contradicted by some of the cited findings. However, these findings are not a problem for the modular model because researchers who espouse the modular view have long since moved away from these three prerequisites and instead focus on "*how modules process information*" (Barrett & Kurzban 2006, p. 630). Although modules are considered to be domain specific, a domain is not defined as a content domain, but rather, as any way of individuating inputs. It is entirely possible that a module will process information for which it was not originally designed as a by-product if this other information conforms to the properties that determine which inputs are processed.

Let us now consider transparency of nested set relations and appeal to evolution. The former is featured by the model favored by B&S, and so they clearly cannot mean to argue against it, which leaves only the latter as a possible basis for disconfirmation. But few in the scientific world would argue that evolution did not happen and so this is unlikely to be disconfirmed; certainly B&S have not presented any evidence to disconfirm evolution. Consequently, the modular model is not forced to make or not make any of the predictions listed in Table 2 of the target article, and I am compelled to conclude that B&S have failed to disconfirm the modular model (or any of the weaker ones).

The foregoing comments should not be taken as arguments in favor of mental modules. For one thing, the watering down of the concept of modules, which renders it less susceptible to disconfirmation, may have caused the informational content and general utility of the model to also be watered down. In addition, the auxiliary assumptions necessary to make the modular model useful are extremely complicated and these complications may be under-appreciated. As an example, consider an arm as a module. Arms increase the ability to use tools, crawl, fight, balance, climb, and many other abilities. In addition, the arm might be said to comprise features (fingers, elbows, etc.) How would one tease apart the functions for which arms evolved versus those that are mere by-products, especially after taking into account that the features may or may not have evolved for very different reasons? Surely a mind is much more complicated than an arm, and so the potential complications are much more extensive. Perhaps these issues will be solved eventually but my bet is that it will not happen soon. Until this time, the modular model seems unlikely to provide a sound basis for Bayesian theorizing or theorizing in any other area of psychology.

The data cited by B&S also fail to provide much support for the dual-process model they maintain. It is doubtless true that presenting Bayesian problems such that the set structure is more transparent increases performance. But it is not clear why this necessitates a distinction between associative and rule-based processes, a distinction that has not been strongly supported in the literature. In fact, Kruglanski and Dechesne (2006) have provided a compelling argument that these two types of processes are not qualitatively distinguishable from each other; both processes can involve attached truth values, pattern activation, and conditioning. Worse yet, even if the distinction were valid in some cases (and I don't think it is), there is very little evidence that it is valid in the case at hand. B&S seem to argue that when the set structure is not transparent, then people use associative processing; whereas they use a rule when the set structure is more transparent. It could be, however, that when the set structure is not transparent, people use rules but not the best ones. Or, when the set structure is transparent, this transparency may prime more appropriate associations. These alternative possibilities weaken the evidentiary support for the distinction.

B&S provide a section titled, "Empirical summary and conclusions" (sect. 2.10) that illustrates what I consider to be the larger problem with the whole area. Consider the empirical conclusions. First, the helpfulness of frequencies varies across experiments and is correlated with intelligence and motivation. Who would predict that there will be no variance and that intelligence and motivation will be irrelevant to problem solving? Second, partitioning the data so as to make it more apparent what to do facilitates problem solving – another obvious conclusion. Third, frequency judgments are guided by inferential strategies. Again, who would predict that people's memories of large numbers of events will be so perfect as to render inferential processes unnecessary? (To anticipate the authors' Response, modular theorists cannot be forced to predict this.) Fourth, people do not optimally weight and combine event frequencies and use information that they should ignore. Given the trend in both social and cognitive psychological research for the last quarter century or more, documenting the many ways people mess up, this is hardly surprising. Finally, nested set representations are helpful, which is not surprising because they make the nature of the problem more transparent. Trafimow (2003) provided a Bayesian demonstration of the scientific importance of making predictions that are not obvious. Hopefully, future researchers in the area will take this demonstration seriously.

ACKNOWLEDGMENT
I thank Tim Ketelaar for his helpful comments on a previous version of this commentary.

The motivated use and neglect of base rates

DOI: 10.1017/S0140525X07001938

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Abstract: Ego-justifying, group-justifying, and system-justifying motivations contribute to base-rate respect. People tend to neglect (and use) base rates when doing so allows them to draw desired conclusions about matters such as their health, the traits of their in-groups, and the fairness of the social system. Such motivations can moderate whether people rely on the rule-based versus associative strategies identified by Barbey & Sloman (B&S).

Barbey & Sloman (B&S) provide a convincing account of the contributions of associative and rule-based cognitive processes to base-rate respect. Absent from their model, however, is a consideration of the effects of psychological motivations on the use of statistical rules. The sorts of motivations known to influence the use of statistical rules fall into three general categories: ego-justifying, group-justifying, and system-justifying (Jost & Banaji 1994).

Ego-justifying neglect of base rates occurs in evaluations of medical diagnoses. For example, Ditto et al. (1998) told participants that they had tested positive for an enzyme (TAA) whose presence was predictive of immunity *or* vulnerability to pancreatic disease. Individuals in the "healthy consequences" condition were told that TAA made it less likely they would get pancreatic disease, whereas individuals in the "unhealthy consequences" condition were informed that TAA increased their chance of getting pancreatic disease. Participants were also told either that the test was highly accurate (1 in 200 failure rate), or relatively inaccurate (1 in 10 failure rate). Participants who were told that their TAA levels put them at risk for pancreatic disease and that the test was relatively inaccurate, perceived the diagnosis as less accurate than participants in the high accuracy condition – a normatively defensible application of the base rate. But participants who were told that their TAA levels reduced the risk of pancreatic disease, and were further informed that the test was inaccurate, were just as likely as participants in the high accuracy conditions to perceive the diagnosis as accurate.

Base-rate neglect can also be driven by bias in favor of one's social group (Ginossar & Trope 1987; Schaller 1992). In one study, the male employees of an organization were described as stronger leaders than the female employees (Schaller 1992). However, there was an additional, much more predictive base rate at work: participants were also told that male employees were dramatically more likely than female employees to be assigned to serve in an executive role. In other words, the males were stronger leaders because more of them were assigned to serve in leadership roles. Making the normatively rational judgment, female participants took into account the base rate of males and females in executive roles and concluded that male and female employees were equally talented leaders. But male participants neglected the assignment of male and female employees into different organizational roles, concluding that male employees were superior leaders. A separate experiment revealed that female participants were likewise biased in favor of their own group. These female participants ignored the base rate of male and female executives when it led them to the (incorrect) conclusion that female employees were superior leaders. In sum, participants neglected a base rate when it allowed them to draw a conclusion favorable to their own gender.

The motivation to uphold the social hierarchy (i.e., system justification) also plays a role in the application of base rates about racial groups to individual group members (McDell et al. 2006; Tetlock et al. 2000). Individuals who are non-prejudiced toward Black Americans make similar estimates of group crime rates among White and Black Americans as prejudiced individuals do. However, only the prejudiced individuals (i.e., those who have a motivation to uphold the social hierarchy) endorse the *use* of base rates to discriminate against an *individual* Black person. Individuals who endorse social hierarchies based on groups competing for power (a so-called "social dominance orientation"; Sidanius & Pratto 1999), are also more likely to endorse the application of base rates to individuals.

These biasing psychological motives likely work through the recruitment of the cognitive processes described by B&S. For example, research has demonstrated that social-psychological motives moderate whether associative or rule-based cognitive processes are employed in the first place. Ditto et al. (1998) presented evidence that people expend little cognitive effort when presented with information that favors a desired conclusion – they quickly accept it with minimal deliberation. Conversely, when presented with *undesired* information (that is, information inconsistent with one of the aforementioned motives), individuals seem especially likely to recruit rule-based, deliberative thinking in an effort to discredit the undesired information.

Ego-justification, group-justification, and system-justification motives are difficult to defend as *rational* influences on the use of statistical rules in social judgments. Although a person motivated by racial prejudice may make a "correct" judgment (i.e., a close approximation to the answer Bayes' Theorem would formally provide) when assessing the probability that a member of another race is a criminal, few would argue that this is due to statistical reasoning. Here we can distinguish between the rationality of the *belief* and the rationality of the *process* that led to that belief. Because social motivations easily (and often) lead to error, they make for suspicious guides to truth. Relying on them to achieve a rational belief is like throwing darts to choose stock winners. One may pick the best stocks, but surely it was by accident. Indeed, many people would reject the influence of these biases if they were made aware of them (i.e., such motives fail the test of *subjective rationality*; Pizarro & Uhlmann 2005).

An emphasis on social-psychological motivations may lead not only to a more complete understanding of base-rate neglect, but may also enrich a variety of cognitive theoretical approaches to human judgment. The human mind may possess specific mechanisms (e.g., in-group loyalty) that were adaptive because they aided in the individual's survival in an inherently social environment. Therefore, it may be important to consider such influences when accounting for phenomena that, at first, appear to be non-social in nature. For example, basic cognitive processes such as induction from property clusters contribute to biological explanations for natural kinds (Gelman 2003, Keil 1989). Yet, recent studies demonstrate that system-justifying motives may lead people to endorse biological explanations such that explaining group differences as "natural" helps justify their continued existence (Brescoll & Uhlmann 2007). Thus, applying social-psychological motives to theories of cognitive processes may lead to a more complex, but hopefully also more accurate, portrait of human cognition.

Base-rate respect meets affect neglect

DOI: 10.1017/S0140525X0700194X

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Abstract: While improving the theoretical account of base-rate neglect, Barbey & Sloman's (B&S's) target article suffers from *affect neglect* by failing to consider the fundamental role of emotional processes in "real world" decisions. We illustrate how affective influences are fundamental to decision making, and discuss how the dual process model can be a useful framework for understanding hot and cold cognition in reasoning.

In the target article, Barbey & Sloman (B&S) do an admirable job of demonstrating that a dual process model of judgment provides a better account of base-rate neglect than the various alternative accounts. We were struck, however, by a curious dissociation in their article that is representative of research on base-rate neglect in general. The examples provided to illustrate how research on base-rate neglect may be important to "real world" decisions typically involve intrinsically emotional contexts such as cancer diagnosis, pandemic infections, or judgments about the guilt of a defendant. Nevertheless, the target article continues the tradition of neglect of affective factors in reasoning. This neglect is odd considering the recent resurgence of interest in affect in cognitive neuroscience and the increasing evidence that both hot and cold cognition are involved in decision making (e.g., Lee 2006; Sanfey et al. 2006). In fact, one of the most important advantages of the dual-process model of reasoning may be that it provides a coherent framework for understanding sources of affective influences on reasoning. Before we turn to why the dual process model is a useful framework for understanding hot and cold cognition during reasoning, we first briefly review some of the evidence that suggests that affective influences should be integrated into research on reasoning.

As one illustration of the central role of affect in decision making and reasoning, consider the risk-as-feeling hypothesis (Loewenstein 2005; Loewenstein et al. 2001). Loewenstein and colleagues argue that, when in conflict, hot cognitive factors will supersede cold ones in decision making, and that the precedence of hot factors helps to explain some violations of normative decision making in traditional theory. For example, the *certainty effect* (e.g., Kahneman & Tversky 1979) is a commonly observed nonlinearity in the way probabilities are weighted in decision outcomes. Although the difference in a very high probability event and certainty may seem trivial from a cold cognitive perspective, real emotion may be either absent or present in these two cases. A medical patient