

ABSTRACT

Title of Document: THE IMPACT OF MOTIVATION,
PROCESSING DIFFICULTY AND
COGNITIVE RESOURCES ON THE USE OF
BASE-RATES IN SOCIAL JUDGMENT

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This study explores the impact of motivation, cognitive resources and difficulty of processing on social judgment. We hypothesized and found all three variables influence the type of information used to render judgment. Only when the information was easy to process, cognitive resources were ample and motivation was high were subjects able to use difficult information as a basis for their judgment. Furthermore, contrary to the common notion that statistical information tends to be utilized when resources are high, we were able to show that subjects relied on statistical information when their motivation was low, the information was difficult to process and/or cognitive resources were limited. These results add to the growing body of evidence attesting that the contents of information as such do not affect the likelihood of their being made use of in judgment. Both base-rates and representativeness (“heuristic”) information seem to be used in accordance with their subjective relevance – when such relevance is discerned given that the individuals’ resources are sufficient to cope with the difficult posed by the cognitive task at hand.

THE IMPACT OF MOTIVATION, PROCESSING DIFFICULTY AND
COGNITIVE RESOURCES ON THE USE OF BASE-RATES
IN SOCIAL JUDGMENT

By

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Chapter 1: Theoretical Rationale

In a world where information is readily available at the touch of a button, people are constantly surrounded by a wealth of information upon which to base their judgments. From decisions as seemingly small as which shampoo is best to major life decisions such as where to go to college, information abounds. Determining which information is most relevant to one's judgment is of key importance in reaching a (subjectively) successful outcome. This paper argues that determining subjective relevance can only be accomplished when cognitive resources are available in order to appreciate the relevance of the information to one's judgment. The following study explores the impact of motivation, difficulty of processing and cognitive resources on social judgments.

The way in which humans make decisions about the world and the factors that affect those decisions has long been the focus of psychological research. At first, individuals were believed to make decisions in a rational, calculating manner, cognitively weighing information as would a good Bayesian theorist (Cohen, 1979, 1981, Scott, 2000; Hastie & Dawes, 2001). This rational choice paradigm was challenged in the 1970s and 1980s by work showing that human's were more limited in their cognitive capacity. The metaphor of humans as cognitive misers, taking shortcuts to minimize processing came into fashion. The capacity limited thinker searches for quick, easy solutions rather than making slower, more accurate judgments (Fiske & Taylor, 1991). The study of judgmental heuristics, rules of thumb, came into popular use by the research of Kahneman and Tversky who showed

that human judgments were subject to an array of biases, fallacies, and the tendency to rely on “improper” evidence (Kahneman & Tversky, 1973).

Representativeness

One of these biases first identified by Tversky and Kahneman was related to the representativeness heuristic, reflecting the degree to which information about a target is similar to or fitting a given category. For example, a target, Steve, would be described as “very shy and withdrawn, invariably helpful, but with little interest in people or in the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail” (Tversky & Kahneman, 1974). Individuals are far more likely to believe that Steve is a librarian than a physician, farmer or salesman. Individuals rely on their stereotypes in order to assess the likelihood that Steve is a member of a given category, in this case, a librarian.

Tversky and Kahneman (1974) argued certain information that should affect one’s judgments typically does not. In particular, the base-rates of an event are often ignored in making judgments about its likelihood. Thus, the fact that there are many more farmers than librarians should affect one’s judgment of Steve’s profession. However, presenting subjects with the frequencies of the various jobs within the population did not typically affect their use of the descriptive information. Instead, individuals tended to evidence base-rate neglect.

Tversky and Kahneman (1974) studied this phenomenon directly by using their now famous lawyer-engineer problem. In the typical lawyer-engineer paradigm, subjects were told that in a group of people 30% were engineers and 70% were lawyers. They were then told that one man’s profile was selected at random and his

description included his hobbies: home carpentry, sailing and mathematical puzzles. Such information was referred to as “representative,” that is, indicative of the degree to which the specific case was similar to a generalizing category (of engineer, in this case). Subjects were then asked to estimate the likelihood that this target person is an engineer. From a normative standpoint one would expect that the base-rate information would be utilized. For instance, if the base-rate of engineers in a sample was said to be X (say 30%) participants would make a different likelihood judgment than if it was said to be Y (say 70%). However, Kahneman and Tversky (1973) found that subjects, regardless of which base-rates they saw, utilized the representativeness heuristic, that is, relied on the use of the individuating information, and, in the example above, overestimating the chance this person was an engineer. Kahneman and Tversky (1973) interpreted this tendency as erroneous and as reflecting people’s general insensitivity to statistical information and their preferential reliance on sub-optimal heuristics.

Recently, Kahneman (2003) offered a general explanation of base-rate neglect and other similar phenomena in terms of a “dual process” model whereby two systems of reasoning exist, one consisting of intuition and one consisting of reasoning. Intuition relies on fast, automatic, effortless, implicit and often emotional processing whereas reasoning relies on slower, serial, controlled, rule-based, effortful, deliberate, and consciously motivated processing (Kahneman, 2003). According to this view, errors or biases occur because, instead of using reasoning, people rely on intuitions when making judgments as the overall mental capacity of humans is limited. While part of the job of reasoning is to monitor intuitions, people are not very

good at this, especially when engaged in another task. When tasks are complex, people rely on heuristic principles which allow for simpler judgmental operations. However, these heuristics can also lead to biases and errors in judgments, as is the case in the representativeness heuristic responsible for base-rate neglect (Kahneman, 2003). In the case of base-rate fallacy, the dual process model explains how individuals rely on a quick, easy assessment (of the individuating information) rather than on a more methodical, deliberate processing (of the statistical base rate information).

Similar to other dual process models, (see Chaiken & Trope, 1999), Kahneman's (2003) model assumes that when cognitive resources are limited, individuals will adopt shortcuts in thinking, relying on various heuristics to make judgments. On the other hand, when cognitive resources are plentiful, individuals can process information thoroughly and correctly. Unlike the cognitive miser view of the past, the updated theory of the motivated tactician believes that people's judgments are influenced by motivations and emotions. "A fully engaged thinker... has multiple cognitive strategies available and chooses among them based on goals, motives, and needs. Sometimes the motivated tactician chooses wisely, in the interest of adaptability and accuracy, and sometimes the motivated tactician chooses defensively in the interest of speed or self-esteem" (Fiske & Taylor, 1991). From this perspective, one would expect that individuals whose resources are depleted or constrained will be especially likely to engage in intuitive thought whereas individuals who have a particular training to facilitate rational thought, e.g., training in statistics, should be particularly likely to give correct answers (Sedlemeier, 1999). This motivated

tactician perspective assumes a flexible process whereby the availability of motivational and cognitive resources may vary across individuals and across situations. In the absence of cognitive resources, individuals may be likely to engage in shortcuts and heuristics and in the presence of resources they may be more likely to engage in more extensive processing (Pierro, Mannetti, Kruglanski, & Sleeth-Keppler, 2004).

Following the above logic, one can assume that different information would be of use to different individuals, depending on their prior knowledge. For example, for a statistician, the base-rates might have greater judgmental relevance than for other individuals. According to Kahneman, intuition can be powerful and accurate, but the key determinant of intuitive thoughts is that “under appropriate circumstances, they come to mind spontaneously and effortlessly” (Kahneman, 2003 p.699). How then are we to understand intuition given the statistician for whom base-rates are intuitive, used spontaneously and effortlessly? Kahneman explains that the issue is one of accessibility, the ease (or effort) with which a particular construct is called to mind. This would suggest that effort is different than the content of information. However, Kahneman himself then says that, “the accessibility of a thought is determined jointly by the characteristics of the cognitive mechanisms that produce it and by the characteristics of the stimuli and events that evoke it” (Kahneman, 2003 p.699). Thus, intuition refers to both the content of the information and the process by which that information is used. Returning to our statistician example, one can see that the content of information is the same but for the statistician the base-rates are intuitive and for everyone else, the base-rates require reasoning. This suggests that

content and effort may not be inexorably linked. By separating content from process, I will suggest that the degree of effort relative to task difficulty determines the impact of given information on the judgments rendered.

Evidence from Persuasion Research

Confusion over content and process can be found in other dual process models as well. Recent research on the dual process models of persuasion has found that upon the separation of content from ease of processing, it was processing difficulty (ease vs. difficulty of processing) rather than the type of information processed (cue vs. message argument) that had more impact on judgments. A review of the research in the area of persuasion has shown that heuristic cues are almost always presented briefly and upfront while message argument information is presented later and in a more complex manner (Kruglanski & Thompson, 1999). The contents of the message (cue vs. message argument) were confounded with processing difficulty or task demand (complex vs. simple and order of presentation). Research in this area (Kruglanski & Thompson, 1999a; Erb, Kruglanski, Chun, Pierro, Mannetti, & Spiegel, 2003; Pierro, Mannetti, Erb, Spiegel, & Kruglanski, 2005; Pierro et al., 2004) has shown that when the content of the information remains the same but difficulty of information processing is varied, it is difficulty rather than content that determines judgmental impact. For example, when message argument information was presented briefly and upfront, hence it was easy to process, the information exerted more impact under low cognitive resources (mimicking the “heuristic” information of previous studies). When communicator expertise information (usually presented as a heuristic,

such as “experts are right”) was presented instead in a lengthy, hence difficult to process, manner, it exerted impact only under the high resource condition (mimicking the effects of “message argument” information). Thus, a separation of content from type of processing shows that it is not the content of the information (e.g., whether the information is about the source or about the issue) but rather its processing difficulty that interacts with cognitive and motivational resources to determine judgment.

Evidence from Base-Rate Neglect Problems

Further evidence by Chun and Kruglanski (in press) using the paradigm of base-rate neglect shows that length of information and order of presentation (difficulty of processing) interact with processing resources to determine use. When the base-rate or individuating information is presented briefly and/or upfront, there is a greater tendency to rely on this information under limited cognitive resources than under ample cognitive resources. However, when the base-rate or individuating information is lengthy and/or presented late in the sequence, there is a greater tendency to rely on this information under high cognitive resources than under limited cognitive resources. It is of interest that in much of the prior research where base-rate neglect was demonstrated, the effect could have been due to the fact that the base-rates were presented briefly and upfront, whereas the individuating (representativeness) information was presented lengthily and subsequently. Specifically, if participants had sufficient motivation and cognitive resources they might have been able to process the late-appearing information and, through a recency effect, might have assigned it greater weight in judgment. The fact that that utilization of easy to process base-rates is increased under load, as is the utilization of

representiveness information when it is presented in a easy to process form, belies the notion that people have a special difficulty in processing statistical information, and suggest that prior demonstrations of base-rate neglect may have stemmed from a confounding of informational type and processing ease.

Issue Involvement

Work in the area of persuasion has argued that non-directional motivation affects an individual's willingness to process information. Under high motivation, individuals are motivated to spend time understanding and exploring an issue, while under low motivation, individuals are more likely to rely on heuristic information as the basis for judgments (Chaiken & Eagly 1976, 1983; Petty & Cacioppo, 1986). Typically, these studies operationalize non-directional motivation as issue involvement (Petty, Cacioppo, & Goldman, 1981). Students who care deeply about an issue were typically assumed to be more highly motivated to process the information than students who were less issue-involved. According to our conception (see also Kruglanski & Thompson, 1999), motivation should be one of the factors that interacts with processing difficulty to affect the judgment process.

The Present Research

The current research extends the findings of Chun and Kruglanski (in press) by exploring the interaction between motivation for processing information, difficulty of processing and availability of cognitive resources. First, previous conceptions of difficulty of processing (e.g., Kruglanski & Thompson, 1999; Chun & Kruglanski, in press) have used information that by its nature is more difficult to process such as

lengthy passages. Because length cannot be manipulated without adding informational content, this presents a difficulty when attempting to separate content from process. For that reason, the present study manipulated difficulty of processing by making the information difficult to read, using an italic font similar in color to the background. Furthermore, whereas Chun and Kruglanski's (in press) analysis assumes that motivation was a factor that impacted the judgmental process, motivation was not manipulated directly in their research. According to the present analysis, motivation should interact with difficulty of processing such that if motivation is high, individuals will be interested in understanding and deciphering the information. In other words, individuals who are highly motivated will devote more cognitive resources in their attempts to understand the information. Thus, only those individuals with high motivation, easy processing task and available cognitive resources should be able to process complex, and hence, cognitively taxing information.

In summary, I explored the separation of content from process within the base-rate paradigm. In prior literature on this topic (see e.g., Kahneman, 2003) base-rate information was implicitly assumed to be more difficult to process with individuating information representing the "heuristic," and hence easier to process, information. By contrast, we are assuming that difficulty of processing can be separated from type or content of information. Therefore, in the present study, information previously thought of as "heuristic" (i.e. individuating information) was presented in a difficult and challenging manner, requiring both resources and motivation for its processing. In contrast, base-rate information was made easy to

process. Thus, we predicted that the individuating information would be used only in the presence of both high processing motivation and ample processing resources. In contrast, the base-rate information should be utilized when either cognitive or motivational resources or both are low.

Chapter 2: Methodology

We provided subjects with information on an issue relevant to them – tuition increases – using a new version of the typical base-rate neglect paradigm. Subjects were given both base-rate information about the faculty’s views on this issue as well as individuating information about a particular faculty member. In our scenario, the individuating information was presented first but was presented in a rather difficult manner, requiring subjects to read and analyze the information. If subjects read the information thoroughly, they should conclude that Dan would support tuition increases. Base-rate information was presented more simply, with the percentages indicating that most of the faculty did not support the increase. Thus, the individuating information and the base-rates had opposite implications, with the individuating information being the more difficult to decipher. Cognitive load, motivation to object to the increase in tuition and difficulty of reading the paragraph were manipulated orthogonally.

Methods

Participants

University of Maryland students participated in the study in exchange for extra-credit in their psychology classes. A total of 110 students participated in the experiment. Data from 17 students were excluded as they recalled less than four digits in the load condition. Gilbert and Hixon (1991) suggested that recalling so few digits may represent a failure of the load manipulation, therefore, these students were excluded from the analysis. Five additional students were eliminated upon analyzing the data as their residual scores were greater than 2 standard deviations from the

mean. Total subject participation was 88 subjects consisting of 27 males and 61 females. Gender differences were not found for any of the dependent variables and thus, will not be discussed further.

Procedure

Participants were told that we were conducting a study for the university on reactions to potential tuition increases. Students were then told that the tuition increases were intended specifically to “increase revenue for administrative support, campus parking, funding for graduate student research, and tuition remission for faculty children.” Participants were told that these domains had been overlooked in the past but were important for increasing the quality of education. This information was intended to convey that the tuition increases would benefit the faculty members and pilot testing showed that students did, in fact, believe that most faculty members would support the increase.

Individuating information was then provided about a particular faculty member, Dan. Students were told that Dan is a faculty member at Maryland and that he has children approaching college age. Pretesting showed that upon seeing this information, students believed that Dan would support tuition increases (average likelihood rating was 68%). However, the individuating information was relatively difficult to process as students needed to understand where the tuition money was going and to infer that Dan would benefit from that money.

Base-rate information was then presented about the faculty’s support of the tuition increase, ostensibly based on a survey we had previously conducted. Students were told that 70% of the faculty did not support the tuition increase while only 30%

supported the increase. This information was presented in a simple format and was the last thing that students read before answering the dependent variable, thus, making the information easy to process as compared to the individuating information.

Non-Directional Motivation. Manipulation of non-directional motivation was done via the supposed year of implementation of the tuition increases. In the high motivation condition, students were told that the tuition increase could take place next fall. Those in the low motivation condition were told that the increase was planned to take effect in five years, insuring the increases would not affect these particular students. Issue involvement was assumed to increase motivation such that if students believed there was a chance their own tuition would increase, they would be more motivated to process the information. Such manipulations have been used effectively in past research (e.g., see Petty & Cacioppo, 1986).

Difficulty of Processing. A second variable, difficulty of reading the vignette was manipulated by using a font and a background color very similar to each other, making the paragraph extremely difficult to read. In the easy condition, subjects saw a purple background with black writing, the same as the rest of the slides in the study. In the hard condition, the vignette was written in italics and in a light purple ink on a purple background, making it rather difficult to read.

Cognitive Load. Participants were placed under high or low load. Participants under high load were told that a second goal of this study was to test how well people were able to concentrate on two tasks at once. To that end, subjects were presented with a seven digit number that they were asked to memorize and repeat while filling out the survey. Participants in the low load condition did not see this manipulation.

Prior to completing the dependent measure, participants were asked to reproduce the number.

Likelihood Estimate. The dependent variable was measuring by having subjects estimate the likelihood that Dan would support the tuition increases. Participants were asked to generate a response from 0% (no chance that Dan would support the increases) to 100% (Dan would absolutely support the increases).

Manipulation Checks. Following the likelihood estimates, participants were asked a number of questions about the study. To assess the load manipulation, participants were asked “how difficult was it for you to concentrate on the vignette” and “how distracted were you by other thoughts while reading the vignette.” Two items were used to assess participants difficulty of processing, “how difficult was it for you to read the vignette” and “how did the ink color affect your ability to read the vignette.” Results for all four questions were answered along a 7 point scale (endpoints: 1=not at all, 7=very much).

Results

Manipulation Checks

Efficacy of Load Manipulation. Distraction ratings were analyzed to assess the efficacy of the load manipulation. The two questions assessing the load manipulation were highly correlated ($\alpha = .79$). When combined, although only approaching significance, there was a main effect of load such that those under load experienced more distractions than those under no load, $F(1, 88) = 2.29, p = .1$. Because these results only approached significance, one-way ANOVAs were conducted on each of the items separately. The question “how distracted were you by other thoughts”

showed that participants in the high load condition experienced more distracting thoughts ($M=4.05$) than those under no load ($M=3.08$), $F(1, 87) = 4.60$, $p < .05$. The second item, which asked participants “how difficult it was to concentrate,” was not significant by itself but was in the predicted direction, with those in the load condition finding it more difficult to concentrate ($M=3.29$) than those in the no load condition ($M=2.98$), $F(1, 87) = .47$, $p = .49$. Taken together, these effects offer support for the notion that our load manipulation was effective.

Efficacy of the Difficulty Manipulation. The two items assessing the difficulty of processing were highly correlated ($\alpha = .7$) and thus were averaged to form a new variable capturing the difficulty of reading the vignette. A one-way ANOVA showed a significant difference in the mean ratings between the easy and the difficult conditions, $F(1, 87) = 37.39$, $p < .00$. As expected, participants in the difficult condition ($M = 4.49$) found the vignette significantly more difficult to read than did those in the easy condition ($M = 2.07$). Looking at each question separately, the results showed similar findings. When asked “how difficult was it to read,” participants in the easy condition found it less difficult ($M=2.34$) than those in the difficult condition ($M=3.21$), $F(1, 87) = 3.29$, $p = .07$. When asked “how the ink color affected their ability to read the vignette,” those in the difficult condition found the ink to have significantly affected their ability ($M=5.77$) as compared to those in the easy condition ($M=1.80$), $F(1, 87) = 97.56$, $p < .000$. These results attest that our manipulation of task difficulty was successful.

Use of Base-Rates

A 2 (motivation) x 2 (load) x 2 (difficulty) ANOVA was performed on the participants' likelihood estimates. An individual who relied on the base-rates, should predict that Dan would not support the tuition increase, thus, their likelihood estimation, should be higher than an individual who relied only on the individuating information. The analysis showed a main effect of motivation such that those who were highly motivated, used the base-rates less ($M = 50.5$) than those in the low motivation condition ($M = 41.2$), $F(1, 87) = 4.94$, $p < .05$. Although not significant, a main effect of difficulty approached significance in the right direction, with those in the easy condition, using the base-rates more ($M = 42.7$) than those in the difficult condition ($M = 49.1$), $F(1, 87) = 2.35$, $p = .1$. From these main effects, it can be concluded that since the base-rates were easier to process, only those with either the motivation or the ability to process information were able to use the individuating information to influence their judgment.

Consistent with this logic, there was a significant two-way interaction between motivation and difficulty such that only those in the easy and high motivation conditions were able to use the more difficult individuating information, $F(1, 87) = 4.55$, $p < .05$. All the other conditions relied on the easy base-rate information. Most importantly, this interaction is qualified by a significant three-way interaction between motivation, difficulty and load, $F(1, 87) = 4.15$, $p < .05$, partial $\eta^2 = .05$. Thus, under the difficult processing condition there was no interaction between motivation and load, but under easy processing, motivation and load interacted. Only the individuals in the easy processing, no load and high motivation condition were

able to rely on the difficult information whereas all the participants in the remaining conditions relied on the easy base-rate information (see table 1). Planned contrasts tested the means in order to explain this three-way interaction. As expected, those in the high motivation, easy processing and no load condition had significantly higher likelihood estimates than all other conditions, which did not differ among themselves.

Table 1: Means and Standard Deviations for mean likelihood ratings

<u>Type of Processing</u>	<u>Easy</u>	<u>Difficult</u>
High Motivation		
No Load	67.69 (17.39)	40.00 (19.82)
Load	48.75 (19.59)	45.71 (18.13)
Low Motivation		
No Load	38.11 (21.58)	45.38 (18.87)
Load	41.82 (17.22)	39.58 (19.82)

Note: Higher average likelihood estimates means greater dependence on the base rates.

To ascertain that our participants were indeed using the base-rates, we tested to see if any of the means was significantly different from 30%, the base-rate given for faculty who support the tuition increases. The only condition mean that was significantly different from 30% was the mean for the high motivation, easy processing and no load condition ($t = 2.17, p < .05$). None of the other condition means were significantly different than 30% ($t < 1$). These results show further evidence that in all conditions, except the critical one, students used the base-rates as the basis for their judgments.

Chapter 3: Discussion

The present research contributes to the understanding of factors that influence the judgmental process. Conducted within the paradigm of base-rate neglect, the study manipulated non-directional motivation, difficulty of processing and cognitive load in order to examine their effects on the use of individuating and base-rate information. We found that all three variables are critical to the judgmental process. When motivation to process the information was low, and or the information was difficult to read, subjects did not pay attention to the difficult information but relied instead on the information that was easy to process. More importantly, the only condition in which subjects were able to process the difficult information was when they had high motivation, easy to read information and full available cognitive resources.

In a typical lawyer-engineer problem, the content of the information and the type of processing was confounded such that one could not separate the effects of the difficulty of processing from the content of the information. Previous studies have shown that when this information is separated, difficulty of processing and participants' cognitive capacity have the greatest impact on judgments (Chun & Kruglanski, in press). This study further extends this finding by using easy to process base-rate information and more difficult to process individuating information. Base-rates were presented last in the sequence of information, making them accessible and easy to remember, while the individuating information was quite complex, requiring subjects to spend some time reading a number of paragraphs in order to infer the target's views on the proposed tuition increase.

The fact that in seven of the eight cells of our design participants did utilize the base-rates is contrary to the notion of general base-rate neglect (Kahneman & Tversky, 1973). What may account for this discrepancy? First, because base-rates were presented last in the sequence of information they were highly accessible and easy to remember. In traditional base-rate studies, the individuating information is the last information seen, making it the more accessible information. In contrast, our individuating information required much greater processing effort on the part of the participant. Figuring out that the target person, Dan, had school age children and that tuition increases would benefit his finances, required motivation and resources. Thus, the individuating information was rendered more difficult to use while the base-rates were the easier to process so that under any of the constraints (low motivation, difficulty of reading, or cognitive load) subjects were inclined to use the base-rates rather than the individuating information.

The current study provides further evidence for the role that task difficulty and cognitive resources play in individuals' tendency to utilize potentially relevant information toward the rendition of judgments. When processing resources are available, an individual will be able to process more complex and difficult information but when resources are limited, easier or more accessible information can be utilized. Contrary to the implication that the use of base-rates represents a rational process, likely to occur under ample processing resources, whereas the use of individuating (or "representativeness") information is likely to occur under limited processing resources, the present results show that where the base-rate information is easy to process, it is likely to be utilized under limited resources, and where the

representativeness information is difficult process, it is likely to be utilized under ample resources. Prior research has demonstrated that people's subjective relevance of base-rates or "heuristic" information matters (Schwarz, Strack, Hilton, & Naderer, 1991). Individuals would use the base-rates if they perceive them to be relevant to the judgment at hand. This study demonstrated that being able to appreciate the relevance of a given piece of information depends on one's cognitive and motivational resources.

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