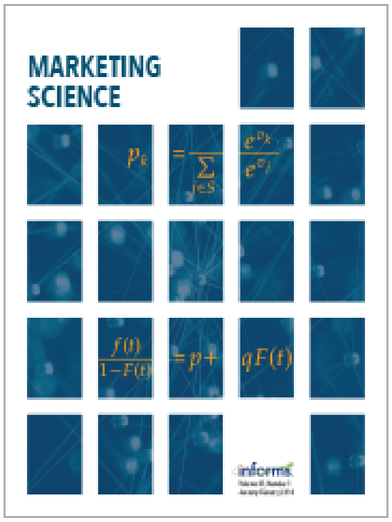

Marketing Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

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To cite this article:
Himanshu Mishra, Arul Mishra, Dhananjay Nayakankuppam, (2007) Seeing Through the Heart's Eye: The Interference of System 1 in System 2. Marketing Science 26(5):666-678. https://doi.org/10.1287/mksc.1070.0278

MARKETING SCIENCE
Vol. 26, No. 5, September–October 2007, pp. 666–678
ISSN 0732-2399 | EISSN 1526-548X | 07 | 2605 | 0666

DOI 10.1287/mksc.1070.0278

Seeing Through the Heart's Eye: The Interference of System 1 in System 2

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Dual process models conceptualize two systems of processing that are activated when presented with a decision task, the quick and affective System 1 and the deliberative and rule-based System 2. In this article, we explore whether the affective component of System 1 has the potential to interfere with the information integration component of System 2 by utilizing everyday consumer decision-making situations that require the integration of provided information to make optimal choices. We posit that if the provided information has an affective System 1 element, then the affective reaction serves as an input to the System 2 process of information integration. Such an affective input has the potential to cause improper information integration resulting in a biased mental representation, which in turn leads to suboptimal choices. Across three experiments, we test the interfering role of affect in information integration. Experiment 1 establishes the mediating role of the affective System 1 generating a preference for the suboptimal option and rules out the alternate account of analytical skills. Experiments 2 and 3 provide converging evidence for the proposed account that System 1 interferes with System 2 and argue against the alternate account of System 1 directly influencing choice.

Key words: system 1 and system 2; dual process models; choice; affect; irrationality; two-part tariff; misattribution; information integration; stimulus-induced affect; affect and cognition; behavioral decision theory
History: This paper was received April 5, 2005, and was with the authors 13 months for 2 revisions; processed by Ravi Dhar.

1. Introduction

Consider a consumer contemplating the purchase of a toaster oven at a store. The consumer carefully compares the various models and attempts to weigh the risks and benefits of consumption, to balance the appeals of ergonomics and features against the costs and comparison points. Now consider the same consumer at dinner—when the dessert tray rolls around, one look and he immediately succumbs to the lure of the cheesecake and rationalizes the choice with notions of deservedness or the promise to spend an extra 15 minutes on the treadmill. Situations abound in everyday decision making when it is assumed that affective and deliberative systems are set in motion simultaneously and work independently to provide their respective feedback and influence the decision outcomes. Extant findings have amply demonstrated such influences on consumer decisions (Hoch and Lowenstein 1991, Hsee and Kunreuther 2000, Luce 1998, Luce et al. 1999, Pham et al. 2001, Shiv and Fedorikhin 1999). The affective system is considered to have the ability to bias judgments and lead to suboptimal decisions, and thus a common recommendation is to rely on the deliberative system. Adam Smith (1759, Part 1, §2) long ago warned of "dangerous passions," suggesting that affect was capable of undermining normative decision-making ability. Although the deliberative system's responses are considered slower, they are believed to remain unbiased by the affective cues in the decision environment. However, in this work we show that relying on the deliberative system does not necessarily lead to an optimal choice, since affective reactions have the potential to interfere with the ongoing processes of the deliberative system and thus bias the output. Specifically, we posit that along with providing a direct decision output, affect also has the potential to interfere with the working of the deliberative system.

In this article, we utilize the nomenclature of Systems 1 and 2 suggested by decision theorists (Kahneman and Frederick 2002, Stanovich and West 2002, Sloman 2002). An affective response is part of System 1 processing (the fast, affectively charged, and automatic system) and a deliberative response belongs to System 2 processing (the slower, rule-based, and deliberatively controlled system). Therefore, System 1 being intuitive and faster provides a quick output, while System 2 being slow and rule based takes longer to generate an output.

Systems 1 and 2 are conceptualized as two distinct entities that are set in motion simultaneously and work independently to provide their respective feedback when faced with a decision task. Conceptualizing these two systems as independent modules, however, leaves a crucial question unanswered. Can the quick and affectively charged System 1 influence the slower and rule-based System 2? In other words, instead of directly influencing the decision, can System 1 influence the decision by interfering with the working of System 2? The objective of this article is to demonstrate the interference of the quick and affective System 1 in the working of the rule based System 2. To this end, we utilize a specific aspect of System 1, affect, and show how it interferes with a specific aspect of System 2, information integration.

An inquiry into the interference of System 1 into System 2 has both managerial and theoretical relevance. From a managerial standpoint, many decisions require the consumer to make a choice after comparing and contrasting the presented information across two or more options (Dhar and Simonson 1999). An optimal choice in such instances entails an unbiased System 2 response. However, if one piece of information produces a System 1 response (e.g., an affective reaction), then it could lead to a suboptimal choice by interfering with System 2 processing (e.g., information integration). By utilizing common choice tasks such as choosing between bank accounts and cell phone plans, this article highlights the relevance of such System 1 interference with System 2 for everyday consumer decision making.

From a theoretical standpoint, a finding of System 1 interfering with System 2 would be relevant to the domain of decision-making models. Many decision-making models (e.g., Fishbein and Ajzen 1974, Kahneman and Tversky 1979, Von Neumann and Morgenstern 1944) often propose a decision calculus requiring deliberative, rule-based System 2 processing to integrate various pieces of information. As marketing researchers have extensively employed these models of information integration in making predictions, an examination of how System 1 can potentially interfere with the processing of System 2 would provide valuable insights in predicting consumer preferences and choices. In addition, this would be among the first attempts to gather empirical evidence testing the conjecture that System 1, along with a direct response, may also interfere with System 2 processes.

The article is structured in the following manner. We first briefly review literature, reporting findings on System 1 and System 2 processes that are relevant to this work, and present our conceptualization. Second, we describe the general format of the stimulus used across all experiments. Third, across three experiments we test for the proposed "interference" account and rule out alternate accounts. Finally, we explicate the theoretical and managerial relevance of the findings.

2. The Two Systems of Processing

The notion of two parallel systems providing feedback to a decision task has gained significance recently (Kahneman 2003, Stanovich 2004, Stanovich and West 2002, Sloman 2002). Across psychological and neurological domains, researchers have provided evidence for two systems competing for control in inference making and action (Goel et al. 2000). System 1 tries to do this by employing affectively charged, automatic, rapid, parallel, heuristic-based processes that are relatively undemanding of cognitive capacity (Kahneman 2003, Stanovich 2004, Sloman 2002). System 1 includes fast and instinctive processes formed by associative learning methods that operate largely beyond awareness. On the other hand, System 2 is controlled, rule-based, slow, serial, and deliberative and is constrained by working memory capacity. Unlike System 1, System 2 is capable of constructing mental representations and simulations of the future based on hypothetical or abstract thought (Evans 2003). Stanovich (2004) states that while System 1 seems to be hard wired, System 2 operations are cognitively more effortful and take longer to run to completion. Research has also documented that people hold intuitive or System 1 beliefs with greater confidence since they can be arrived at faster and more easily. Only in the face of strong arguments are individuals willing to exchange an intuitive belief for a nonintuitive one (Simmons and Nelson 2006).

2.1. Interactions Between Systems 1 and 2

An area recently gaining attention is the notion of System 1 interacting with System 2. System 1 forms a bulk of brain processes and takes place rapidly and outside conscious awareness. Theorists have recently posited that not only do System 1 processes directly trigger responses of their own, they may also provide input to System 2 processes, "…thus biasing analytical processing by the nature of the cognitive representations given to it" (Stanovich 2004, p. 52). In the following paragraphs, we examine evidence from two streams of literature that provide support to the notion of an interaction between Systems 1 and 2.

Affect and Reasoning. Blanchette and Richards (2004) provide a demonstration of how System 1 (affect) influences System 2 (logical reasoning). They gave participants a conditional reasoning task (i.e., if p, then q) and manipulated the affective nature of the statements used as p and q. They asked participants to draw inferences based on these statements. Results showed that participants were more likely to draw invalid or wrong inferences in response to affective compared to neutral statements. The authors suggest that this might occur because prior to drawing any inference people represent the problem in their minds and an affective statement influences or interferes with the correct problem representation.

Amygdala's Influence on System 2. Recent neurological evidence provides converging support for the influence of System 1 on System 2. Phelps (2004) has argued that affective reactions should influence cognitive processes because if an organism has to survive in a changing environment, then it should especially remember those events that are related to an affective consequence. Vigilance and awareness toward an affective stimulus allows for quick assessment and reaction. These findings suggest a mechanism in which the amygdala, a brain structure playing a key role in System 1 (affective) processing (LeDoux 2002), receives the information about the affective nature of the stimuli early in processing and then modulates subsequent perceptual processes. Before the conscious System 2 processing, the amygdala exerts influence in two different ways—by modulating memory and by modulating perception (Phelps 2004). Findings using positron emission tomography indicate that people display better long-term recall of affective words rather than neutral words due to amygdala activation at the encoding stage (Hamann et al. 1999). The above neurological evidence indicates that the stimulus-induced affective System 1 response has the potential to influence different aspects of System 2 processing. In the subsequent section, we build on this to present our conceptualization.

3. Conceptualization

Many everyday decisions require the integration of information to form an accurate representation. Research in diverse areas conceptualizes information integration as a three-stage sequential process which starts with the input stage where various sources of information are processed and sent to an integration stage. Subsequently, the response obtained from the integration stage is sent to the decision-making stage. Thus, each of the three stages of information integration plays a crucial role in determining the quality of the final decision (Movellan and McClelland 2001).

We examine the rule-based System 2 process of information integration and the affective[1] component of System 1 to investigate whether System 1 can potentially interfere with System 2. Theorists have suggested that in several instances, System 2 is dealing with inputs from the social and physical world that System 1 modules have unconsciously placed at the disposal of System 2 (Evans and Over 1996, Stanovich 2004). Thus, if the provided information has an affective element, then the resulting affective response can serve as an input to the process of information integration. We posit that this affective input thus has the potential to interfere with information integration and bias the mental representation which, in turn, could result in a suboptimal choice.

In testing this conceptualization, we utilized a decision-making scenario that consumers are likely to encounter while making a choice. Consistent with previous consumer research which argues that choices are not made in isolation but options are compared and contrasted simultaneously (Dhar and Wertenbroch 2000, Dhar et al. 1999, Dholakia and Simonson 2005, Shugan 1980), the stimulus was a choice set comprising two alternatives, one being a dominant alternative. Information about each alternative was given on two related dimensions. An integration of both dimensions, a System 2 activity, revealed the dominance relationship with one alternative being better than the other. However, in the stimuli, information on one dimension created an affective System 1 response in favor of the suboptimal option. Thus, the choice of the suboptimal option would allow us to infer the interfering role of affect (System 1) in information integration (System 2). In other words, if the information were properly integrated as ought to be done, the choice of the dominant option would become patently obvious. The inability to choose the dominant option would reflect problematic information integration.

The following is the general format of the stimulus used across all experiments with minor variations in contexts. Consumers were asked to choose between two options described on two related dimensions. For instance, the dimensions could be the number of free anytime minutes offered by two cell phone plans and the penalty each plan charges for exceeding the given anytime minutes.

[1] Here, affect refers to affective reactions arising from the stimulus itself. It is different from ambient affect which refers to affective states due to background conditions such as mood and fatigue (Shiv and Fedorikhin 1999).

The stimulus says, "You want to buy a cell phone with a wireless plan. Two firms in your area offer such plans, Firms A and B. Both firms charge the same monthly charges of $19.99 and offer a free cell phone, unlimited night and weekend minutes, and free voice mail. However, both firms impose a per-minute fee if you use more than the given number of anytime minutes.

Firm A provides 160 anytime minutes per month and Firm B provides 200 anytime minutes per month. The schedule of charges for exceeding these anytime minutes are as follows":

If you exceed anytime minutes by	Firm A imposes (per minute) ($)	Firm B imposes (per minute) ($)
10 minutes	0.00	2.00
20 minutes	0.25	2.00
30 minutes	0.50	2.00
40 minutes	1.00	2.00
More than 40 minutes	2.00	2.00

Consider a consumer contemplating the described wireless cellular phone plans. Consumers are likely to prefer a plan that offers more anytime minutes (free calling time) with lower penalties for exceeding those minutes (surcharges for exceeding the anytime minutes). Note that Firm A appears to have a more lenient penalty structure but Firm B offers more anytime minutes. As can be seen, Firm A offers less anytime minutes and therefore starts charging a penalty earlier than Firm B. Moreover, by the time Firm B starts charging a penalty, the level of fees charged by Firm A is as high as that being charged by Firm B. If one uses more than 160 minutes, one would pay more for Firm A's plan, and usage of less than 160 minutes makes both plans equivalent. When the two pieces of information—free anytime minutes and the penalty structure—are integrated properly, the choice of the optimal option, Firm B, becomes obvious. The choice of Firm B would be the normative or rational choice as defined in the marketing literature (Shugan 2006). On the other hand, the lenient penalty structure of Firm A creates an affective response in its favor. The affective response, in turn, has the potential to interfere with the information integration process and result in the choice of the suboptimal option (i.e., Firm A).

Data consistent with such a view was obtained in an initial pilot test. Fifty-nine participants read the information about the cell phone plans of Firms A and B. Participants were then asked to choose which firm's plan they preferred. Analyses revealed that 63% of the participants chose Firm A over B ($\chi^2(1) = 3.8$, $p < 0.05$) (i.e., a preference for the suboptimal option). Note that participants were not indifferent between the options, a puzzling result in itself, but actually preferred the suboptimal option. Furthermore, this phenomenon occurred in a within-participant design—that is, each participant saw both options. Thus, explanations based upon idiosyncratic reference points, evaluability, or differential weighting are not applicable. In normative terms, nobody ought to choose Firm A's offer.

Several accounts can be put forward that could potentially explain the choice of the suboptimal option, for instance, a lack of analytical skills, a direct influence of System 1 (the "direct influence" account), and the interference of System 1 in System 2 processing (the "interference" account) as discussed in the conceptualization section. In the set of experiments presented in the article, we discuss and test each account and provide converging evidence for the "interference" account as the underlying mechanism. Experiment 1 establishes the mediating role of the affective System 1 in causing a preference for the suboptimal option and rules out the alternate account of analytical skill. Experiments 2 and 3 provide converging evidence for the "interference" account and rule out the "direct influence" account.

4. Experiment 1

The objective of this experiment was to demonstrate the role of affect in the choice of the suboptimal option. Past research has shown that affectively charged System 1 reactions influence decisions only when they have informational value (Loewenstein et al. 2001), and the influence of these reactions can be reduced if they are attributed to factors irrelevant to the decision (Novemsky et al. 2007, Winkielman et al. 2003). For instance, Reber et al. (2004) reduced the influence of affect by suggesting to participants that their reactions to stimuli might be influenced by background music.

If affect is involved in the choice task, then misattributing the affective reaction to some external source (background music) should reduce the choice of the suboptimal option. Participants who misattribute their affective reaction should utilize it less when making choices and should be less prone to choose the suboptimal option. However, if the results are driven by a lack of analytical skills, then we should see no difference across the misattribution-present and misattribution-absent conditions as misattribution just reduces the influence of affect and has no influence on analytical skills.

The structure of the experiment was as follows. First, participants read the description of two cell phone plans (identical to the cell phone plans described in the general format of the choice tasks), then prior to indicating their preference for either

Firm A or B, participants completed an eleven-item affect scale (cronbach alpha $= 0.94$) designed to capture participants' affective response toward the options in the stimulus. These items were adopted from affect scales used in previous research (Hsee and Rottenstreich 2004, Pham et al. 2001). The responses to the affect scale served as a manipulation check for the misattribution manipulation and also served in testing for the mediating role of affect. In addition, to rule out order effects, the presentation of the information was counterbalanced so that the suboptimal option appeared either in the first or second column of the penalty structure. Therefore, this experiment used a 2 (manipulation: misattribution present versus misattribution absent) $\times$ 2 (presentation of information: suboptimal optimal versus optimal suboptimal) between participant design.

4.1. Method

One hundred and sixty-one undergraduate students took part in this experiment for partial course credit. They were randomly assigned to one of the four conditions. Each participant was seated in front of a computer. All participants were told that in this experiment we were trying to mimic what happens in online shopping. Similar to many online retailers who play some music while consumers shopped, some background music would be played. Participants in the misattribution-present condition were informed that the music might influence their feelings while participants in the misattribution-absent condition were *not* told that the music might influence their feelings. Subsequently, all participants were asked to put on headphones.

The next screen on the computer presented the choice task between cell phone plans offered by Firms A and B. Additionally, participants in the optimal-suboptimal condition saw the penalty structure of the optimal option in the first column and that of the suboptimal option in the second column, while those in the suboptimal-optimal condition saw the penalty structures in the opposite order. Participants then provided their responses to the affect scale. The items on the affect scale measured which of the two firms the participants found to be more pleasant, valuable, good, satisfactory, likeable, friendly, etc. On the scale, 1 indicated Firm B, 4 indicated that both the firms were equivalent, and 7 indicated Firm A. Some of the items were reverse coded and were rescaled for the analysis. Subsequently, participants indicated their preference between Firms B and A on a 1 to 7 scale.

4.2. Results

Manipulation Check. Participants' responses to the affect scale served as a manipulation check for the misattribution manipulation. Analyses revealed that participants in misattribution-absent condition displayed more favorable affective reaction ($M = 5.18$) toward the suboptimal option than participants in misattribution-present condition ($M = 3.67$), $F(1, 159) = 53.66$, $p < 0.0001$. Further, the affect scale values in the absence and presence of misattribution were significantly different from the scale midpoint (i.e., 4), $t(76) = 8.24$, $p < 0.001$ and $t(83) = -2.21$, $p < 0.02$, respectively.

Preference. Participants' preference for the suboptimal option changed across the misattribution-present and misattribution-absent conditions. In the misattribution-present condition, they showed a lower preference for the suboptimal option ($M = 3.16$), than in the misattribution-absent condition ($M = 4.98$), $F(1, 159) = 24.66$, $p < 0.001$. There was no qualification by the order condition ($F < 1$).

Mediation by Affect. A mediation analysis was conducted to examine the mediating influence of affect on the preference for the suboptimal option (Baron and Kenny 1986). The misattribution manipulation had a significant influence on preference for the suboptimal option, $F(1, 159) = 24.66$, $p < 0.001$. The misattribution manipulation also predicted the affective response, $F(1, 159) = 53.66$, $p < 0.0001$. The affective response significantly predicted preference, $F(1, 159) = 76.76$, $p < 0.0001$. Finally, when a full model was run examining the joint impact of the misattribution manipulation and affect on preferences, the influence of the misattribution manipulation decreased and no longer remained statistically significant, $F(1, 158) = 2.02$, $p > 0.15$. However, the influence of affective response on preference remained significant, $F(1, 158) = 47.41$, $p < 0.0001$.

4.3. Discussion

The results of this experiment provide evidence that affect (System 1) plays a role in the choice of the suboptimal option. Misattributing the affective reaction to background music resulted in significantly lower preference for the suboptimal option. The results of the mediation analysis and responses to the affect scale show that participants experience more favorable affective reaction when they evaluate the suboptimal option due to the seemingly lenient penalty structure. Additionally, the alternate account of a lack of analytical skills does not predict the obtained pattern of results.

This experiment implicates an affectively charged System 1 in the suboptimal choice but it does not explicate how System 1 is influencing the final choice. We suggest that System 1 provides an affective input to System 2 which leads to improper information integration, causing a biased representation of the available information ("I like Firm A more because it looks less expensive") and resulting in the choice of the suboptimal option. In sum, this account states that System 1 interferes in the processes of System 2 (we call it the "interference" account). However, an alternate account for the choice of the suboptimal option could be that people rely on the affective signal from the choice task to directly reach a decision ("I like Firm A more, although I'm not really sure why") and do not integrate information ("direct influence" account). We now provide converging evidence for the proposed "interference" account in Experiment 2 by utilizing a recall task and in Experiment 3 by utilizing a recognition task. We also rule out the "direct influence" account.

5. Experiment 2

The objective of this experiment was to provide evidence for the "interference" account and rule out the alternate "direct influence" account. Similar to Experiment 1, this experiment used a misattribution manipulation. Participants were shown similar information as in Experiment 1 about Firm A's and Firm B's cell phone plans. In order to assess the mental representation of the given information, participants were asked to recall information about the penalty structure and the anytime minutes in an integrated form. By integrated form, we mean that participants were asked to provide a response which had integrated both the anytime minutes and the penalty for exceeding the anytime minutes. For instance, they were asked how much penalty they would have to pay for both Firms A and B if they used 190 anytime minutes. The first dependent measure was the number of errors participants made in completing the integrated table, and the second dependent measure was the time taken by them in providing the responses. Half of the participants completed the integrated table by retrieving information from memory (invisible condition) while the other half had the information about the cell phone plans in front of them while they completed the integrated table (visible condition). Thus, it was a 2 (manipulation: misattribution present versus misattribution absent) $\times$ 2 (information: visible versus invisible).

In this experiment, availability of information (visible versus invisible) can be conceptualized as a manipulation that forces (or does not) appropriate information integration. That is, regardless of the affective reaction one experienced, having the information explicitly visible while performing an information integration task should result in appropriate information integration. The misattribution (present versus absent) can be considered a manipulation of affect—the presence of misattribution renders affective reactions nondiagnostic and thus reduces the influence of affect.

Recall that the "interference" account suggests that affective reactions interfere with information integration and lead to biased mental representations, while the "direct influence" account posits that information integration never takes place but affect is utilized directly as a cue to guide judgments. Therefore, the proposed "interference" account posits that information integration takes place in both the misattribution-present and misattribution-absent conditions and the choice of the suboptimal option is indicative of the biases caused by the affective reaction interfering in the process of information integration. The "interference" account generates the following testable predictions.

First, biases in mental representations should surface in the form of differing error rates. Regardless of whether affect was involved in the process or not, having the information clearly visible should allow individuals to integrate it properly when the task they are explicitly performing is information integration. Thus, we should see relatively low error rates in the information visible condition, irrespective of the misattribution manipulation. However, when information is invisible, participants have to retrieve information from memory in order to perform the task. If affect did interfere with information integration earlier, we should expect to see greater errors in this subsequent task, when affect was more interfering (misattribution absent) than when affect was less interfering (misattribution present).

Second, we should expect to see differential response latencies based on individual memory (or lack thereof) for information in integrated form. The "interference" account suggests that when information is invisible (i.e., participants are recalling information), participants in both misattribution present and absent conditions should be fast at recalling information—be it accurate or biased. However, when information is visible, participants have the opportunity to check their representation against the visible information, thus increasing latencies. Further, the "interference" account would predict a differential hindering of responses across the two visible information conditions. Since the misattribution-present participants misattributed affect, they would have formed a more accurate representation of the integrated information, and while checking against the visible information should be less surprised (as it matches their internal representation). However, participants in the misattribution-absent condition (for whom affect interfered and produced a biased mental representation) would be more surprised when given the chance to check their internal representation against the visible information (since it would differ from the biased representation they have). Thus, we would expect the misattribution-absent participants to be hindered more than the misattribution-present participants in the information visible condition. In other words, this account predicts an interaction on the response latencies, wherein visible information, compared to the invisible information condition, would hinder the recognition of integrated information but more so for the misattribution-absent participants.

The "direct influence" account, however, would make a different pattern of predictions. Specifically, the "direct influence" account suggests that in the absence of misattribution, individuals utilize affect directly as a cue, unmediated by information integration. When information is visible, individuals in the misattribution-absent condition can rely on the visible information to construct an integrated table online. However, when information is invisible, participants in the misattribution-absent condition would have no information in integrated form in memory to rely on. Instead, they would need to rely on recalling the raw information and then performing the information integration. Thus, this account would predict considerable hindrance (longer latencies) for these participants.

In summary, there are two crucial differences in the predictions made by the two accounts. First, the "interference" account predicts that when information is invisible, participants in both the misattribution-absent and misattribution-present conditions will take about the same time to access a mental representation of integrated information—whether that representation is correct or not. In contrast, the "direct influence" account would state that misattribution-absent participants, who never formed a mental representation of integrated information, would take considerably longer to generate the integrated information from memory for the raw information in comparison to misattribution-present participants who would have access to information in integrated form. Second, the "interference" account predicts that visible information (compared to invisible information) will hinder the misattribution-absent participants, whereas the "direct influence" account predicts that it is invisible information (compared to visible information) that will hinder these participants.

5.1. Method

One hundred and eighty-nine participants took part in Experiment 2 for partial course credit and were randomly assigned to one of the four conditions. The experiment took place in a computer lab. Participants were randomly assigned to the misattribution-present versus misattribution-absent condition by providing instructions identical to that in Experiment 1. Subsequently, participants were shown the consumer choice task that depicted the wireless plan of Firm A (which gave 170 anytime minutes) or Firm B (which gave 200 anytime minutes). The penalty structure was largely similar to that in Experiment 1 with some differences: Only three levels were provided in the penalty structure,[2] that is, Firm A imposed a penalty of $0.50, $1, or $2 per minute for exceeding anytime minutes by 10, 20, or 30 minutes while Firm B charged $2 per minute for exceeding anytime minutes by 10, 20, or 30 minutes. Participants were asked to read all the details provided about the two plans. Participants could not move to the next screen as long as music was being played ensuring that all of them saw the display for the same amount of time. Note that they were not asked to choose between the two plans. In the next screen, participants were told that they would be asked some questions about the two plans that they had seen and they had to type in their responses in the space provided.

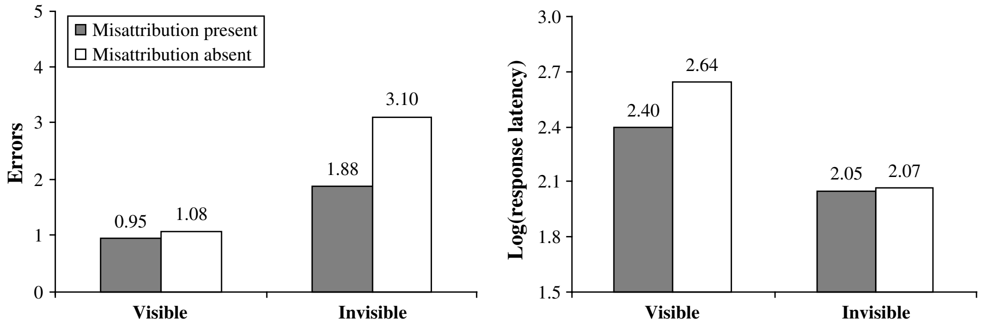
In the next screen, half the participants were shown all the information about the two plans again (visible condition) while the other half were not (invisible condition). All participants were then asked that if they utilized 180 minutes, how much penalty would they have to pay per minute for Firms A and B. They were asked to type their response in the space provided. On the next two screens, they typed in the penalty charges for using 190 and 200 minutes. All subsequent screens always displayed the previous typed responses and in this manner participants completed a table that had the penalty structure and the total anytime minutes in an integrated form. In sum, participants provided six responses, three each for Firms A and B, and therefore could make zero to six errors in their responses. The response time for each of the six responses was measured.

5.2. Results

Error Analysis. Given the categorical nature of the error data, a probit analysis was run which revealed an information × misattribution interaction, Wald $\chi^2(1) = 5.11$, $p < 0.02$. The information × misattribution interaction was due to the fact that when information was visible, participants in misattribution-absent and misattribution-present conditions made approximately the same number of errors (Ms = 1.08 and 0.95, respectively; Wald $\chi^2(1) = 0.04$, $p > 0.83$). However, when the information was invisible, participants in misattribution-absent condition made more errors ($M = 3.1$) than in misattribution-present condition ($M = 1.88$), Wald $\chi^2(1) = 12.71$, $p < 0.001$. Figure 1 graphs the results.

[2] A separate test with 84 participants revealed that having only three levels in the penalty structure yielded results consistent with previous experiments, with 61% choosing the suboptimal and 39% choosing the optimal option, $\chi^2(1) = 3.85$, $p < 0.05$.

Figure 1 Measure of Errors and Response Time for Experiment 2



Latency Analysis. A log transformation was performed on the response times. Analyses yielded an information × misattribution interaction, $F(1, 185) = 4.97$, $p < 0.02$. Response latencies of participants in misattribution-absent and misattribution-present conditions did not differ when the information was invisible ($M = 2.07$ and 2.05, respectively), $F(1, 185) = 0.14$, $p > 0.71$. However, when information was visible, participants in the misattribution-absent condition ($M = 2.64$) took more time than did the participants in misattribution-present condition ($M = 2.4$), $F(1, 185) = 14.28$, $p < 0.001$. Further, the differences in response latencies were significantly different across misattribution present ($M = 2.4$ and 2.05 for visible and invisible conditions, respectively, $F(1, 185) = 27.2$, $p < 0.0001$) and misattribution absent ($M = 2.64$ and 2.07 for visible and invisible conditions, respectively, $F(1, 185) = 69.96$, $p < 0.0001$).

5.3. Discussion

The obtained results are in line with the predictions made by the "interference" account. If we consider the response latency pattern and the error pattern in the invisible condition in conjunction, we find that although both sets of participants (misattribution absent and present) took similar time to recall the information, misattribution-absent participants made more errors compared to misattribution-present participants. This illustrates that while both misattribution-absent and misattribution-present participants could recall integrated information (since both took the same amount of time to complete the integrated table), misattribution-absent participants had a biased representation (leading them to make more errors) compared to the misattribution-present participants.

The results do not support the "direct influence" account. The "direct influence" account suggests that individuals in the misattribution-absent condition utilize affect directly as a cue—that is, they do not perform any information integration. First, this account would predict that in the information-invisible condition, misattribution-absent participants should take considerably longer to complete the integrated table than misattribution-present participants. The data, however, do not support this notion and are consistent with the "interference" account that predicts similar response latencies. Second, this account predicts that participants in the misattribution-absent condition should be faster at completing the integration task in the visible (where they can at least use the visible information to construct the table) compared to the invisible condition (where they lack both an internal representation and a source of information in the external environment). This prediction is not supported by the data with misattribution-absent, information-visible participants taking longer ($M = 2.64$) than misattribution-absent, information-invisible participants ($M = 2.07$). Note that this pattern of results supports the "interference" account which suggests that misattribution-absent participants do perform information integration, albeit ending up with a biased representation. Thus, these individuals should be surprised by the visible information that does not match their internal representation and it would be the information-visible, misattribution-absent participants who would demonstrate greater hindrance. The results are thus incompatible with the "direct influence" account[3] and consistent with the "interference" account.

[3] Additional evidence against the plausibility of the "direct influence account" came from a separate study utilizing 117 participants. Research suggests that System 1 operations are hard wired and automatic, and that System 2 operations are cognitively more effortful (Stanovich 2004). If the "direct influence account" holds true, then people should report greater cognitive effort in the misattribution-present compared to the misattribution-absent condition. In contrast, the "interference account" suggests that there should be no difference reported in cognitive effort since participants in both conditions integrate information. In the study, participants were shown the same choice task as in Experiment 2 and were either asked to misattribute affect or not asked. Participants first indicated their choice and then provided their response to a five-item cognitive effort scale (alpha = 0.92) modified from previous research (DeCarlo and Leigh 1996). The items measured whether participants considered the given information, evaluated the given information, found the task effortful, performed calculations, and took into account penalty structure and free minutes

To obtain converging evidence for the proposed "interference" account, we conducted Experiment 3 utilizing a recognition task.

6. Experiment 3

In this experiment, we assigned participants to an affective (System 1) prime, a rule-based (System 2) prime, or a control condition. Also, instead of asking participants to generate an integrated representation (as in Experiment 2), we presented them with integrated information and asked them to provide a true or false response. This was done to achieve the following objectives: First, the true or false response provides another measure of accessibility of a mental representation, where we measure recognition, rather than the generation of a mental representation. Second, we wanted to test whether the influence of the affective reaction on information integration could be enhanced since in previous experiments we had reduced the affective signal through misattribution. We anticipated that affectively primed participants would be more likely to choose the suboptimal option compared to the rule-based or control group participants.

Finally, this experiment was designed to find converging evidence in favor of the "interference" account. The first set of evidence would be provided by the mediation analysis, i.e., if affect interfered with information integration, then we should find that mental representation of the integrated information mediates the influence of affect on choice. Additionally, the comparison of the control condition and the rule-based prime affords another test of the "interference" versus the "direct influence" accounts. The "direct influence" account, suggesting that affect is utilized as a cue, would predict that priming rule-based thinking should result in individuals becoming less likely to use the output of System 1 (i.e., affect) as a cue, and more likely to use the deliberative, rule-based System 2. Thus, we should see a lower percentage of individuals choosing the suboptimal option when primed with rule-based thinking. In contrast, the "interference" account would predict that when primed with rule-based thinking, although individuals may not utilize the System 1 affective response as a cue, the affective response is still provided as an input to the System 2 process, thus subverting the deliberative process. In other words, the "interference" account would suggest that affect, even if not used as a direct cue, could still serve as a biasing input to the System 2 process and result in increased choice of the suboptimal option. Therefore, enhancing the performance of System 2 will not influence choice if what is being processed more efficiently is still a biased input. The "interference" account does not predict differences between the control condition and the rule-based prime.

6.1. Method

Three hundred and one participants took part in the experiment for partial course credit. They were seated at a computer and were randomly assigned to one of the three conditions—affective prime, rule-based prime, or control condition. The experiment took place in two phases. In the first phase, participants in the affective priming condition were shown four sets of paintings with two paintings in each set. They were asked to respond as to which painting in each set they found more beautiful and aesthetically pleasing. Participants in the rule-based priming condition were given four mathematical problems to solve. The priming manipulations were adopted from primes used by Hsee and Rottenstreich (2004). After the priming manipulation, participants saw the following stimulus: "Star Bank offers two checking accounts—Checking A and Checking B and both accounts offer similar basic services such as monthly statements, protection against identity theft, etc. Accountholders can write 15 checks per month for Checking A and 19 checks per month for Checking B. The bank imposes a fee per extra check if you exceed the specified limit of checks." The following is the schedule of fees:

	True form	
If you exceed check limit by	Amount charged for Checking A ($)	Amount charged for Checking B ($)
1 check	0.25	2.00
2 checks	0.25	2.00
3 checks	0.50	2.00
4 checks	1.00	2.00
5 checks	2.00	2.00

After performing an unrelated filler task, participants entered the second phase where we tested for differences in the hypothesized mental representations of the two checking accounts. After performing an unrelated filler task, participants entered the second phase where we tested for differences in the hypothesized mental representations of the two checking accounts. Participants were shown integrated information about the checking accounts, but in either true

to arrive at a decision on a 1 (strongly disagree) to 7 (strongly agree) scale. Results indicated no difference in cognitive effort across misattribution-present ($M = 4.99$) and misattribution-absent ($M = 4.89$) conditions ($F(1, 115) = 0.25$, $p < 0.62$) a pattern inconsistent with the "direct influence" account.

form or in false form:

	True form	
If you write	Amount charged by Checking A ($)	Amount charged by Checking B ($)
16th check	0.25	0
17th check	0.25	0
18th check	0.50	0
19th check	1.00	0
>19 checks	2.00	2.00

	False form	
If you write	Amount charged by Checking A ($)	Amount charged by Checking B ($)
16th check	0.25	2.00
17th check	0.25	2.00
18th check	0.50	2.00
19th check	1.00	2.00
>19 checks	2.00	2.00

Participants were required to make true or false judgments and the errors they made served as dependent variables. Responding "true" to information in false form or responding "false" to information in true form were coded as errors. Specifically, we hypothesized that participants who had chosen the suboptimal option would be more likely to make errors in recognizing the actual representation (since they had formed a wrong representation) as compared to participants who chose the optimal option. In order to rule out a consistency bias we counterbalanced the order of presentation such that half the participants chose before performing the true or false judgment while half of them made a choice after the true or false judgments.

6.2. Results

Choice. The order of performing the choice task (test of mental representation followed by choice or vice versa) did not interact with the priming manipulation, $\chi^2(2) = 1.06$, $p > 0.58$. The priming manipulation had a significant impact on the choices made by participants, $\chi^2(2) = 11.62$, $p < 0.003$. Specifically, 80% of the participants in the affective priming condition chose the suboptimal option compared to (1) 61.8% of the participants in the rule-based priming condition, $\chi^2(1) = 9.29$, $p < 0.002$, and (2) 60.6% participants of the control condition, $\chi^2(1) = 8.31$, $p < 0.003$. The difference between participants choosing the suboptimal option in the rule-based prime condition and control condition was not significant, $\chi^2(1) = 0.02$, $p > 0.85$ which is inconsistent with the predictions made by the "direct influence" account and in line with the "interference" account.

Error Analysis. Similar to the choice results, the order of performing the choice task (test of mental representation followed by choice or vice versa) did not interact with the priming manipulation $\chi^2(2) = 1.25$, $p > 0.53$. Significant differences in errors emerged as a function of the priming manipulation, $\chi^2(2) = 20.16$, $p < 0.0001$. Note that 61.7% of participants in the affective priming condition made errors in recognition of the integrated information compared to (1) 34.6% of participants in the rule-based priming condition, $\chi^2(1) = 16.46$, $p < 0.001$, and (2) 36.6% participants in control condition, $\chi^2(1) = 10.93$, $p < 0.001$. Further, the difference in percentage of participants making errors in the rule-based prime condition and control condition was not significant, $\chi^2(1) = 0.08$, $p > 0.77$.

This picture of a faulty mental representation is even stronger when errors are analyzed across choice. Significant difference emerged as a function of choice, $\chi^2(1) = 30.39$, $p < 0.0001$. Fifty-seven percentage of those who chose the suboptimal option made errors in recognition while only 21.3% of those who chose the optimal option made errors. These results indicate a faulty representation of the problem in generating this preference for the suboptimal option. While categorical modeling yielded a main effect for the true or false nature of the stimulus (i.e., false probes resulted in greater errors than true probes), importantly, truth did not moderate these effects on errors.

Mediation Analysis. In our conceptualization, we proposed that affect interferes in information integration. If this is the case, we should expect that the influence of affect be mediated through the mental representations being formed by participants. Considering the priming manipulation as a manipulation of affect and errors in recognition of the true or false form as an indicator of mental representation as well as examining choice as the dependent variable, we conducted a mediation test to examine whether the influence of affect on choice is being mediated through the mental representations. Utilizing the framework provided by Baron and Kenny (1986), we ran a series of categorical models. These analyses only used the participants in the order condition that performed the recognition task prior to the choice task.[4] The priming

[4] Analyses run using the entire sample provided similar results. The priming condition had a significant influence on recognition, $\chi^2(2) = 19.65$, $p < 0.0001$, as well as on choice, $\chi^2(2) = 11.39$, $p < 0.003$. Recognition predicted choices, $\chi^2(1) = 30.39$, $p < 0.0001$. When a full model was run examining the joint impact of priming as well as recognition on choice, the influence of the priming condition decreased and no longer remained statistically significant, $\chi^2(2) = 4.66$, $p < 0.09$. However, the influence of recognition on choice remained significant, $\chi^2(1) = 24.76$, $p < 0.0001$.

condition had a significant influence on recognition, $\chi^2(2) = 14.33$, $p < 0.0008$, and on choice, $\chi^2(2) = 9.3$, $p < 0.009$. Recognition had a significant impact on choice, $\chi^2(1) = 21.15$, $p < 0.0001$. Finally, when a full model was run examining the joint influence of priming and recognition on choice, the influence of the priming manipulation no longer remained significant, $\chi^2(2) = 3.39$, $p < 0.18$. However, the influence of recognition on choice remained significant, $\chi^2(1) = 16.8$, $p < 0.0001$.

The mediation analysis confirmed that the influence of affective reactions on choice was mediated through the mental representations formed by the participant, which is consistent with the "interference" account.

6.3. Discussion

By enhancing the influence of affective reaction on choice, we provide converging evidence to the findings of Experiment 2 where, using the misattribution paradigm, we had reduced the influence of the affective response on choice. The results of the mediation analysis revealed that the influence of affect on choice was mediated through mental representations, suggesting that affect interfered with the information integration that preceded the mental representation. The results of the mediation also argue against the alternate account of "direct influence," which would not predict such a mediation since it argues for a direct role of affect unmediated by information integration. In sum, the results demonstrate that System 1 has the capacity to interfere with the process of information integration. This results in a biased representation of the given information and finally results in the choice of the suboptimal option.

7. General Discussion

In this article, we utilize everyday decision-making situations requiring information integration to explore whether the quick and affective System 1 has the potential to interfere with the workings of the rule-based System 2. We posit that if the given information has an affective element, then it generates an affective System 1 response which serves as an input to the System 2 process of information integration. The affective input causes improper information integration which biases the mental representation, leading to the choice of a suboptimal option.

In the set of experiments presented in the article, we discuss and test alternate accounts and provide converging evidence for the proposed "interference" account. Experiment 1 establishes the involvement of the affective System 1 in creating a preference for the suboptimal option and rules out the alternate account of analytical skills. Experiments 2 and 3 utilize recall and recognition tasks, respectively, to provide converging evidence for the "interference" account and to argue against the "direct influence" account.

7.1. Implications and Future Directions

The findings of the article have both theoretical and managerial implications. According to expected utility theory, a decision maker assigns weights to different attributes of the available options and chooses an option that offers the highest utility. Our findings indicate that affective reactions from one piece of information have the potential to bias the process of information integration, influence utility estimation, and result in the choice of a suboptimal option. Extant literature suggests that the predictive ability of consumer choice models can be improved by understanding consumers' rational and irrational behavior (Shugan 2006). The current findings suggest that marketing models should take into account that if the given information has an affective component, then it has the potential to influence deliberations and consumer choice. Therefore, what might be believed to be a deliberative System 2 choice might have been interfered with by the reactions of an affective System 1.

The role of affect in consumer decision making has been a focus of considerable inquiry. Several articles in the consumer research literature have contributed to this growing field by examining the impact of affect on judgments, attitudes, evaluations, preferences, and consumer choice (Hoch and Loewenstein 1991, Hsee and Kunreuther 2000, Luce 1998, Luce et al. 1999, Pham et al. 2001, Shiv and Fedorikhin 1999). More recently, researchers have designed models that capture the information-processing problem of a consumer who is unable to separate affect from the true valuation of product quality (Iyer and Kuksov 2005). This article adds to this literature by exploring the interfering role of the affectively charged System 1 in judgments and behavior. Specifically, while extant theories and empirical evidence have tended to examine the two systems as relatively independent entities, we demonstrate interactions between the systems. Studying the interactions between the affective System 1 and the deliberative, rule-based System 2 will hopefully generate not only a greater understanding of consumer choice and behavior but also a more nuanced and rich picture of the consumer information processing apparatus.

Choice is arguably one of the important aspects of consumer decision making. We have demonstrated that while comparing and contrasting the presented information, if one of the options creates an illusion of leniency, the consumer might choose a suboptimal option. Firms should thus avoid using such comparisons and be made more vigilant about competitors who could create affective cues in their comparative advertisements to make their products appear more appealing.

The emerging area of "emotional mining," which attempts to capture affective reaction to brands, attributes, experience, and quality suggests that several times people base their decisions on subconscious affective reactions that they are unable to describe (Thomas 2006). Our findings show that these affective reactions may also have the potential to influence how consumers represent information. In other words, the assessment of consumers' perceptions of the products may reflect biases induced by the hidden affective reactions.

The article presents certain areas that could be explored in future works. First, we investigate the influence of affect, an aspect of System 1, on information integration, an aspect of System 2. Future studies should look into other aspects of System 1 (for instance, perceptual or associative processes) and their influence on other aspects of System 2 (for instance, learning or logical reasoning). Such studies would provide more insight on the different ways in which System 1 can influence the workings of System 2. Second, we have concentrated on one specific type of choice task that is common in consumer decision making. A promising area for future research is finding converging evidence for the interfering ability of System 1 on System 2 utilizing different tasks (e.g., other kinds of choice problems or evaluations) and other types of measures (e.g., psychophysical measures like a skin-conductance response). Third, an area of future study could be to demonstrate the influence of System 1 reactions such as immediate benefits and impulsive choices (Wertenbroch 1998) on System 2 processes such as calculation of costs and benefits. Such work can provide convergent evidence and help to further specify the exact nature of interference of System 1 on the workings of System 2. Finally, a limitation of this work is that we only tested for the interfering quality of positive affect arising from the lenient penalty structure of the suboptimal option. Further tests could be conducted that examine the interfering role of negative affect on the process of information integration to find out whether its influence is similar to that of positive affect on System 2 tasks such as information integration.

Acknowledgments

The authors acknowledge helpful comments made by Ashok Lalwani, Joseph Priester, and Baba Shiv. The authors also thank the editor, the area editor, and four anonymous reviewers for their helpful and insightful feedback.

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