Hot Cognitions in Coherence-Based Reasoning and Decision-Making

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Abstract

The studies examine the role of *hot cognitions* alongside *cold cognitive appraisal* within the framework of *coherence-based reasoning.* In two simulated legal cases we find that emotions towards the suspect and motivation with respect to the outcome of the case are strongly correlated with the cognitive appraisal of the facts of the case, the judged credibility of the witnesses, and the overall judgment of the suspect's blame. Moreover, emotion and motivation partially mediate the effect of experimental manipulations on decisions.

Keywords: Decision-making; constraint satisfaction processes; coherence based reasoning; legal decision-making.

Introduction

Decision making in real-world situations characterized by complex patterns of facts often involves *coherence-based reasoning*; as decision makers consider a pattern of evidence and come to a conclusion, judgments about the facts of the case and the conclusion shift to become more coherent with each other (Holyoak & Simon, 1999; Simon, 2004; Simon et al., 2004a; Simon et al., 2004b). We sought to extend this research by investigating the role of *hot cognitions* in the *cold* cognitive appraisals involved in such judgments. We were particularly interested in whether and how emotions and motivation are implicated in conclusions about a suspect's guilt. Considerable research has recently examined the role of emotions in decision-making (Rick & Loewenstein, 2008). Particular attention has been directed at anger, which leads to systematic distortions in a variety of judgments. These distortions are especially problematic when the anger is aroused by a source that is unrelated to the person being judged. Observers aroused by such *incidental anger* are more likely to attribute blame to the person being judged, to perceive her conduct as intentional, to lower the required threshold of evidence, to neglect alternative explanations and mitigating circumstances (Lerner, Goldberg, & Tetlock, 1998; Goldberg, Lerner, & Tetlock, 1999; Quigley & Tedeschi, 1996), and to increase the desire for retaliation (Ferguson & Rule, 1983)

Social judgment has also been shown to be affected by motivation. As noted by Kunda (1990), reasoning processes under *directional goals* often lead to results that comport with those goals, whereas *accuracy goals* tend to lead to more objective conclusions (Balcetis & Dunning, 2006; Ditto & Lopez, 1992; Piercey, 2009).

In the current studies we sought to study the impact of *directional goals* by giving some subjects a specific role as either prosecutor (or investigator) and other subjects the role of defender. Taking on such *adversarial roles* may lead to biased information search and hypothesis testing. We also hypothesized that such *adversarial roles* may lead to negative emotions, such as anger.

Unfortunately the research demonstrating the effect of emotion and motivation on reasoning offers little insight into how these effects occur. How do emotion and motivation interact with the variables on which the judgments are supposed to be based: facts, preferences, values, etc.? One possibility is that emotion and motivation override these underlying variables. Another possibility is that emotion and motivation influence the underlying variables in the corresponding direction, which makes the corresponding judgments feel natural and obvious. The latter explanation is consistent with the Gestaltian notions that underlie *coherence-based reasoning*: the mental model of the task settles at a state of equilibrium at which all relevant elements—the underlying variables, conclusion, motivation, and emotion—all cohere with one another. Thus, we hypothesized that the constraint satisfaction processing that underlies *coherence-based reasoning* would engulf both the cold cognitions (as observed previously) and the hot cognitions. This prediction dates back to Heider's Balance Theory, in which liking for a person or an object was theorized to affect the overall balance of the structure (Heider, 1958). More recently, researchers have modeled hot and cold cognitions within the framework of constraint satisfaction processing (Nerb, 2007; Thagard, 2006).

Overview of Studies

In both studies, participants judged a quasi-criminal case concerning an allegation of academic misconduct by a university student. Participants were asked to imagine that they worked at a state university in the Office of Student

Disciplinary Affairs, which deals with allegations of academic misconduct. The Office investigates and adjudicates the allegations and, where appropriate, recommends disciplinary actions. The procedure consisted of an investigation followed by an adversarial-like disciplinary hearing, in which a University Representative prosecutes the case, and the student is defended by a Student Representative. The cases are ultimately decided by the university's Chief Judicial Officer.

The case involved an allegation that a student, Debbie Miller, cheated on a closed-book exam by copying from her notes. Participants received the case information, and were asked to make a variety of judgments about the incident. All participants received the same case information and instructions, except for assignment instructions, as described below. None of the manipulations provided any information pertaining to whether she cheated or not. In all conditions, participants were instructed to be "fair and objective."

The first study examines whether the objectivity of investigation is affected by directional motivations and emotions that are elicited by the adversarial nature of the process. Participants were asked to play the role of the investigator, and assigned to investigate the case for one of the two parties (the two adversarial assignments) or for both (the non-adversarial assignment).

The second study examines the effects of the intensity of adversarialism. Participants were asked to role-play a prosecutor-like role in a case of alleged academic misconduct. Half of the participants were given background information intended to induce low intensity (*non-partisan*) (*e.g.*, you feel that most of the time, the disciplinary process reaches correct decisions), while the other half were given information intended to induce high intensity (*partisan*) (*e.g.*, you believe that many of the students who were cleared by the disciplinary process did in fact cheat).

Study 1: Adversarial and Inquisitorial Investigations

This study tested whether and how investigations conducted in an adversarial framework might lead to different outcomes than investigations conducted in a non-adversarial mode. Participants were assigned to investigate the case for either one of the parties (two adversarial conditions) or for both parties (the non-adversarial condition). We predicted that relative to the non-adversarial assignment, the adversarial assignments would result in views of the case that would be tilted towards the respective assignments and that these views would be mediated by motives and emotions elicited by the role assignment.

Method

Participants. Participants were 296 individuals who completed the study via the Internet. The sample was 62% female, with an average age of 43.

Procedure. Participants went through a series of web pages containing the instructions, the case information, and the measures. They were informed that the assigned role of

investigator entailed preparing the evidence to be submitted to the disciplinary hearing. All participants received the same case information and instructions, except for assignment instructions, as described below.

Assignment. Participants were randomly assigned to one of three conditions. The "university-assignment" condition was designed to simulate a police investigation. Instructions emphasized that the individual was performing the investigation on behalf of the University and their reports were central to the case. They were also told that someone would be fulfilling a similar function for the other side.

The "Debbie-assignment" condition was designed to simulate a private investigation for the defense. The instructions for this assignment were identical to the university assignment, but the sides were reversed.

The "Sole Investigator" condition was designed to mimic a non-adversarial investigation; participants were told that they were the sole investigator in the case. The instructions emphasized that they were the only investigator working on the case and that both sides would rely on their report.

All participants were exposed to the same case and instructed to be fair and objective. Participants performed the study alone, and there was no other investigator.

Case. The case was intricate and ambiguous. From the university files, participants learned that Debbie, a junior, was an "A" student, and was considered hardworking and ambitious. At high school, she was charged with cheating on an exam, but the file did not indicate whether she was disciplined or not. An interview with the examination room proctor revealed that Debbie sat against a wall, close to the back corner of the room. The proctor noticed that Debbie sat crouched over her papers, as if she was hiding something. At the end of the exam, she noticed also that Debbie stuck something into the pocket of her sweater, which later turned out to be a note with a summary of the course. Brad Loomis, a fellow student who sat behind Debbie, claimed to have seen her pull out the note from her sweater pocket and copy from it throughout the exam. The professor reported that Debbie was anxious about the exam, but did not believe that she cheated. He did mention that she was the only student to respond correctly to one of the questions. Debbie denied the allegations adamantly. She stated that as an A student, she had only to lose by cheating. She explained that she crouches when sitting for long periods of time because of a back injury she sustained while playing on the college volleyball team.

Dependent Variables. *1. Overall Judgments.* Participants estimated the likelihood that Debbie cheated on the exam (0-100%), how they would decide the case, how they expected the Chief Judicial Officer to decide the case, and which side their view supported.

2. Case facts and related beliefs. Participants evaluated 13 factual issues involved in the case, and 9 belief questions that corresponded to 9 of the factual questions (1 - 11 scale).

3. Judgments of Liking, Emotions, and Motivation. Participants indicated how much they liked Debbie (0-100). Next, they reported how much they felt three positive

emotions (sympathy, compassion, and sorrow) and three negative emotions (anger, scorn, disgust) towards Debbie. Another question gauged participants' motivation towards the outcome of the case by asking participants which side they wanted to see win the case. (all on a 1-11 scale)

4. Objectivity and Distrust. The questions measured participants' assessments of the objectivity of their own view of the case; the objectivity of the other investigator; how their own objectivity would be judged by the other investigator; and how the Chief Judicial Officer would assess their own objectivity and the other investigator's. (all on 1-11 scale).

Results

The prediction was that role assignment would influence participants' judgments of all aspects of the case.

1. Overall Judgments. The assignment had the predicted effects on overall judgments of the case. The estimates of the probability that Debbie cheated were 33%, 43%, and 53% for the Debbie-Assignment, Sole Investigator, and University-assignment conditions, respectively, F (2, 292) = 12.75, p < .001. A similar pattern was found in participants' judgments as to which side of the case was supported by their view: 3.5, 5.0, and 5.8, with higher numbers meaning more University support, (F (2, 292) = 15.17, p < .001. A chi-square analysis, Chi-square (2) = 6.99, p < .05, revealed that the assignment also influenced how participants would decide the case themselves (23%, 37%, and 40% would decide that Debbie cheated, respectively).

2. Case facts and related beliefs. First, consistent with prior research on *coherence-based reasoning* (Holyoak & Simon, 1999; Simon et al., 2001; Simon et al., 2004b), views of these items clustered around a coherent mental model of the case. The 13 fact items formed a reliable composite (alpha = .88). Participants developed globally coherent structures that tended to view the factual pattern as indicative either that Debbie cheated or that she did not. We found a similar clustering of the 9 beliefs that were related to the facts of the case (alpha = .60). This weaker alpha is understandable given that background knowledge is more stable than ad hoc judgments of specific events.

Second, the assignment influenced the facts and related beliefs as predicted, Facts F (2, 292) = 15.87, p < .001; Beliefs F (2, 292) = 14.11, p < .001. Those assigned to the university-condition were more prone to interpret the facts as incriminating Debbie (Fact M = 5.7, Belief M = 5.4), whereas those assigned to the Debbie condition interpreted them as least incriminating (Fact M = 4.4, Belief M = 4.5). The judgments in the Sole Investigator condition were in between (Fact M =5.2, Belief M =5.0),

3. Judgments of Liking, Emotions, and Motivation. The assignment also influenced liking and emotional reactions to Debbie, as well as motivation with respect to the outcome. Participants in the university-condition were consistently the most negative toward Debbie, whereas those in the Debbie assignment condition were consistently most positive, with Sole Investigator in between: (Liking: 56 vs. 60 vs. 65;

Negative emotions: 4.0 vs. 3.5 vs. 3.1; Positive emotions: 5.4 vs 6.0 vs. 6.8; Motivation to see University win: 5.7 vs. 4.6 vs. 3.7), all *ps* < .05.

4. Coherence: Correlations and Mediation

All the primary variables, whether cold (facts, likelihood, decision) or hot (liking, emotions, motivation), were strongly inter-correlated, rs = .57 -.76, *p*< .01, two tailed. These widespread correlations capture the essential core of the network that underlies constraint satisfaction processing.

Mediational analyses of the potential causal paths among the variables provided additional evidence to support the *coherence-based* mechanism. They were conducted with an SPSS macro by Preacher and Hayes (2004).

The first set of mediational analysis analyzed the relationship between the three primary variables—role assignment ("condition"), judgments of the case facts ("facts"), and the "likelihood" item ("likelihood that Debbie Miller did cheat on the exam"). Case facts were shown to be a significant mediator between assignment and likelihood, (*p* < .001). The assignment manipulation influenced the participant's perceptions of the case facts, which, in turn, influenced perceptions of guilt. A significant mediational effect was also observed in the reverse direction, with judgments of likelihood mediating the effect of assignment on the evaluations of the facts (*p* < .001). This is consistent with the bi-directional nature of *coherence-based reasoning,* in which all the elements in the network should mutually influence one other.

Another set of analyses examined whether participants' emotions and motivations mediated their "likelihood" judgments. Four Sobel tests were conducted, one for each mediator: facts, liking for Debbie, motivation (which side participant wanted to see win), and emotion. The effect of the assignment on the likelihood judgments was mediated significantly by each variable, all in the predicted directions. Similar meditation was observed when the "facts" were treated as the dependant variable.

To explore the relative strength of each mediator we conducted multiple mediational analysis. We included the four significant mediators (facts, liking, motivation, and emotion) simultaneously in the same analysis. The analysis revealed that two of the four remained significant, with the case "facts" being the strongest mediator (z = 4.59, p < .001), then "motivation" (z = 4.00, p < .001), while emotion composite was marginal (z = 1.79, p = .07).

5. Perceived Objectivity – The Adversarial Mindset. The findings provide insight into the participants' metacognitive judgments. First, participants felt that their views of the case were equally objective in the adversarial conditions (7.9 and 8.0, on a 1 to 11 scale) as in the non-adversarial condition (7.9). They were unaware that the adversarial manipulation biased their judgments. Second, participants' in the two adversarial conditions had different views of their own and their adversary's objectivity. Participants deemed their adversary to be less objective, M=6.45, than they deemed themselves, M = 8.0, t = 6.80, p < .001. They also deemed him or her to be less trustful of themselves, M =

6.2, than they believed themselves to be, M = 8.0, t = 8.46, p < .001. Participants also believed that the other investigator's distrust was unwarranted, in that it was less credulous, M = 6.2, than the Chief Judicial Officer's evaluation of themselves, M = 7.2, t = 5.06, p < .001.

Discussion

The adversarial role strongly influenced people's perception of an ambiguous case. Relative to the non-adversarial assignment, adversarial role assignments skewed participants' views of the case in a self-serving manner. Participants in the condition that simulated police investigators were more likely to conclude that Debbie was culpable, whereas those simulating investigators for the defense were more prone to infer that she did nothing wrong. Most likely both conditions had a biasing influence on participants' judgments. Indeed, participants in the Sole Investigator condition viewed the case to be very close to the middle between the two adversarial conditions. The biasing impact of the adversarial assignment was manifested also by the arousal of mistrust towards their adversary.

Finally, the study provides the first experimental evidence of the interrelationship between hot and cold cognitions in *coherence-based reasoning*. More evidence for this relationship will be presented in Study 2.

Study 2: Partisanship and Coherence

Study 2 tested the effects of *strength* of *partisanship* on people's perceptions of a case and the role of motivation and emotion. We compared participants primed with a *non-partisan* manipulation with participants primed with a *partisan* one. We also examined whether the assignment would influence assessments of the trustworthiness of the witnesses. *Coherence-based reasoning* would lead to the prediction that judgments of the evidence would be positively related to judgments of the source's credibility.

We also sought to test *coherence shift* of beliefs. Study 2 introduced a pre-test instrument that tested participants' responses to the "belief" items, which were later included in the body of the study. This repeated-measures design enabled us to test within-subject shifts in the participants' responses to the belief items.

Method

Participants. The study used the same procedure as in Study 1. 163 individuals participated via the Internet. The sample was 48% female, with an average age of 46.

Procedure. We used the same case of Debbie Miller (with minor changes). The instructions described the adversarial hearing and the role of the University Representative ("University Rep"), which was substantively very similar to the role of a prosecutor, and role of the Student Advocate. All participants were assigned to the role of University Representative. After receiving the case, participants made a variety of judgments about it. All participants received the same case and instructions, except for information that was designed to manipulate the degree of partisanship.

Dependent Variables. Most of the variables were identical to those in Study 1. In addition, we measured participants' responses to the belief items on the pre-test and the judgments of the trustworthiness of the witnesses. To obtain a baseline measure for testing *coherence shifts*, participants received a pre-test questionnaire prior to the presentation of the case, containing questions probing their beliefs on a number of seemingly unrelated social issues. These questions were identical to the "belief" questions administered later on. Each of the belief items probed for a background belief that pertained to an ambiguous fact of the case (*e.g.*, "In general, people who have lower back pain tend to crouch when they sit for extended periods of time"). We predicted that responses to the belief items would shift from pre-test to post-test, ultimately cohering more strongly with the view of the case (see Simon, Snow, & Read, 2004).

Treatment. Participants were assigned to one of two conditions differing in their *partisanship*. Participants in the *non-partisanship* condition were told that for the most part they felt the process was fair. They were also provided with positive information about the Student Advocate assigned to represent Debbie Miller, Jim Cooper. He was said to be fair and professional and interested in the truth.

Participants in the *partisanship* condition were told that they had become frustrated by the number of students who had been cleared, despite being almost certainly guilty. They were upset about the impact of this on the University's reputation and the harm inflicted on students who did not cheat. Participants in this condition also received negative information about their adversary, Jim Cooper, being told that he was overzealous, strongly biased toward students, and responsible for many of the recent cases in which cheaters were cleared.

Results

The prediction was that participants in the *partisan condition* would be more inclined to believe that Debbie did cheat than participants in the *non-partisan condition* and that this would influence a range of different judgments.

1. Overall Judgments. The estimates of the likelihood that Debbie cheated were 40% in the *non-partisan* condition and 53% in the *partisan* condition, F (1, 161) = 6.93, p < .01. The assignment also influenced how participants would decide the case themselves, *non-partisan*: 33% Guilty vs. *partisan* : 49%, Chi-square (1) = 4.23, p = .04.

2. Case facts and related beliefs. Those in the *partisan* treatment perceived the case to be more consistent with the conclusion that Debbie cheated (Facts M = 5.6; Beliefs M = 5.4) than did participants in the *non-partisan* condition (Facts M = 4.8; Beliefs = 5.0), where higher numbers are more consistent with Debbie cheating, F (1, 160) = 9.65, p = .002 and F (1, 160) = 6.14, p = .014, respectively. The 13 "fact" items cohered to make a reliable composite (alpha = .86), as did the related "beliefs" (alpha = .61). Also partisanship affected the perceived trustworthiness of the witnesses. Both witnesses who testified that Debbie cheated were deemed more trustworthy by *partisan* participants

(Proctor: 6.8 v. 6.0; Brad Loomis: 6.0 v. 4.9), $F (1, 160) = 4.96$, $p = .027$ and $F (1, 160) = 10.0$, $p = .001$, respectively.

3. Judgments of Liking, Emotions, and Motivation. The partisanship manipulation also influenced participants' emotions and motivations. Compared with *non-partisan* participants, *partisan* participants liked Debbie less (M = 53 vs. 59), had stronger negative feelings (M = 2.7 vs. 2.1) and weaker positive feelings towards her (M = 3.3 vs. 4.0), and were more motivated to see the university prevail (M = 5.8 vs. 4.3), all differences p < .05.

4. Coherence Shifts of the Belief Items. Despite the initial ambiguity (as denoted by the non-significant differences at pre-test), by the time of the decision, the beliefs shifted to cohere with the decision and with one another, creating a strongly interconnected mental model (Holyoak & Simon, 1999; Simon et al, 2004a, Simon et al, 2004b). Figure 1 shows the coherence shifts in the belief items, plotting the data separately based on participants' response to the question: "if you were the Chief Judicial Officer, how would you decide the case"? (regardless of partisanship). A test of the interaction confirmed that these shifts were highly significant, $F (2, 158) = 91.5$, $p = .000$.
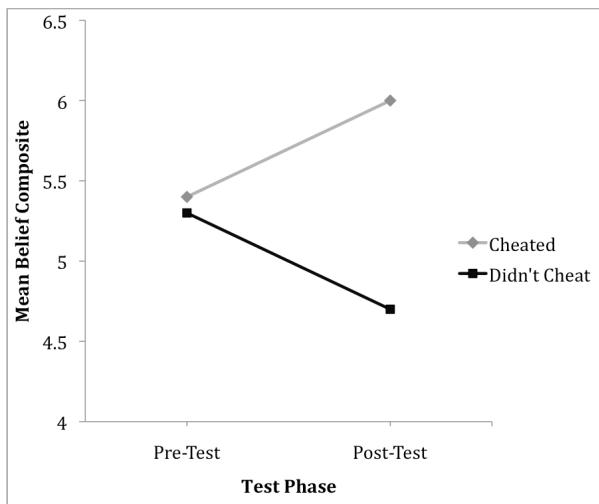

Figure 1. Coherence shifts in belief measures

5. Mediations and Structural Equation Modeling. We used SEM to perform simultaneous testing of the interrelationships among the study variables to identify which of the competing models best accounts for the relationships. The first analyses contained the four primary *cold cognitions*: partisanship assignment ("condition"), judgment of the case facts ("facts"), "likelihood" that Debbie Miller cheated on the exam, and the "decision" ("how would you decide the case?").

Two models (see Figure 2) show that partisanship predicts the primary variables. Model 1 shows that partisanship affected the judgment of the facts, which affected likelihood, which affected the decision. This is compatible with rational models of inference. Model 2 suggested that the inference chain may also run in reverse. These opposing models capture the bi-directionality of *coherence-based* reasoning; a central feature of the mutual influence in constraint satisfaction processes.
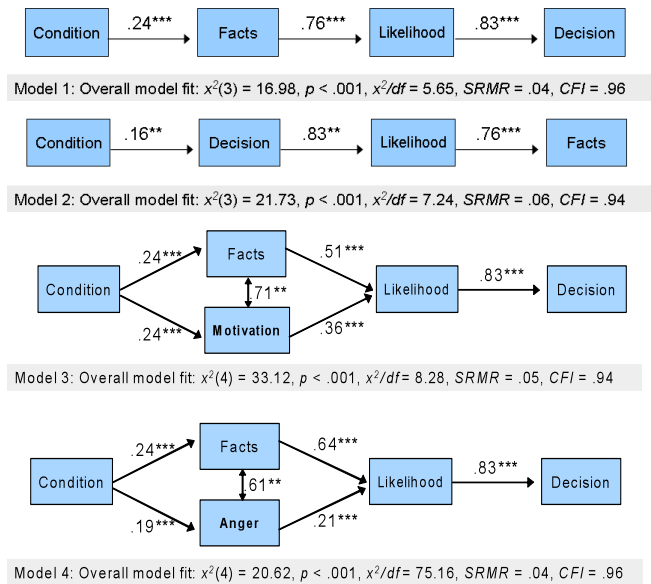

Figure 2: SEM models of hot and cold cognitions

Our primary question was whether hot cognitions are involved in the constraint satisfaction processes that drive the representation towards coherence. We first tested mediational relationships between the three hot cognitions (anger towards Debbie, motivation, and liking) and a central cold cognition: decision, (See Figure 3). A simultaneous mediational analysis between the condition and the decision revealed effects for "anger" and "motivation", but not for "liking". Mediation by hot and cold cognitions was also observed using SEM (see bottom of Figure 2), which found good fitting models for both "motivation" and "anger" as joint mediators, with "facts," of "likelihood", and decision.
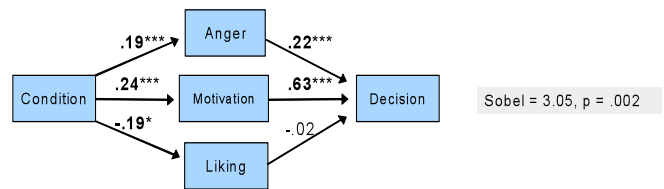

Figure 3: Multiple mediation model

Discussion

Judgments were influenced considerably by the intensity of partisanship. As in Study 1, the treatment assignment resulted in coherent mental models of the case, in which the wide range of variables involved in the judgment all cohered with the manipulated conclusion. Participants' assessments of the trustworthiness of the witnesses were also influenced by the assignment. Partisan participants were more likely to trust the witnesses who claimed to have seen Debbie cheat. Most important, we observed that hot cognitions mediated the effect of the assignment on the cold cognitions.

General Discussion

The studies show that the perception of a factually ambiguous case depends on the conditions under which the judgments are made. Study 1 simulated a police investigation and found that the perception of the case was strongly influenced by the participants' role assignment. Relative to the non-adversarial assignment, adversarial role assignments skewed participants' *hot* and *cold* cognitions in a manner that supported their assigned side. The non-adversarial assignment led to judgments close to the midpoint between the two adversarial conditions. The symmetry of the polarization supports the conclusion that adversarialism results in a distorted perception of the case. Participants in all conditions deemed their perception of the case to be equally objective, suggesting that the participants in the adversarial conditions were unaware of the influence of the assignment on their judgments. Study 2 simulated a prosecutorial view of the same case and found that both hot and cold cognitive judgments are influenced considerably by the intensity of the partisanship.

These studies provide further corroboration for the *coherence based reasoning* framework (Holyoak & Simon, 1999; Simon, 2004; Simon et al., 2004a; Simon et al., 2004b). We found again that participants' views of a complex task tend to cluster into large and coherent mental representations that encompass the overall judgments of the case as well as of the entire set of facts and related beliefs.

However, the most important contribution is the novel finding of the interrelationship between the hot and cold cognitive aspects of the task. While a great deal of research has observed the effect of emotion and motivation on cognitive processing (*e.g.*, Kunda 1990; Slovic, Finucane, Peters, & Macgregor, 2002; Zajonc, 1980), that research has not provided much insight into the mechanisms by which these effects occur. Mediational analyses and SEM revealed that emotion, motivation and to some degree also liking, mediated the effect of the assignment on the various cold cognitive judgments of the case, while similar mediations were observed in the reverse direction. While one ought to be cautious drawing causal conclusions from these data, these observations are strongly consistent with the Gestaltian features of high interconnectivity and bi-directional influence that characterize constraint satisfaction processing and *coherence-based reasoning*.

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