accept football players

and movie stars' salaries?" The expected inability to provide a fully satisfactory answer should activate the goal of consistency and, because it has not been attained, carry over that activation to a subsequent task (Förster et al., 2007; Zeigarnik, 1967).

Furthermore, if a goal is successfully activated, then a delay that frustrates its attainment further increases the level of activation (Bargh, Gollwitzer, Lee-Chai, Barndollar, & Troetschel, 2001; Förster et al., 2007). Thus, any goal priming tactic should produce an even higher level of activation after a delay of a few minutes. For this reason, the new priming method always consisted of two tasks, the first one to activate the goal of consistency followed by a filler task that delayed goal achievement. These two tasks were then followed by one of several criterion tasks that each tested a theoretical prediction about the role of cognitive consistency.

Note that our first objective was methodological, not theoretical. That is, we sought a method for reliably priming the goal of cognitive consistency, using whatever techniques we could devise. We have not attempted to study the basis of those techniques' success, for instance by testing both semantic and conundrum-driven priming or by validating the benefit of a delay to increase the level of activation. We first wanted to find a priming process that worked.

Research Strategy

Research Design

In all the studies, participants were randomly assigned to one of two conditions, goal priming versus control. In the priming condition, participants were given 3 minutes to answer

a conundrum, followed by a 5-minute delay task. In the control condition, participants were directed to the 5-minute delay task without answering the conundrum.

In experiments 1, 3 and 4 the delay task was a 5-minute silent film, an extract of Charlie Chaplin's "The Kid" (<http://www.youtube.com/watch?v=2MUBrClhgks>). In experiments 2, 5 and 6 participants responded to the following: "Describe one interesting thing you did last week. Your challenge is to enable the reader to experience, through your words, what you yourself did." Both tasks served their purpose and, as near as we could tell, are interchangeable.

The only difference among experiments is the criterion task, which was chosen to fit the purpose of each study. More specifically, our experiments aim to meet two objectives. The first (Experiments 1-3) is to verify that our behavioral priming method (conundrum, followed by a delay) successfully primes the goal of cognitive consistency. The second objective (Experiments 4, 5 and 6) is to demonstrate the impact of the goal of cognitive consistency on three different judgmental phenomena.

Method Validation: Experiments 1, 2, and 3

We first looked for different, convergent methods that would enable us to confirm that consistency has been successfully primed by our manipulation. We selected three.

Experiment 1 uses an implicit measurement of goal activation, based on reaction time measurements (Abad, Noguera, & Ortells, 2003; de Groot, 1985; Neely, 1991). This method verifies the effectiveness of a priming method by checking whether participants respond faster to words related to the goal when orally naming those words. This technique relies on the network of concepts associated to the goal. If a goal is primed, then the entire network is activated, which results in faster reaction times to closely connected concepts like related words.

Experiment 2 uses an explicit measurement of goal activation (Carlson et al., 2010). Participants are interrupted during a task and asked to record their level of activation of one or more goals. The timing of this method is important because if asked post-task when the goal has been accomplished, its activation level would have dropped substantially, possibly below a level of conscious awareness (Förster, Liberman, & Friedman, 2007).

Experiment 3 uses a behavioral measure of the activation of cognitive consistency, the predecisional information distortion (ID). ID is the biased evaluation of new information to support an emerging preference or belief. Specifically, during a choice process, as one alternative naturally emerges as the tentative leader, individuals typically interpret incoming information as favoring this leader more than they should. Because (semantic) priming of cognitive consistency has been shown to increase information distortion during a choice process (Russo et al., 2008), the efficacy the new behavioral priming technique can be validated by finding for the same increase in ID.

Verifying the influence of cognitive consistency on judgments: Experiments 4, 5, and 6

We expected the impact of a desire for cognitive consistency to be observable in phenomena for which an individual may have the underlying goal of fitting together what is known and information that is newly acquired. As such, our subsequent experiments examined whether cognitive consistency may be driving the impact of existing beliefs on information search (Experiment 4), of expectations on perceived experience (Experiment 5), and of desirability on likelihood judgments (Experiment 6).

Experiment 4 tests the impact of cognitive consistency on biased information search, a bias sometimes referred to as selective exposure to information (Festinger, 1957; for a review, see Hart, 2009). As previous research has already shown that cognitive consistency is

a driver of the biased evaluation of incoming information, this investigation seemed like a natural extension.

Experiment 5 investigates the effect of an expectation on the judgment of actual experience (e.g., Lee, Frederick, & Ariely, 2006; Kahan, Hoffman, Braman, Evans, & Rachlinski, 2011; Massey, Simmons, & Armor, 2011). In this phenomenon, sometimes termed selective perception, expectations are the established belief and perceived experience is the new information. Because it is natural to attempt to match expectations and experience, the goal of cognitive consistency seems a likely candidate for driving this matching process.

Finally, Experiment 6 examines the impact of cognitive consistency on the desirability bias. This is the result of the desirability of an outcome influencing the judgment of its expected likelihood. This phenomenon has a substantial history (see the review by Krizan & Windschitl, 2007) and remains of current interest (e.g., Bastardi, Uhlmann, & Ross, 2011). The essence of the argument for why cognitive consistency might contribute to the desirability bias is that so long as there is an active desire to seek consistency between two beliefs, there is a desire to reconcile the estimated likelihood of an event's outcome (the evaluation of new information, including information retrieved from memory) with the preference for that outcome (an established belief).

Experiment 1: Response Times

Participants

For compensation of \$10, 20 students took part in a computer-based experiment that was run in the laboratory of a large North American university. They were assigned randomly to the control condition or to the consistency priming condition.

Procedure

Participants assigned to the consistency priming condition were given three minutes to answer a conundrum. They then watched a movie extract for 5 minutes. Participants in the control condition only watched the movie extract.

All participants were then told that the next task would test their concentration skills. They were instructed to read aloud, as quickly as possible, each of a series of common words appearing on a computer screen. Response times were recorded with the expectation that words related to consistency would be responded to more quickly. This word-naming task is commonly used to assess the effect of priming (Abad, Noguera, & Ortells, 2003; de Groot, 1985; Neely, 1991). It has also been used successfully in previous research on cognitive consistency (Russo et al., 2008).

Two categories of six words each were presented to every participant. The first contained the words related to consistency: (agreement, coherence, compatible, congruence, consistent, and fitting). The second category contained neutral words (above, collection, deepen, kitchen, overcome, underline) that were relatively unrelated to consistency. The neutral words provided a response time baseline for each participant.

Results

The dependent measure was the within-participant difference between the mean response time to the six consistency-related words and the mean to the six neutral words. Successful activation of the consistency goal should have yielded briefer response times to the consistency-related words (relative to the baseline of the neutral words) only in the priming condition.

In the control group the within-participant difference in RT between words related to consistency and control words was 107.7 ms ($SE = 14.85$), a value significantly different

from zero ($t(10) = 7.78$, two-sided $p < .0001$). Thus, on average participants took longer to react to consistency-related words than to neutral words. Since the words in the two categories were of similar length, this difference was assumed to come from an effect of word familiarity. Words such as “kitchen” or “above” were likely to be used more often than words such as “coherence” or “fitting”.

In the priming condition, the within-participant difference in RT between words related to consistency and control words was still positive, but less so (22.6 ms, $SE = 21.93$). A t-test between those two RT conditions confirmed the reliability of the expected difference between the priming and control condition ($t(18) = 3.28$, two-sided $p < .01$).

Thus, the greater accessibility of consistency-related words verified that cognitive consistency had been successfully activated as a goal. Yet, because word-naming might have reflected only a semantic effect and not an actual increase in motivation, the next study used an explicit measurement of goal activation.

Experiment 2: Online Assessment of Goals

Participants

Through Amazon Mechanical Turk 60 participants were recruited. Each received a payment of 50 cents. Participants were assigned randomly to the control condition or to the consistency-primed condition. One participant who failed to follow instructions was excluded, leaving 59 respondents.

Procedure

Following the priming phase, participants were first given definitions of four goals, consistency and three distracters. Carlson et al. (2010) argue that this pre-task familiarity with

the goals is needed to ensure that all participants share the same meaning of each goal and can recognize them when interrupted and asked to report their activation levels. Each participant read the following instructions:

On the pages that follow, you will be asked to read and evaluate information that will help you make a decision between two products. During the choice process, you will be asked to report what strategies you are using to actually come to a decision.

To be sure that you fully understand the meaning of a question that will be asked later in the study, please take some time to read out loud the four following definitions:

- *Conserve Effort: Save effort when examining or making judgments about the options.*
- *Be consistent: See new information as consistent with information seen earlier.*
- *Separate the options: Exploit differences between the options to separate them from each other.*
- *Memorize: Commit the information seen to memory.*

Once you have read out loud the four definitions, you can start the study. Thanks in advance.

Participants then completed a choice task between two resort hotels, using several product attributes as units of information. Midway through the choice process and again near its end, participants reported the activation level of each of the four goals on a scale from 0 (*not at all*) to 100 (*as much as possible*).

Results

The test for successful goal activation was the difference in the means of the self-reported levels of consistency activation between the priming and the control conditions. Participants in the priming condition should have reported a higher mean level of activation.

In the control group participants reported a mean activation of the consistency goal of 68.9 on the scale from 0 to 100 ($SE = 4.79$). This value suggested that the goal of cognitive consistency is always somewhat active in such a choice task. Note that the self-report method and the resulting mean activation also suggested that the activation of the goal of cognitive consistency is not all-or-none, but lies on a continuum (see Carlson et al., 2010).

In the primed group participants reported a mean activation of the consistency goal of 80.0 ($SE = 3.65$). A t-test revealed that this value was significantly above the control group's mean ($t(57) = 1.83$; one-sided $p < .05$). Thus, the greater activation level of the consistency goal in the primed condition verified that cognitive consistency had been successfully activated as a goal.

Experiment 3: Information Distortion

As a third and final test of the ability of the conundrum-based method to activate the goal of cognitive consistency, we sought a criterion task where the consistency goal had already been shown to drive an observable effect. Thus, the task was binary choice and the effect was the predecisional distortion of information to support an emerging preference (Russo et al. 2008). If the conundrum-driven priming of consistency could successfully increase information distortion, there would be a third validation of the method, this time in a more natural task, the choice between two alternatives.

Participants

Participants were 70 students from a large North American university. They were paid \$5 for a 30-minute session in a laboratory and assigned randomly to either the priming or control condition.

Procedures

After the priming phase, participants chose between two options (resort hotels) based on five narrative attributes presented sequentially (e.g., Meloy, Russo, & Miller, 2006). After reading each attribute, participants were asked three questions. The first was a rating of the diagnosticity of the attribute on a 9-point scale, where 1 meant “strongly favors” one hotel, 9 meant “strongly favors” the other hotel, and 5 meant “favors neither hotel”. This response formed the basis of the measurement of information distortion. Second, participants were asked which alternative they would choose if they were to pick one at this stage, knowing that more information would be provided. This response identified the currently leading option. The third response was the participant’s confidence in this leading option.

Results

The calculation of information distortion required two steps. To begin, a participant’s estimate of an attribute’s diagnostic value (on the 9-point scale) was compared to an unbiased evaluation of the same information that was pre-tested to be approximately 5, which meant that the information favored neither hotel. Second, the absolute difference between those two values was signed positively if the attribute’s rating favored the leading alternative (which qualified as information distortion) and negatively if it favored the trailing one (which should only have occurred by chance). Note that if the confidence in the leading hotel was zero, no reliable leader existed and no estimate of ID could be computed. We expected participants with a higher activation level of the consistency goal to exhibit greater information distortion.

The results exhibited the same pattern as those from Experiments 1 and 2. The mean information distortion was significantly higher when consistency was activated ($M_{\text{priming}} = 1.15$ versus $M_{\text{control}} = .40$; $t(68) = 2.41$; two-sided $p < .05$). Thus, the new behavioral priming method, resolving a difficult conundrum, succeeded in replicating the known effect of cognitive consistency on the biased evaluation of incoming information.

Experiment 4: Selective Exposure

We have argued that developing a method for priming cognitive consistency is potentially useful for explaining one underlying cause or mechanism of judgmental phenomena in general. The test of that value is the ability of the method to contribute to our understanding of multiple specific phenomena. With this in mind, we chose to study three well known phenomena where consistency has been predicted to, or might be expected to, play an important role, but where that role has not been tested until now. The first of these is selective exposure (Festinger, 1957; Frey, 1986).

Participants

One hundred and twenty participants were recruited through Amazon Mechanical Turk and run online. Each participant was compensated 50 cents and randomly assigned to one of the two conditions. priming or control.

Procedures

Following the usual priming phase, the criterion task required participants to make a choice between buying and not buying a laptop based on an initial description and five user reviews.

The initial information given was the following:

Your current laptop is getting old and crashes too often. You have very important data on your laptop and don't want to risk losing any of it in case your laptop breaks. Thus, you decide buy a new laptop.

You have a budget of around \$500 to spend, and it happens that there is a laptop for around that price that you are considering. (For the purposes of this study we have removed the name of the laptop and just labeled it X.) There are certainly other laptops that might be what you're looking for, and quite possibly better ones, but this one has caught your eye and you want to seriously evaluate it. Below is a description of the laptop that you want to evaluate.

Laptop X	\$490 - \$500
Battery life:	6 hours
Weight:	5.2 pounds
Processor:	1.6GHz Intel N270 Atom Processor
Memory:	1 GB DDR2 RAM
Hard Drive:	80 GB SATA Hard Drive
Size:	14.2"

After making their initial, tentative buy/ no buy decision, participants were told that they had to look at five pieces of information before making their final decision, after which they were free to reverse their decision or maintain it. These additional pieces of information

were consumer reviews, which could be extracted from one of four websites: a fan page, the company's website, a blog opposed to the laptop, or an online retailer website. The fan page and the company's website were described as likely to contain positive reviews. The blog and the online retailer were described as likely to contain negative reviews. All four sites contained 5 reviews, and each of the total of 20 reviews was found online and written by an actual consumer. They were lightly edited for clarity and length.

After making their final decision, participants were told that "curiosity moves you to go online" where they were instructed to "get three more pieces of information". These final three user reviews could be selected from the same four sources. Participants could not reverse their purchase decisions at this stage.

Results

Our interest was both what participants did after they had made their initial buy/no-buy decision (when they were instructed to select five user reviews) and what they did after they had made their final decision (when they were instructed to select three additional user reviews). In each of these cases, the dependent measure was the proportion of reviews that were confirmatory. A review was coded "confirmatory" if the participant had decided to buy (not to buy) the camera and it was selected from one of the two more positive (negative) sources. The opposite held for "disconfirmatory".

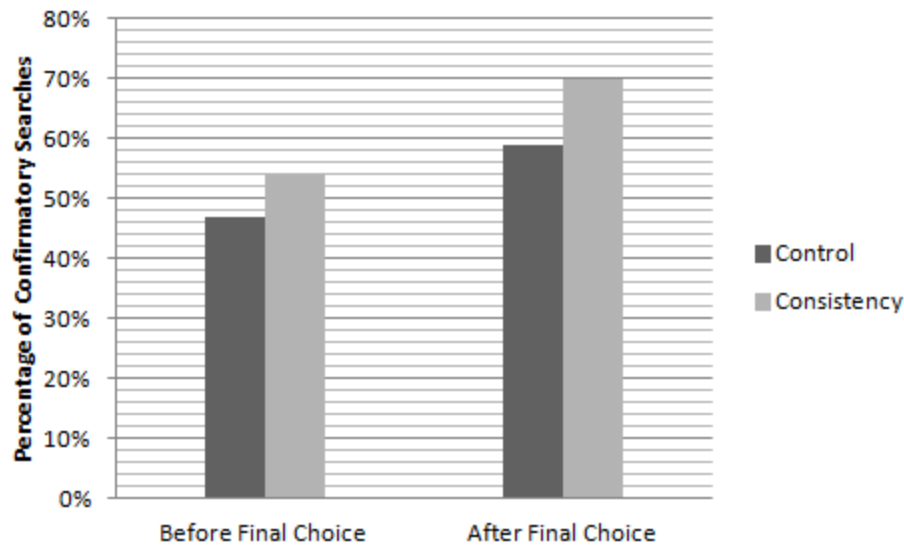
The argument for the effect of the desire for consistency applied to confirmatory search both before and after the final decision. The open question was whether the effect of priming the consistency goal would have a greater effect before or after that final decision. On the one hand, the priming effect of the conundrum may have faded after the initial choice phase, thereby reducing its effect after the final decision. On the other hand, the commitment to the decision to buy or not buy the laptop should have been greater after the final decision,

and that commitment might have combined with whatever priming effect was left to yield greater selective exposure after the final decision.

The results are displayed in Figure 2. Priming consistency yielded a significant increase in the overall proportion of confirming searches, confirming the findings of earlier studies (again see Hart et al., 2009). The results of a MANOVA confirmed the significant main effect of priming ($F(1, 118) = 8.73$; two-sided $p < .05$). The same MANOVA also revealed a main effect of time ($F(1, 118) = 18.01$; two-sided $p < .01$). Participants searched for significantly more confirming information after having made their final decision than after having made their initial decision. This result was fully compatible with the greater commitment after the final decision than before (when the tentative decision was reversible).

The open question was whether the effect of priming consistency was greater before or after the final decision. The consistency-driven increase in selective exposure was observed both before and after the final decision was made ($\text{Prop}_{\text{priming-after initial}} = .55$ versus $\text{Prop}_{\text{control-after initial}} = .47$, and $\text{Prop}_{\text{priming-after final}} = .70$ versus $\text{Prop}_{\text{control-after final}} = .59$). The interaction effect between priming and time was not significant ($F(1, 118) = .26$, two-sided $p > .60$). Thus, primed participants tended to look for about the same amount more confirming information than the controls, whether that search occurred before or after the final decision.

Figure 2: Effect of priming on the selective exposure bias



Overall, our results confirmed the earlier work showing that cognitive consistency drives, at least partly, the process that underlies the post-choice bias in the search for information that supports a decision (commonly known as selective exposure). However, that result is extended methodologically, by using a general priming method rather than ones that are task-specific.

Experiment 5: Judgment influenced by expectations

We now investigate whether it also has the power to increase the extent to which expectations bias our judgments.

Participants

The study was run online through Amazon Mechanical Turk. The 160 participants were each paid 50 cents. They were randomly assigned to one of the two conditions.

Procedures

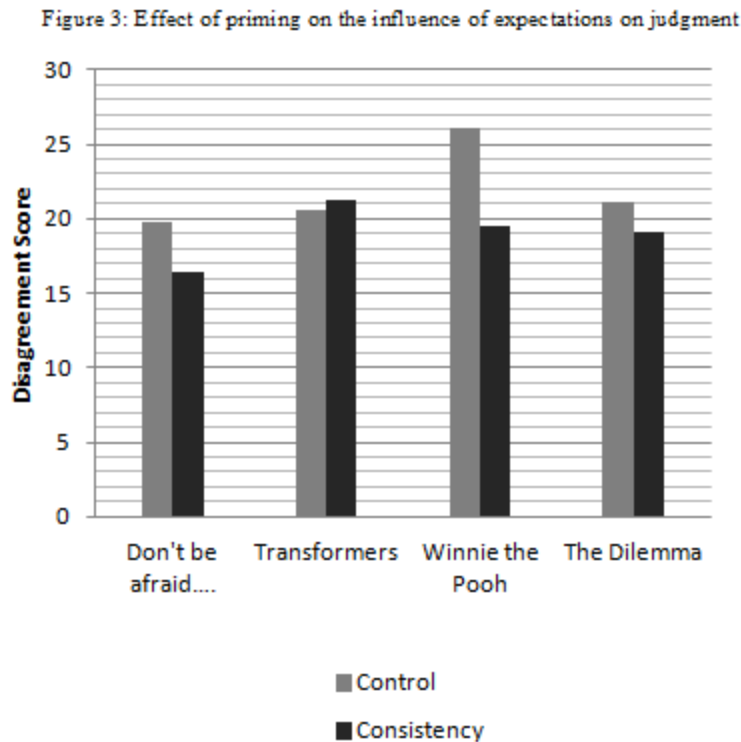
After the same priming phase, participants were told that they were about to watch movie trailers and rate them. Four trailers were selected for movies that had not yet been released at the time of the experiment: Don't be afraid of the Dark, Transformers - Dark of the Moon, Winnie the Pooh, and the Dilemma. Prior to viewing them, participants read each one's title, a list of the main actors, and a synopsis of the plot. Based on this information, they were asked to rate how much they expected to like each movie's trailer on a scale from 0 (*not at all*) to 100 (*very much*). After watching all four movie trailers in a randomized order, participants rated how much they actually liked each one on the same 0-to-100 scale.

Results

The first criterion for the effect of consistency was a disagreement score, the absolute value of the difference between the rated expectation and actual experience, averaged across the four movies. Lower scores meant lower disagreement, which in turn meant a greater influence of the expectation on the reported liking. We predicted that increased activation of the desire for consistency in the primed group would lead to lower disagreement scores. The mean disagreement score in this condition was 19.1 ($SE = 1.20$), compared to 21.9 ($SE = 1.21$) in the control condition. The difference between these two scores was statistically reliable ($t(158) = 1.66$; one-sided $p < .05$).

We then assessed the effect of priming cognitive consistency on the disagreement score independently for each movie. A MANOVA yielded the expected main effect of priming ($F(1, 158) = 2.77$, one-sided $p < .05$) and also showed an unexpected marginal effect of the type of movie ($F(3, 156) = 2.27$; two-sided $p < .10$). This marginal effect was due to a higher disagreement rate for the movie Winnie the Pooh. Although participants expected to dislike its movie trailer ($W_{\text{innie-exp}} = 47.75$, $SE = 2.14$), they actually really enjoyed it (W_{innie}

$_{real} = 62.6$, $SE = 2.36$), resulting a higher disagreement score. Note though that the interaction effect between priming and type of movie was far from significant ($F(3, 156) = .93$, two-sided $p < .50$). Therefore, the effect of priming the goal of cognitive consistency did not differ reliably across movies (see Figure 3)



These results showed that the influence of expectation on perception is driven at least partially by the desire for consistency.

Experiment 6: Desirability Bias

As our final investigation of the influence of cognitive consistency on judgmental phenomena, we examined the desirability bias (see the review by Krizan & Windschitl, 2007). This is the often documented effect of the preference for an event on the estimated

likelihood of that event. For a desired event, its likelihood is often elevated, while for undesired events it is decreased. We raise the possibility that a desire to make the outcome and its likelihood more consistent may contribute to this bias.

Participants

The study was run online through Amazon Mechanical Turk. The 147 participants were each paid 50 cents.

Procedures

Participants were first assigned randomly to the control condition or to the consistency priming condition. They were then asked to make a series of six predictions regarding the 83rd Academy Awards winners, held in February 2011. Note that the study was run in January 2011, near enough to the awards themselves that the actual list of nominees could be used.

The instructions were the following:

For each of the six major Academy Award categories listed below, please predict the winner to the best of your ability and knowledge. This is the nominee that you believe will win, regardless of whether they should win.

The six categories were: best actress, best actor, best supporting actor, best supporting actress, best director, and best picture. For instance, for the category best actor, the participants answered the following question:

Which nominee do you predict will win Best Actor?

— *Colin Firth (The King's Speech)*

— *James Franco (127 Hours)*

- *Javier Bardem (Beautiful)*
- *Jeff Bridges (True Grit)*
- *Jesse Eisenberg (The Social Network)*

After making all six predictions, participants were asked to indicate which nominees they would actually like to see win. The instructions, adapted for each category, were:

Now please tell us the nominee that you would most like to see win the Academy Award, regardless of their chance of winning. This is the nominee that you hope wins, that would most please you if they do win, completely independent of whether they actually will win.

Which nominee would you most prefer to win Best Actor?

- *Colin Firth (The King's Speech)*
- *James Franco (127 Hours)*
- *Javier Bardem (Beautiful)*
- *Jeff Bridges (True Grit)*
- *Jesse Eisenberg (The Social Network)*

Results

The dependent measure was the number of predictions that matched the participant's preferences, a number between 0 and 6 that amounts to an agreement score between preferences and likelihoods. Our expectation was that priming consistency would yield a higher agreement score.

Results confirmed this expectation. In the control condition the number of matches averaged 2.26 ($SE = .16$). In the priming condition, the average number of matches increased to 3.05 ($SE = .18$). This difference was highly significant ($t(145) = 3.28$; two-sided $p < .001$).

A MANOVA was performed with type of prize category as a repeated-measure factor and priming as the second factor. Both main effects were significant. First, the significance of the difference between conditions ($F(1, 145) = 10.81$, two-sided $p < .005$) was confirmed. Second, a difference between prize categories was also observed ($F(5,141) = 4.14$, two-sided $p < .005$), due an overall higher agreement for the category Best Actress (largely dominated by Natalie Portman in 2011). However no interaction effect between prize category and condition was found, meaning that the priming effect did not differ significantly across categories ($F(5, 141) = 1.59$, two-sided $p > .15$).

Discussion

The present research demonstrates that cognitive consistency can be activated as a goal by a relatively straightforward behavioral priming task. Experiments 1, 2, and 3 verified that our conundrum-based method successfully primes consistency. Experiment 4, 5, and 6 demonstrate that the desire for cognitive consistency drives three well-known phenomena of human judgment: selective exposure or the bias to search for confirming information after a decision, selective perception or the influence of expectations on judgment, and the desirability bias.

The main objectives of the present work were to introduce and validate the conundrum-based method and then to demonstrate its applicability to some familiar tasks. One natural next step is to use the method to better understand other phenomena, including attempts to test for the role of cognitive consistency in tasks where this goal has already been proposed as a candidate explanation. With this in mind, the following additional phenomena are proposed.

Other phenomena that may be driven by cognitive consistency

Consistency within social groups: social influence. Early research on cognitive consistency was related to consistency within social networks. Social influence, defined as an influence exerted by a group on a peer to follow the normative rules of the group is an area in which a pressure to reach consensus can be observed. The result is often a change in beliefs or behavior to match the norms of the group. Berns, Capra, Moore and Noussair (2009) used functional magnetic resonance imaging (fMRI) to identify the neural mechanisms associated with social influence among adolescents in the domain of music. They measured both judgments of preference and neurobiological responses to clips of songs, with and without the overall popularity of the song revealed. They show a main effect of popularity on the participant's song attitudes, and the fMRI results suggest that a principal mechanism whereby popularity ratings affect consumer choice is through *"the anxiety generated by the mismatch between one's own preferences and others. This mismatch anxiety motivates people to switch their choices in the direction of the consensus. Our data suggest that this is a major force behind the conformity observed in music tastes in some teenagers."* As a result, this research shows that inconsistency creates anxiety, which further drives a need to match one's preferences to those of one's social group. This result is in line with the hypothesis that social influence may be driven by the goal of cognitive consistency.

Assimilation vs. Contrast Effects. Assimilation and contrast effects (Sherif & Hovland, 1961) might also be considered a consistency-related phenomenon. This theory posits that there are zones (or latitudes) of acceptance and rejection in individuals' perceptions. If the discrepancy between beliefs and incoming information is small enough, it will fall into the consumer's latitude of acceptance, and the individual will tend to assimilate the difference. If the discrepancy is too large, it enters in a zone of rejection, and the individual magnifies the perceived disparity creating a contrast effect. An activated goal of

consistency may increase the zone of acceptance and boost assimilation effects in comparison to contrast effects. This prediction is consistent with research done in the context of the violation of expectations by Anderson (1973). Fitting dissonance theory predictions, his results verify that if the discrepancy between consumer expectations and actual product performance is too high, it will cause a less favorable evaluation of a product than a somewhat lower level of disparity. It would be interesting to check whether activating a goal of consistency would actually increase assimilation effects, possibly by widening the acceptance zone.

Hindsight Bias. The hindsight bias relies on the outcome of a past event to provide important information that is difficult to ignore. Then the estimated likelihood of that outcome, estimated as if the outcome were not known, is biased to accord with the outcome. Of course, the challenge in avoiding any hindsight bias is to ignore the knowledge of “what really happened”. The prediction is that cognitive consistency contributes to the retrospective fitting of the estimated likelihood with the known outcome.

There is no reason for the above list of phenomena to be exhaustive. For instance, might the representativeness heuristic or anchoring and underadjustment be influenced by the goal of cognitive consistency? Might the same be said for the confirmation bias (Nickerson 1998) and the foot-in-the-door technique (Freedman and Fraser, 1966)? The proposed method for priming cognitive consistency is not meant to be specific to any phenomenon. It should be able to be used to investigate the role of cognitive consistency in many phenomena.

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PAPER 3: THE INFLUENCE OF ASSOCIATIVE REASONING ON JUDGMENT
AND DECISION-MAKING

A growing body of literature views human judgment and decision-making as the product of one of two underlying systems of reasoning (Epstein, 1973; Evans & Over, 1996; Kahneman & Frederick, 2002; Sloman, 1996; Stanovich & West, 2000). The evidence for the existence of two systems usually stems from the capacity of the human mind to exhibit simultaneous contradictory responses from a single reasoning problem, called Criterion S by Sloman (1996). A well-known example of the existence of Criterion S is known as the Linda-the-bank-teller problem (Tversky and Kahneman, 1983; Sloman, 2002). In this task, participants are first asked to read the following description of a hypothetical person:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and she participated in anti-nuclear demonstrations.

Participants are then asked to rank order the probability of eight statements about Linda, including:

Linda is a bank teller

Linda is a bank teller and is active in the feminist movement

The rules of probability theory require the second of the above statements be less likely than the first because it has an additional requirement. However, a large majority of participants mistakenly rank it ahead of the first. This error in logical reasoning about probabilities is usually attributed to the “representativeness heuristic”, a rule of thumb by which judgments of probabilities rely on similarity relations. Because Linda’s description is more similar to a feminist bank teller than to a typical bank teller, the second statement is

judged more likely than the first. In other words, probability rules provide one response, while reliance on the representativeness heuristic provides another. This is exactly the type of situation from which the existence of two systems of reasoning is sometimes inferred.

The labels of these two systems have varied across authors. I use the most neutral terms proffered in the literature, System 1 and System 2 processes (Stanovich, 1999, 2004; Kahneman & Frederick, 2002). System 1 is generally assumed to be a default process (Evans, 2008), by which fast and automatic answers are given. For instance, in the Linda problem, System 1 would automatically trigger the response “Linda is a bank teller and is active in the feminist movement”. System 2 is usually considered an “overriding process” by which the automatic answers of System 1 are inhibited. System 2 is usually considered slow and controlled. In the Linda problem, System 2 would be responsible for overriding the first intuitive answer and replacing it by the correct response “Linda is a bank teller”.

The demonstration of the existence of two systems based on evidence from Criterion S has been challenged (Kruglanski & Thompson, 1999; Osman, 2004; Keren and Schul, 2009). The main focus of these debates is the number of systems that might actually exist, viz., a single continuous system (e.g., Osman, 2004), the familiar two systems (all dual-reasoning theories), or potentially more than two (Evans, 2009). The purpose of the paper is not to resolve the debate about the number of reasoning systems.

Following Keren and Schul (2009), I question the conclusions drawn from studies run in a dual-reasoning paradigm. Thinking of System 1 as a “default” system that System 2 can override in specific conditions has had two important intertwined and pervasive implications on the study of human reasoning.

The most manifest implication has been methodological. Most researchers interested in studying System 1 have limited themselves to *inhibiting System 2* in order to study System

1. Two of the most widely used methods to prevent the use of System 2 are the imposition of a cognitive load and the time pressure of quick answers (e.g., Bless & Schwarz, 1999; Chaiken, 1980; Petty & Cacioppo, 1986; Evans & Curtis-Holmes 2005; De Neys, 2006). These techniques succeed because System 2 has been shown to be limited by working memory and to be slow (for a review see Evans, 2008). As a result, imposing either a cognitive load or a time limit restricts the capacities of System 2 and should reduce its ability to override the responses of System 1. In other words, the methodology most commonly employed to study System 1 has relied on the assumption: Shut down System 2, and then only System 1 is left.

The second assumption is theoretical. If System 1 is defined as the “default” of System 2, and studied methodologically as “the inhibition of System 2”, then the only valid conclusions that can be drawn from such studies is that “not- System 2” is driving their main effects. Inferring that whatever is “not-System 2” is a single unitary system, namely System 1, may not be justified and lead instead false conclusions. Keren and Schul (2009) illustrate this idea with a short description of the “not-the-liver” fallacy (Bedford, 1997). In this analogy, a physician from the 18th century claims to have discovered two organs. The first is the liver, which clears toxins from the blood. The second, called “not the liver”, has for main functions blood circulation, nutrient absorption, waste expulsion, and protection from foreign invaders. The argument for the existence of the “not the liver organ” is that, “for when the liver is removed, the body is still able to do all these things and more, until such time as the toxin buildup is fatal” (p.231). In this case, the fallacy is to conclude that what is left after the removal of the liver is one single organ. In the case of dual-reasoning theories, the fallacy is to think that what is left after the inhibition of System 2 is a single unitary system, or System 1.

More specifically, after inhibition of System 2 three “not-System 2” alternatives are possible:

- An actual unitary System 1, as assumed by dual-reasoning theorists
- One system, but with several distinct characteristics (e.g., holistic, associative,...)

that require abandoning the assumption of a unitary system

- Several systems, with their own sets of characteristics (e.g., System 3 is holistic, System 4 is experiential,...)

The purpose of this paper is not to specify what “not-System 2” actually is and how it works, which may remain a debated topic for some time before it can be resolved. In the “not-the-liver” fallacy described above, the second organ is known to perform several functions (e.g., blood circulation, nutrient absorption, etc.). Similarly, “not-System 2” has been described as associative, evolutionarily old, domain-specific, universal, contextualized, pragmatic, experiential, parallel, stereotypical, rapid, implicit, automatic, instinctive, effortless, non verbal, and holistic (for an exhaustive list, see Evans, 2008 – Table 2, p. 257). I chose not to assume that these attributes describe a single unitary system. Instead, I focus on the study of only one dimension, associative processing, as if the interest of “not-the-liver” were only on blood circulation. Said differently, this paper does not try to inhibit System 2 in order to infer the consequences of a hypothetical unitary System 1 on information processing. Rather, it attempts to prime one dimension commonly attributed to System 1 and investigate how this priming influences human reasoning.

Priming Associations

One of the oldest and most recognized dimensions attributed to System 1 is its associative properties. For instance, Sloman (1996, p.4) defines it as “*associative because its*

computations reflect similarity structure and relations of temporal contiguity". Similarly, Kahneman defines System 1 as an "*associative machine*" (2011).

However, even this seminal dimension of System 1 has recently been questioned by Mitchell, De Houwer, and Lovibond (2009). The authors distinguish between two meanings of associative learning. The first meaning is the *phenomenon* of associative learning, that is, the capacity to learn that two or more events are related to each other. The second meaning focuses on the *psychological mechanism* underlying associative processes. The authors argue against the traditional view of associative learning by the dual-system approach, according to which associative learning can result from controlled processes but also from the automatic formation of links between mental representations. Instead, they claim that associative learning depends only on effortful and attention-demanding reasoning processes, based on the hypothesis testing of propositions. Take the classic empirical demonstration of associative learning by Pavlov (1927). If the mechanism underlying associative reasoning indeed stems from an automatic formation of links between mental representations, then the dog learns that the bell brings food by forming a link between the mental representation of the bell and the food. When the bell rings, it activates the mental representation of food. If the mechanism underlying associative reasoning, instead, stems from hypothesis testing, then the proposition tested by the dog is "When I hear a bell, I shall receive food". This hypothesis is learned and retained in memory, and becomes a belief that is held with more or less confidence. Note that these two views of associative learning make very different predictions. For instance, if associative learning always requires controlled processes, then people should be able to report their reasoning, i.e., to report what hypothesis they are testing and the strength with which they hold it. In contrast, if associative learning is the result of an automatic process, people may not be able to report the strategy that they are using. A second prediction is that, if learning is effortful, it should be hampered when cognitive resources are depleted.

In this exploratory paper, my goal is neither to challenge the common assumption that System 1 is *per se* associative, nor to contribute to the related debate about whether associative reasoning relies on automatic and/or controlled processes. Instead, I attempt only to answer the following question: How does associative reasoning impact judgment and decision-making?

The intended contribution of this paper is two-fold:

- Methodologically, proposing an alternative to methods that inhibit System 2
- Theoretically, disentangling effects from associative reasoning from effects potentially caused by other “not-System 2” dimensions (e.g., holistic reasoning or experiential reasoning)

The necessary first step is to find a method for priming an associative type of reasoning in a laboratory setting. Recent research on mindsets provides insights on how this might be accomplished.

Priming an Associative Mindset

A mindset is defined as a cognitive or behavioral procedure that is associated with a particular goal. For instance, Xu and Wyer (2008) studied the comparison mindset, that is, the cognitive procedure associated with the goal of comparing two or more objects. A characteristic of a mindset is that, once activated, it is then more likely to be used subsequently, even in a different domain, and even without the activation of its associated goal. For instance, Xu and Wyer (2008) have shown that comparing animals makes people more likely in a subsequent task to buy a product because they have automatically started to compare the available products. In a similar fashion, thinking of yourself as interdependent makes you more likely to see objects in relation to others in a display (Kühnen & Oyserman,

2002), and generating reasons why a proposition is not true leads to a less favorable evaluation of a product (Xu, 2010)

Activating an associative mindset means finding a task that requires the repeated use of an associative process (Wyer & Xu, 2010). Repetition of such a task should build momentum for that associative procedure. As a consequence, associative reasoning should be more likely to be used in a subsequent, unrelated task.

The first associative mindset activation task I developed involved brand associations. Participants are asked to pair sequentially 10 brands with 20 personality traits. Brands and traits were extracted from previous research on brand personality (Aaker, 1997). The instructions were:

On the pages that follow, you will be presented with 10 brands. For each of the 10 brands presented, drag and drop the personality traits (on the left) that you think describe it best. There is no right or wrong answer. Please answer according to your own personal judgment. You can drag and paste as many items as you want.

For two reasons a second task was developed to priming an associative mindset. The first was to check that any results obtained would not be confined to brand associations. The second was to investigate whether the type of associations activated in the priming phase matters. More specifically, the process of associating a brand with some personality traits is known to be largely impacted by marketing strategies and constructed through classical conditioning. Brand associations are thus learned as a social phenomenon, with those associations shared across the population (Aaker, 1997). The second priming method aimed at activating associations that were not learned by societal construction but instead would be idiosyncratic to the participant.

In this second priming task participants are told that the objective of the first part of the experiment is to study synesthesia. They read a brief description of the phenomenon, followed by the following instructions:

On the next pages, you will be presented with 15 different first names (e.g., John). Each time, pick the color on the right that you consider best fits the name on the left. You can only pick one color for each name. There is no right answer, so please answer according to your own personal judgment.

In both priming methods, actual answers are not important. Their only purpose is to activate an associative procedure or mindset, in order to determine whether this activation would impact reasoning in an immediately following and unrelated choice task.

Experiment 1: The availability heuristic

I first looked for a dependent variable that has been explicitly claimed to be caused by associative reasoning. One such phenomenon is the availability heuristic.

The availability heuristic refers to “*a tendency to form a judgment on the basis of what is readily brought to mind* (Medin & Ross, 1997, p. 522).” For instance, suppose that you open the last book you have read and pick a word randomly. Is this word more likely to start with R or to have R as its third letter? A majority of respondents tend to answer that R is the first letter is more likely. The reason advanced for this result is based on “*associative distance*” (Tversky and Kahneman, 1972). The availability heuristic is used when probabilities are assessed based on the ease with which associations are brought to mind. The shorter the associative distance, the easier it is to recall associations. The longer is the associative distance, the tougher it is to recall associations. People use ease of recall as a proxy for estimating probabilities of occurrence.

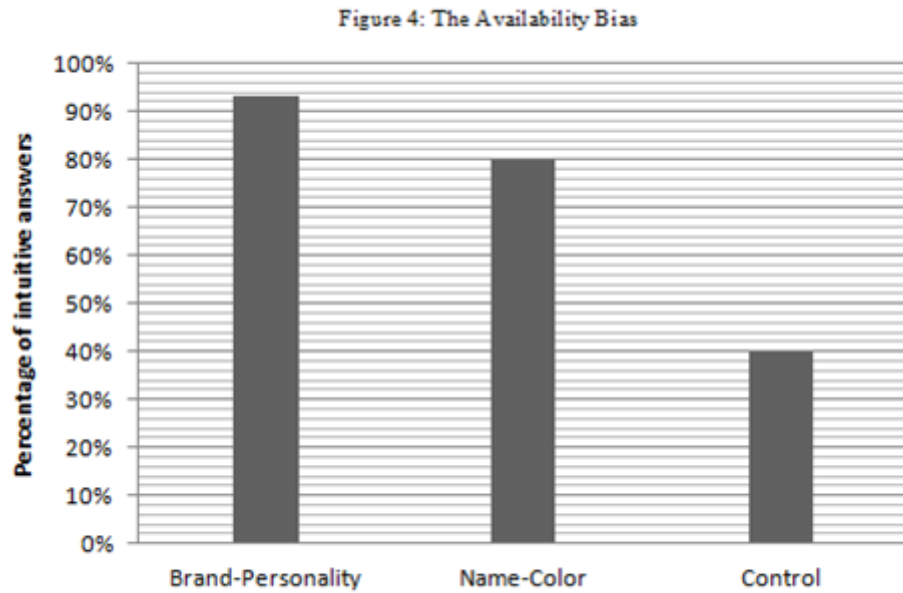
Design

Forty-five participants were recruited through Amazon Mechanical Turk and paid 75 cents for their participation in an experiment on decision-making. They were randomly assigned to one of three conditions: control, brand-personality associations, and name-color associations. Participants in the control group were instructed to read a brief description of the Burgess Shale fossil fields (http://en.wikipedia.org/wiki/Burgess_Shale).

After the associative priming phase, participants were asked whether more deaths per year in the United States were caused by accidents (of all kinds) or strokes. Accidents are typically easier to retrieve, and, thus, following Kahneman's terminology, are more associatively close. However, strokes actually cause more annual deaths than accidents in the United States. If my two associative priming methods work, there should have been an increased proportion of participants selecting accidents instead of strokes in comparison to the control group.

Results

The results revealed an overwhelming effect of both methods of associative priming (see Figure 4). Participants in the brand-personality and name-color conditions chose "Accidents" 93% and 80% of the time, respectively. In comparison, this rate was only 40% in the control group. A logit model yielded a significant impact of condition (Chi-Square (2, N=45) = 11.5, $p < .01$). In addition, planned comparisons revealed that both primed conditions differed significantly from the control group (Chi-Square (1, N= 45) = 10.6 for brand associations; Chi-Square (1, N = 45) = 5.2 for color associations; Bonferroni-corrected *two-sided* $ps < .05$)



Priming an associative mindset increased the number of “associatively close” answers, that is, increased reliance on the availability heuristic. Because both priming conditions yielded similar effects, I considered them as interchangeable. Thus, I used only one or the other in all of the following experiments.

Experiment 2: The representativeness heuristic

The second phenomenon investigated in this paper has also been linked to associative reasoning. The representativeness heuristic, briefly illustrated in the introduction, refers to a tendency to evaluate the likelihood of an event by the degree to which it is similar in essential characteristics to its parent population (Tversky & Kahneman, 1975). Linda’s description is more similar to a feminist bank teller than to a typical bank teller, thus Linda is judged more likely to be a feminist bank teller. The reason advanced for this phenomenon is based on the properties of associative thought: *“The primary reason for this is that the degree to which an association is operative is proportional to the similarity between the current stimulus and previously associated stimulus (...) Associative thought uses temporal and similarity relations*

to draw inferences and make predictions that approximate those of a sophisticated statistician (Sloman, 2002, p. 381).”

Design

One hundred and thirty participants were recruited through Amazon Mechanical Turk and paid 75 cents for their participation in an experiment on decision-making. They were randomly assigned to one of two conditions: control versus priming. The name-color associative task was used to prime the associative mindset.

Following the priming phase, participants were asked to read the description of the hypothetical person Linda given in the introduction of this paper. They were then asked to rank order the likelihood of eight of her possible occupations (Tversky and Kahneman, 1983), including “Linda is a bank teller” and “Linda is a bank teller and is active in the feminist movement”.

Results

The first analysis had for its dependent variable the proportion of participants who ranked “Linda is a bank teller and is active in the feminist movement” as more likely than “Linda is a bank teller”, indicating the use of the representativeness heuristic. Even though proportions trended in the expected direction, this first analysis did not yield a significant difference, as both groups showed a clear tendency to exhibit the expected bias ($P_{\text{control}} = 72.4\%$ vs. $P_{\text{primed}} = 79.6\%$, *two-sided p-value* > .30).

The second analysis had as its dependent measure the average difference in ranking between the feminist version and the non-feminist version. For instance, if the feminist version was ranked 7th and the non-feminist version ranked 8th, the within-subject ranking difference was 1. If the feminist version was ranked 8th and the non-feminist version ranked 7th, the within-subject ranking difference was -1. If participants in the primed group relied

more on the representativeness heuristic than participants in the control group, they should have ranked Linda as a feminist bank teller significantly higher than the less stereotypical alternative of Linda as a bank teller with no more said. This was indeed the case. The average difference between the two ranks in the control group was .77, against 1.48 in the primed group ($t(129) = 2.09$, *two-sided p-value* <.05). In addition, note that the mean difference observed in the control group (.80) was, as expected, significantly different from 0 ($t(65) = 3.64$, *two-sided p-value* <.001). This last result confirmed that participants tend to rank the feminist version ahead of the non-feminist one. Priming an associative mindset significantly increased this tendency.

Experiment 3: The sunk cost fallacy

I then sought a phenomenon for which causes are still under debate, but which could be impacted by an associative mindset. One such phenomenon is the sunk cost bias, manifested as “*a greater tendency to continue and endeavor once an investment in money, effort, or time has been made.* (Arkes & Blumer, 1985, p. 124).” In other words, people frequently face situations in which they need to reverse decisions or change behaviors in order to avoid negative consequences. However, people often fail to terminate their original commitment because of the already sunk investment of money or time.

As a post-hoc explanation for this fallacy, Arkes and Blumer (1985) proposed that the desire not to waste resources that have been used is the psychological justification for this behavior. More recently, Arkes and Ayton (1999) gave further credence to this potential explanation by comparing the sunk cost fallacy in adults, young children, and animals. Since animals and young children do not show evidence of the fallacy while older adults do, they conclude that the sunk cost bias must be due to the learning and overgeneralization of a

“don’t waste rule”. The logic underlying this hypothesis is that during their lives humans are exposed to many admonitions against waste (e.g., from parents, “don’t waste your food” and “clean your plate or you won’t get dessert”). Thus they associate the act of wasting with negative feedback and overgeneralize the rule to situations in which it does not apply. Even though this explanation appears reasonable, laboratory evidence supporting it is scarce and other potential explanations exist (see Arkes and Blumer, 1985).

My work intends to contribute to this research stream by examining the impact of priming associations on the sunk cost fallacy. If priming associations indeed increases the sunk cost bias, it means that the activation of some kind of learned associations is one of its drivers.

Design

Ninety participants were recruited through Amazon Mechanical Turk and paid 75 cents for their participation. They were randomly assigned to one of two conditions: control or associative mindset. The name-color associative task was used to prime the associative mindset.

After the usual priming phase, each participant was randomly assigned to one of the two following conditions. In the sunk cost condition (SC), participants were asked whether they were willing to continue to complete an endeavor in which they had previously invested. In the no sunk cost condition (NSC), participants were asked whether they were willing to continue to complete the same endeavor, but this time without any previous personal investment.

The two versions of the problem are as follows (Arkes & Blumer, 1985):

Sunk cost version: *Your family pays \$200 for tickets to a basketball game to be played 60 miles from your home. Unfortunately, on the day of the game there is a snowstorm. Would you still go to the game?*

No sunk cost version: *Your family was given free tickets worth \$200 to a basketball game to be played 60 miles from your home. Unfortunately, on the day of the game there is a snowstorm. Would you still go to the game?*

In each case, participants were asked to respond either by *Yes* or *No*.

The results are displayed in Table 1. The control group and the primed group did not show any difference in their answers to the no-sunk cost problem, so they were averaged (32%) to provide a baseline level to which the two other groups could be compared.

Forty-five percent of the participants in the control-SC condition exhibited the sunk cost fallacy. This 13% increase from the baseline was only marginally significant (one-sided $p < .15$). In the associative mindset-SC condition, 74% of the participants decided they would still go to the game. This 42% increase in proportion from the control proved to be significant (Chi-Square (1, N = 90) = 11.5, *two-sided* $p < .01$).

Condition	Proportion of Yes		N
	No Sunk Cost	Sunk Cost	
Control	30%	45%	42
Associative Mindset	33%	74%	48

Table 1: The Sunk cost fallacy

Experiment 4: Mental models

My last study is more exploratory. It attempts to investigate the impact of associative processing on deductive reasoning that involves mental models (e.g., Johnson-Laird, 1983; Johnson-Laird & Byrne, 1991; Mackiewicz & Johnson-laird, 2012). Mental models are *“psychological representations of real, hypothetical, or imaginary situations (...) They have a structure that corresponds to the structure of what they represent”* (Johnson-Laird, Girotto, & Legrenzi, 1998, p.1). Interestingly, Sloman (1996) categorized deductive reasoning as a form of rule-based reasoning that would not be based on associative processing. However, a number of mental model theorists have since described the formation of initial simplified models, usually representing what is true at the expense of what is false, as a relatively automatic and effortless process. However, the process of searching for counter-examples (sometimes referred to as “fully explicit models”) is usually described as more effortful and limited by working memory capacity (Johnson-Laird & Bara, 1984; Johnson-Laird & Byrne, 2002).

As an illustration, consider the following assertion: “John is in the same place as Jane if and only if Jane is in the same place as Mike.” Is it possible that John and Mike are the only two in the same place? A majority of respondents tend to mistakenly answer that it is not possible, because they mentally represent first John at the same place as Jane and then Mike, who has to be at the same place as Jane. They then incorrectly infer that the three characters have to be in the same place. This reasoning is insufficient as it only represents the “truth”, and fails to look for counter-examples. For instance, the three characters could be at three different locations. Alternatively, Jane could be alone, and Mike and John could be standing together.

This type of faulty reasoning has, to my knowledge, never specifically been attributed to associative reasoning. However, it has been explicitly linked to dual-reasoning by Osman (2004): “*Johnson-Laird and Byrne’s (1991) mental models theory proposes that the initial construction of representations is often incomplete, but with time or the appropriate context they become ‘fleshed out,’ leading to correct responses. Thus, it predicts that increasing the time to think about the task encourages participants to expand the number of representations, which alternatively describes the changes from heuristic to analytic processes*”. Therefore, I decided to investigate whether the mere priming of an associative mindset would increase reliance on initial mental models, independently of time pressure or cognitive load.

Design

Fifty participants were recruited on Amazon Mechanical Turk, and paid 75 cents for their participation. They were randomly assigned to the control condition or to the associative mindset condition. Participants in the associative mindset condition were asked to pair 10 existing brands with potential personality traits.

Participants were then asked to make four inferences about possibilities from a compound premise (Mackiewicz and Johnson-Laird, 2012).

The generic structure was as follows:

A is in the same place as B if and only if B is in the same place as C.

- Illusory Question: Is it possible that A and C are the only 2 in the same place?
(Correct Answer: Yes)
- Control Question: Is it possible that A and B are the only 2 in the same place?
(Correct Answer: No)

A is in the same place as B if and only if B is not in the same place as C.

- Illusory Question: Is it possible that B and C are in the same place? (Correct Answer: Yes)
- Control Question Is it possible that A is not in the same place as C? (Correct Answer: Yes)

The premise always contained three individuals, in the order A-B and B-C in the two clauses. Two of the inferences were “control” questions because the use of initial mental models yielded the correct answer. The other two inferences were “illusory” questions because mental models yielded incorrect answers and the use of fully explicit models was necessary to obtain the correct response.

Note that the letters A, B, and C were replaced by different first names in each of the four questions, and that the order of the four questions was randomized. In addition, I recorded the time participants spent answering each of the four questions and individual differences in intuitive and analytical information processing (Epstein et al., 1996).

Construction of a Bias Index

To be able to capture within-subject differences, a bias index was computed for each participant. This index was the difference in the number of correct answers to control versus illusory questions: the higher the index, the less bias was observed. Each participant answered 4 questions, which meant that the belief index could take five possible values: -2, -1, 0, 1 and 2. A score of 0 meant a total absence of bias, as the number of correct answers to the illusory questions is the same as the number of correct answers to the control questions. A positive score (1 or 2) meant the participant answered illusory questions more accurately than control questions, which is often the case. A negative score (-1 or -2) meant the opposite.

Results

Results are displayed in Table 2 and Figure 4. They confirmed that participants primed with an associative mindset were overall more likely to score negatively on the bias index.

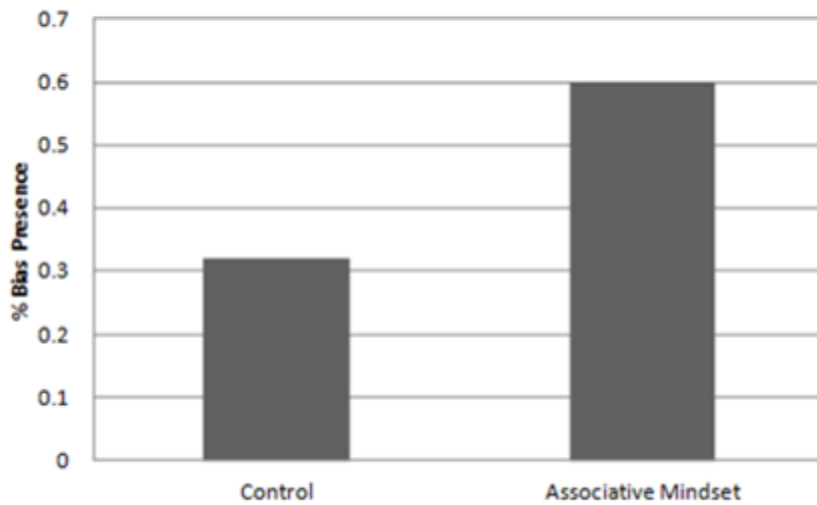
Condition	Percentage scoring -2, -1, 0, 1, and 2 on the Bias Index					N
	-2	-1	0	1	2	
Control	16%	16%	44%	24%	0%	25
Associative Mindset	8%	52%	32%	8%	0%	25

Table 2: Mental model fallacies

First, the mean numbers of correct answers across conditions were compared. Results yielded a marginal effect of condition ($M_{\text{control}} = -.24$ vs. $M_{\text{priming}} = -.60$, $t(49) = 1.42$, *one-sided* $p = .08$).

Second, a logit model was constructed with the presence of bias as a binary dependent variable, and condition (control versus associative mindset), time spent on the task, and individual differences as independent variables. Results yielded a significant effect of condition (Chi-Square (1, $N=50$) = 4.7, $p\text{-value} < .05$), a marginal effect of the time spent on the task (*one-sided* $p\text{-value} > .15$), and no effect of individual differences ($p\text{-value} > .30$). Note that the marginal effect of time trended in the expected direction, i.e., participants who spend more time on the task showed less bias. In addition, note that the time spent on the task did not differ reliably across groups ($T_{\text{control}} = 92.2$ s vs. $T_{\text{control}} = 93.4$ s, $p\text{-value} > .30$).

Figure 5: Mental Model Fallacies



Overall, results showed that priming an associative process increased reliance on simplified mental models. In addition, participants who were primed with associations did not spend more time on the task. As a result, it seemed like the process of relying on mental models that are representing the truth might be driven by associative reasoning.

Discussion

Summary of findings

Studies 1 and 2 show that the priming of an associative mindset increases reliance on the availability heuristic and the representativeness heuristic, strengthening the existing evidence that automatic associations hinder the use of analytical reasoning. Study 3 demonstrates that the sunk cost fallacy is more likely to occur when associative reasoning is activated, highlighting that the use of learned associations may be at the origin of this bias. Finally, Study 4 demonstrates that priming associations increases the likelihood of relying on an initial mental model instead of looking for counter-examples.

Implications

Two conclusions may be drawn from this research:

- Theoretically, mere associative processing leads to at least some of the biases in judgment and decision-making.
- Methodologically, associative reasoning can be primed directly through the priming of an associative mindset.

Interestingly, my last experiment recorded the time spent on the task and failed to demonstrate that participants primed with associative reasoning spent less time working on the criterion task than participants in the control group. This result seems to open the door to two complementary hypotheses that may be worth testing in future experiments: (a) associative reasoning may interfere with the System 2's inhibitory role; and (b). associative processing may not always be faster than System 2.

Future Research

It would be interesting in future research to see whether the activation of other dimensions of System 1 (e.g., holistic reasoning, experiential reasoning) would trigger the same results as my associative priming. For instance, if some phenomena are activated by associative reasoning but not by holistic reasoning, it may mean that System 1 may not be as unitary as some have assumed.

Alternatively, it may be interesting to compare whether a method using inhibition of System 2 (with a cognitive load or a time limit) and the new methods of associative priming actually produce the same effects. Preliminary results in the domain of information distortion show that this equivalence may not be the case. Predecisional information distortion (ID) is the biased evaluation of new information to support an emerging preference or belief. Specifically, during a choice process, as one alternative naturally emerges as the tentative

leader, individuals typically interpret incoming information as favoring this leader more than they should. Recent research by Polman and Russo (2012) shows that the use of a cognitive load significantly increases information distortion. I have collected preliminary data showing that priming an associative mindset does not increase ID. It would be interesting to compare in a single study the impact of these two methods and determine when they do and do not contribute to obtaining similar results.

Finally, other phenomena may be caused by associative reasoning, such as cause and consequence matching (LeBoeuf & Norton, 2012), decision framing (Tversky & Kahneman, 1981; Svenson & Benson, 1993), the belief bias (Evans & Curtis-Holmes, 2005), and anchoring (Tversky & Kahneman, 1974). In addition, it may be interesting to see whether priming an associative mindset may be able to facilitate learning. Most of learning is indeed associative and priming associations may thus actually boost performance on simple learning tasks. Similarly, priming effects are usually said to rely on associations (see the chapter “the associative machine” in Kahneman, 2011), which may suggest that priming associative reasoning could increase results obtained from priming tasks.

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