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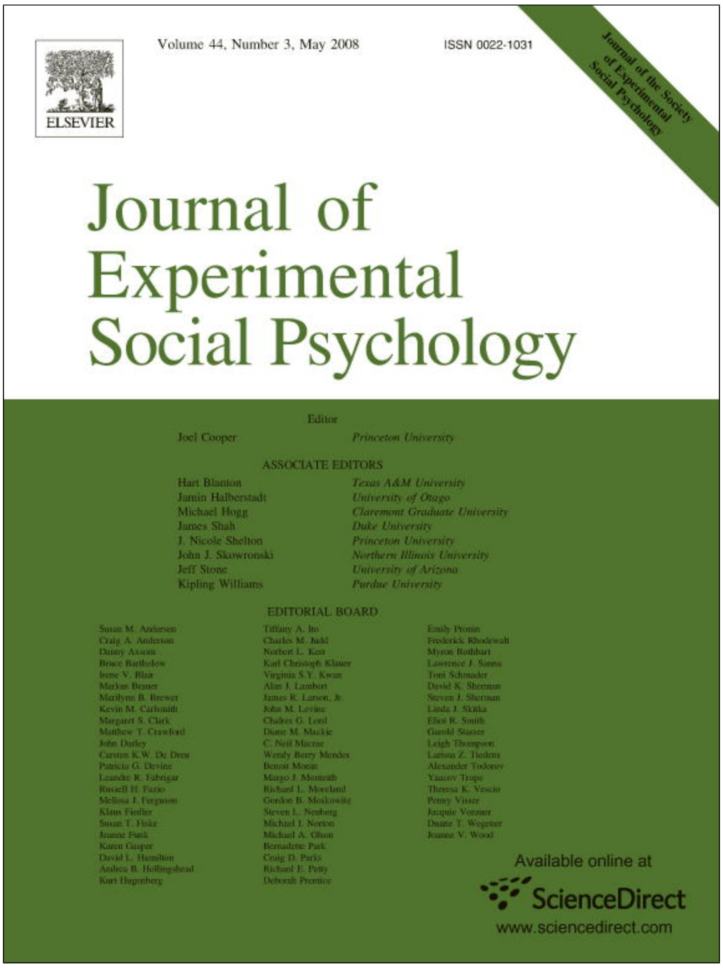

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Differential effects of regulatory fit on category learning ☆

Lisa R. Grimm, Arthur B. Markman *, W. Todd Maddox, Grant C. Baldwin

Department of Psychology, University of Texas, 1 University Station, A8000, Austin, TX 78712, USA

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Abstract

Motivation affects the degree to which people engage in tasks as well as the processes that they bring to bear. We explore the proposal that a fit between a person's situationally induced self-regulatory focus and the reward structure of the task that they are pursuing supports greater flexibility in processing than does a mismatch between regulatory focus and reward structure. In two experiments, we prime regulatory focus and manipulate task reward structure. Our participants perform a rule-based learning task whose solution requires flexible strategy testing as well as an information-integration task for which flexible strategy use hinders learning. Across two experiments, we predict and obtain a three-way interaction between regulatory focus, reward structure, and task. Relative to a mismatch, a match leads to better rule-based task performance, but worse performance on the information-integration task. We relate these findings to other work on motivation and choking under pressure.

Keywords: Motivation; Regulatory focus; Regulatory fit; Category learning; Flexibility

Introduction

There has been much interest in general motivational factors that affect performance (e.g., Higgins, 2000; Husman, Derryberry, Crowson, & Lomax, 2004; Locke & Latham, 2002). In this paper, we explore the proposal that people's overall regulatory focus interacts with the way they are rewarded for performing a task to affect the degree to which they can perform a task flexibly (Maddox, Baldwin, & Markman, 2006). We begin by describing regulatory focus research, and then present two studies examining the influence of motivation on classification learning.

Regulatory focus and regulatory fit

There is widespread agreement in current social psychological theories that motivational states organized around the approach of positive items and the avoidance of negative ones have a significant influence on cognition and action (e.g., Aarts, Gollwitzer, & Hassin, 2004; Ferguson & Bargh, 2004; Fishbach, Friedman, & Kruglanski, 2003; Higgins, 2000). More general than the approach and avoidance of particular items, however, Higgins (1997) proposed that people have generalized motivational orientations, known as a *promotion* or a *prevention focus*, which highlight potential gains and losses in the environment, respectively. With a promotion focus, goals are framed as ideals one would like to accomplish while those with a prevention focus are concerned with security and responsibilities.

Early research on regulatory focus examined differences between promotion and prevention focus, suggesting for example, that individuals with a promotion focus were generally more concerned with achieving correct responses in tasks, while those with a prevention focus were more concerned with avoiding incorrect responses (e.g., Crowe &

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* Corresponding author. Fax: +1 512 471 5935.
E-mail address: markman@psy.utexas.edu (A.B. Markman).

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Higgins, 1997). More recently, however, research has explored the interaction between regulatory focus and the nature of tasks that people perform. When a person's regulatory focus is compatible with some aspect of their environment (e.g., the means for attaining a goal), they are said to be experiencing a regulatory *fit* (Higgins, 1997). Higgins and colleagues have shown that there is a value associated with conditions of regulatory fit (Higgins, 2005; Higgins, Idson, Freitas, Spiegel, & Molden, 2003), and that fit influences persuasion (Cesario, Grant, & Higgins, 2004) and consumer behavior (Aaker & Lee, 2001).

Shah, Higgins, and Friedman (1998) gave participants trial-by-trial feedback as they solved anagrams. Participants earned rewards for correctly solving each anagram printed in green, and were punished by losing a point unless they solved each anagram printed in red. Regulatory focus was both measured as a chronic trait via questionnaire (*chronic focus*) and manipulated (*situational focus*) via framing a monetary performance bonus as either a desired outcome to attain (e.g., "earning" the bonus; promotion focus) or an undesired outcome to avoid (e.g., "losing" the bonus; prevention focus).

For participants with a situational promotion focus, a stronger chronic promotion focus was associated with solving more of the reward anagrams, that is, anagrams that matched their focus. Similarly, for participants with a situational prevention focus, a stronger chronic prevention focus was associated with solving more anagrams that matched their focus, that is, the punishment anagrams. These results suggest that a fit between reward structure and people's regulatory focus improves performance on some tasks. However, this study does not shed light on the particular mechanism influenced by this kind of regulatory fit. One aim of the current study is to address the mechanisms involved.

Regulatory fit and flexibility

Our interest is in the consequences of regulatory fit (Maddox, Markman, & Baldwin, 2007; Maddox et al., 2006; Markman, Baldwin, & Maddox, 2005; Markman, Maddox, & Baldwin, 2005). Previous research suggests that different regulatory foci promote distinct orientations to problems. For example, Förster and Higgins (2005) argued that a promotion focus supports more global processing while a prevention focus supports more local processing. Evidence for this claim comes from embedded figures tests (Förster & Higgins, 2005), tests of creative performance (Friedman & Forster, 2001), preferences for stability and change (Liberman, Idson, Camacho, & Higgins, 1999), hypothesis generation (Liberman, Molden, Idson, & Higgins, 2001), and probability estimates for conjunctive and disjunctive events (Brockner, Paruchuri, Idson, & Higgins, 2002).

Using this approach, Friedman and Forster (2001) predicted and obtained an interaction between regulatory focus and task. They argued that a promotion focus improves performance on tasks requiring elaborative processing while a prevention focus improves performance on tasks hurt by elaborative processing. For example, they primed participants with promotion or prevention using a maze task in which a mouse needed to find some cheese (promotion) or avoid being eaten by an owl (prevention). In Experiment 2, relative to prevention-primed participants, promotion-primed participants generated more creative uses for a brick.

We believe that this two-way interaction of focus and task is actually qualified by a three-way interaction between focus, task, and task reward structure. In previous studies, we found that a fit between people's regulatory focus and the reward structure of the task increases elaborative processing (for example, prevention-focused individual in a losses task), whereas a mismatch between reward structure and focus decreases elaborative processing (for example, prevention-focused individual in a gains task). We define elaborative processing as flexible processing or as the tendency to try a variety of strategies for solving the task at hand. Consequently, in tasks for which flexibility is advantageous, fit leads to better learning, but, in tasks for which flexibility is disadvantageous, fit leads to worse learning (Maddox et al., 2006, 2007).

We believe that this three-way interaction is not just a product of laboratory experiments but can appear in real world contexts as well. For example, take two employees at an engineering firm. One employee is new to the firm and concerned about making errors, which induces a prevention focus. The other employee has been at the firm for several years and is concerned with getting a raise, which induces a promotion focus. Both employees are asked to make design recommendations for two projects: for project A the description emphasizes the importance of not making errors (e.g., losses) and for project B the description emphasizes the importance of a big payout if the contract is won (e.g., gains). All else being equal, if the projects both require creative solutions, the new employee would perform better on project A than B, while the old employee would perform better on B than A because the presence of a regulatory fit enhances elaborative and creative processing. In contrast, if the project recommendations needed to follow a template, the new employee would now perform better on B and the old employee on A because a regulatory mismatch reduces creative processing that would otherwise hinder template adherence.

Following the example set by Higgins and his colleagues in the social literature, we conducted research on regulatory fit using controlled laboratory tasks. We use well-understood tasks in the service of studying the mechanisms underlying regulatory fit. For example, we have focused on categories that require people to learn rules that distinguish between them. As shown in the left side of Fig. 1, there are two categories of simple objects that vary in their background color, foreground object shape, foreground object color, and number of foreground objects. In this example,

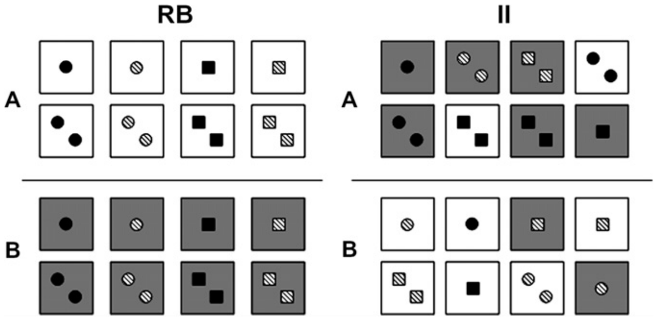

Fig. 1. Rule-based (RB) and information-integration (II) category structures derived from a small number of stimuli that vary along four binary-valued dimensions.

the items with a white background are in one category and the items with a gray background are in the other. We can change the rule used to separate categories to make behaving flexibly be good or bad.

One study examined a situation in which flexibility was good (Maddox et al., 2006, Experiment 1). We manipulated regulatory focus using a situational incentive manipulation in which we offer participants a chance to earn a ticket into a drawing for $50 cash (e.g., promotion focus) or by giving a ticket to participants at the start of the study and telling them that they will lose the ticket unless they earn enough points (e.g., a prevention focus). Further, as feedback on each trial, participants in a gains reward structure received points for correct responses, but received no points for incorrect responses. Those in a losses reward structure lost points for incorrect responses and lost fewer points for correct responses. Participants needed to get a certain number of points or remain above a negative number of points, for gains and losses, respectively.

Participants learned to classify stimuli into two categories. The stimuli were lines that varied in length, angle, and position on a computer screen. The highest accuracy that a participant could achieve by focusing on any one dimension was 83%, which was not sufficient to achieve the learning criterion, which we set at 90%. The optimal rule for classifying the stimuli required attending to both the length and angle and yielded 100% accuracy. Thus, in order to do well enough, participants had to abandon their initial one-dimensional strategy (pilot data demonstrated subjects typically started with a rule using position) and search for the more complex optimal strategy. Participants in a regulatory fit (promotion/gains or prevention/losses) learned the complex strategy faster and were more likely to meet the point goal than were participants with a regulatory mismatch.

A second study examined a task in which flexibility hurts performance (Maddox et al., 2006, Experiment 2). We manipulated regulatory focus and reward structure like Maddox et al. (2006, Experiment 1). Participants were required to fine-tune their default strategy, rather than making a qualitative change to their strategy. In this study, large changes to the strategy hurt performance. We found that with positive feedback the promotion participants were less accurate than prevention participants, because the regulatory fit led subjects to make large changes to the specific strategy that they used, harming performance.

Taken together, these studies suggest that a fit between people's regulatory focus and the structure of their environment increases flexibility, or their tendency to try a variety of strategies. When flexibility is beneficial (Maddox et al., 2006, Experiment 1; Maddox et al., 2007), such as in a rule-based learning task, regulatory fit leads to better learning. In contrast, when flexibility is not beneficial (Maddox et al., 2006, Experiment 2; Maddox et al., 2007), regulatory fit leads to worse learning.

In the present paper, we explore the effects of regulatory fit on learning in a somewhat different way. We contrast a rule-based learning task, like the one described above, with an *information-integration* task.[1] In rule-based learning, participants need to test strategies to correctly classify the stimuli. Flexibly trying rules leads to better performance because the participant may try and abandon incorrect rules prior to discovering the correct rule. Rule-based learning is effortful, and factors that influence working memory and explicit processing also interfere with it (Maddox, Filoteo, Hejl, & Ing, 2004; Waldron & Ashby, 2001; Zeithamova & Maddox, 2006, 2007).

In contrast, information-integration learning requires learning categories in which the boundary that distinguishes among categories is difficult or impossible to state verbally. Information-integration category learning depends on trial-by-trial feedback and is assumed to be learned by an implicit system, the procedural learning system, instead of the explicit system (Maddox & Ashby, 2004). For example, the right side of Fig. 1 shows an information-integration structure in which three of the dimensions are relevant (background color, foreground object color, and foreground object number). The two categories have a family resemblance structure, and an item belongs to the category if the values on two of the three dimensions match the most frequent value in the category. It is easier for subjects to learn this category structure by focusing on the similarity among category members rather than on verbal that distinguish between categories because no relatively simple rule divides the categories. Thus, explicitly trying many rules actually hurts acquisition of information-integration categories.

In two experiments, we manipulate regulatory focus and the task performed. For the rule-based task, we predict individuals who persist in testing rules will perform better than those who do not. In contrast, for the information-integration task, those who persist in rule testing will not perform as well because this strategy helps with explicit but not pro-

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[1] We use information-integration as a label to be consistent with the extant work in classification learning from the last 15 years. We use this term to refer to category structures where the stimulus dimensions are integrated prior to independent judgments about the dimension values or the category judgment (see Ashby & Gott, 1988).

cedural learning. Using the regulatory fit framework, we further predict that participants in a regulatory fit will test rules more effectively than participants in a regulatory mismatch. Therefore, we predict that a regulatory fit will improve performance on the rule-based task but hurt performance for subjects learning information-integration categories, with the opposite being true of a regulatory mismatch.

In Experiment 1, we use a gains task. This task places promotion-primed participants in a regulatory match and prevention-primed participants in a regulatory mismatch. In contrast, in Experiment 2, we use a losses task. This task places promotion-primed participants in a regulatory mismatch and prevention-primed participants in a regulatory match. Therefore, comparing across Experiments 1 and 2, we expect to reverse our predicted two-way interaction to demonstrate the presence of a three-way interaction between regulatory focus, task, and reward structure.

Experiment 1

Method

Participants

Subjects were 90 undergraduates from the University of Texas at Austin, who participated in exchange for either introductory psychology course credit or a base payment of $6. All participants had an opportunity to earn raffle tickets into a drawing for $50. Forty-six participants were in the prevention condition and 44 were in the promotion condition.

Design and materials

This study had a 2 (regulatory focus: promotion vs. prevention) × 2 (task: rule-based vs. information-integration) design. Regulatory focus was run between subjects, and task was run within subjects.

Regulatory focus manipulation

Participants completed two category learning tasks. For each task, a participant could earn a ticket into a drawing for $50 cash. Promotion participants were told that they started with no tickets, and could earn one ticket for each task they successfully completed. Prevention participants were given two tickets at the beginning of the experiment and were told that they would lose one ticket for each task they failed to complete. Participants could earn (promotion) or lose (prevention) any or all of their tickets. There was one drawing for each group of 10 participants; the actual number of entries into each drawing was determined by the number of tickets earned by those 10 participants.

Category learning task

Stimuli were visually presented and had four properties: background color (either yellow or blue), foreground object color (red or green), foreground object shape (circle or square), and number of foreground objects (one or two). By combining all possible stimulus properties, a full set of 16 stimuli was constructed. Different category structures were defined by creating different classification rules to divide the stimuli into two categories. Two sample category structures are shown in Fig. 1.

For the rule-based task, categories were defined by arbitrarily making one stimulus dimension relevant (e.g., background color), and assigning one value of that property to one category (e.g., yellow is "A") and the other value to the other category (e.g., blue is "B"). Four different rule-based category structures were created by making either background color, foreground color, foreground shape, or number of objects relevant.

Four information-integration category structures were also defined. First, one stimulus dimension was made irrelevant (e.g., foreground object shape). Then for each remaining stimulus dimension, the possible properties of each stimulus were given a value of 1 or -1 (e.g., for foreground color, green $= 1$ and red $= -1$). Then, each category structure was created by the following mathematical formula (where the three relevant stimulus dimensions are X, Y, and Z):

$$\text{If } X + Y + Z > 0, \text{ then } ``A", \text{ else } ``B".$$

By changing the irrelevant dimension, four different information-integration category structures were created.

Procedure

Participants performed the experiment on a personal computer in a dimly lit room. Each participant completed a rule-based task and an information-integration task, which were each randomly selected from the four possible structures of each type. The task order was counterbalanced across participants. After seeing a stimulus and making a response about its category membership, the participant saw corrective feedback ("Correct" or "Incorrect"). Also, when participants made a correct response, they heard a cash register ring sound through the computers' speakers. When they made an error, they heard a buzzer sound. In addition, there was a point meter on the side of the screen that moved up several pixels for every correct response and reset to the bottom of the screen on incorrect responses (see Fig. 2). The top of the point meter, which was at the top of the screen, corresponded to the goal of the current task (10 correct trials in a row). In each task, participants had 150 trials to achieve the goal. If they achieved the goal, the task ended and the participants were told that they had earned (or kept) a ticket into the drawing for $50. If they failed to achieve the goal on a task, the participants were told that they failed to earn (or lost) a ticket into the drawing. After both tasks were completed, participants placed the tickets they had earned or lost into jars labeled "$50 drawing: YES" or "$50 drawing: NO" and were debriefed.

Results

Overall, participants performed well in the experiment, reaching the performance criterion on an average of 1.9

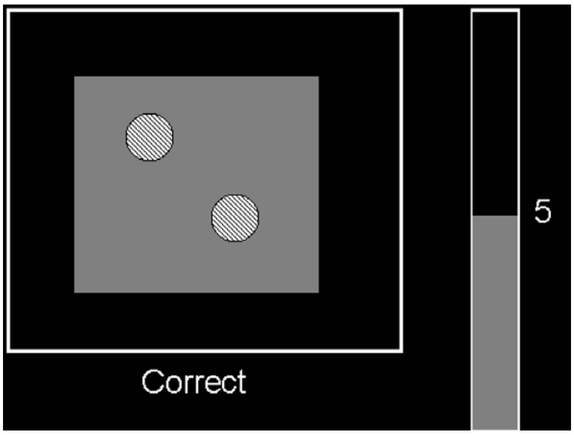

Fig. 2. Schematic of task screen.

(out of 2) tasks.[2] Prevention participants learned slightly more tasks on average ($M = 1.9$) than did promotion participants ($M = 1.8$), but this difference was not significant, $t(88) = 1.04$, $p > .05$. Chi-squared analyses were performed on the number of participants reaching criterion separately for each condition, and there were no significant differences between promotion and prevention focus, $p > .15$ for all tests. In the analyses that follow, we examine the number of trials subjects required to reach 10 in a row correct. Subjects who failed to reach the criterion were given a value of 150 trials.

The mean number of trials to reach the criterion for each combination of Regulatory focus and Task is shown in Fig. 3. An ANOVA was performed on these data. There was a main effect of task, $F(1,88) = 73.49$, $p < .001$, $\eta_p^2 = .46$, reflecting that the rule-based task was learned more quickly on average ($M = 24.8$) than was the information-integration task ($M = 66.7$).[3] However, of central importance to our hypotheses, this was qualified by a significant task × focus interaction, $F(1,88) = 6.75$, $p < .05$, $\eta_p^2 = .07$. This interaction reflects that promotion focus participants reached the criterion more quickly on the rule-based task ($M = 19.8$) than prevention focus participants ($M = 29.7$), $t(88) = 2.08$, $p < .05$. In contrast, prevention focus participants reached the criterion significantly more quickly on the information-integration task ($M = 58.9$) than promotion focus participants ($M = 74.4$), $t(88) = 1.77$, p (one-tailed) <.05.

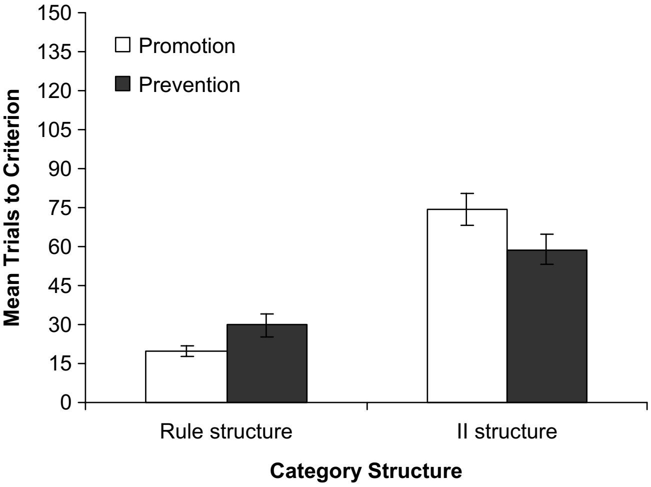

Fig. 3. Mean trials to criterion in the rule-based and information-integration tasks in Experiment 1.

Discussion

In Experiment 1, we demonstrate that regulatory focus interacts with task. All participants completed tasks with a gains reward structure. In each task participants were trying to gain correct classifications to meet the specified criterion (e.g., 10 in a row correct). Participants in a regulatory match (i.e., promotion participants) performed better on the rule-based task which required flexible rule testing while participants in a regulatory mismatch (i.e., prevention participants) performed significantly better on the information-integration task for which flexible rule testing is not advantageous.

Experiment 2

So far, we have demonstrated only a two-way interaction, between regulatory focus and task type. To complete the three-way interaction, we created a losses reward structure. In Experiment 2, participants are told they need to get five correct trials in a row and that each time they make an error, the criterion increases by one (so after the first error, the criterion becomes six trials in a row, and so on). This task is a losses structure because the criterion moves farther away each time the participant makes an error. That is, the task becomes more difficult and the shift in criterion with each error is experienced as a loss. Given the losses task, prevention-primed participants will now be experiencing a regulatory match and promotion-primed participants will be in a regulatory mismatch.

Methods

Participants

Subjects were 48 undergraduates from the University of Texas at Austin, who participated in exchange for introductory psychology course credit. All participants had an

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[2] The study also manipulated trials to criterion (10 or 20 in a row) to examine the influence of an unrelated variable. There was a main effect of criterion, $F(1,88) = 75.366$, $p < .001$, $\eta_p^2 = .461$, reflecting that the 10-trial criterion was learned more quickly on average ($M = 45.74$) than was the 20-trial criterion ($M = 76.4$). There was also a task × criterion interaction, $F(1,88) = 33.108$, $p < .001$, $\eta_p^2 = .273$, which was driven by a difference between the 10 ($M = 66.68$) and 20 ($M = 117.56$) conditions for the information-integration tasks.

[3] This replicates prior work by Waldron and Ashby (2001).

opportunity to earn raffle tickets into a drawing for \$50. Twenty-three participants were in the prevention condition and 25 were in the promotion condition.

Design and materials

We used the same design, regulatory focus manipulation and category learning tasks as Experiment 1 with one exception. Participants completed a rule-based task and an information-integration task, where the starting goal was to get 5 in a row correct.

Procedure

The computer task was identical to that used in Experiment 1 except for the losses reward structure. For every incorrect response, the set goal (i.e., number of correct responses needed in a row) increased by 1.

Results

Participants reached the performance criterion on an average of 1.3 (out of 2) tasks. Promotion participants learned slightly more tasks on average ($M = 1.4$) than did prevention participants ($M = 1.2$), this difference was significant, $t(46) = 2.03$, $p < .05$. Chi-squared analyses were performed on the number of participants reaching criterion separately in both conditions and tasks. There were no significant differences between promotion and prevention focus for the rule-based task, $\chi^2(1) = .27$, $p > .05$, but there were differences for the information-integration task, $\chi^2(1) = 6.3$, $p < .05$. Relatively more promotion-primed participants reached the task goal ($M = .5$) than the prevention-primed participants ($M = .2$), $t(46) = 2.6$, $p < .05$. There were no significant interactions or main effects of task order so order effects will not be examined further.

In the analyses that follow, we examine the number of trials subjects required to reach the learning criterion.[4] Subjects who failed to reach the criterion were given a value of 150 trials. The mean number of trials to reach criterion for each combination of regulatory focus and task is shown in Fig. 4. An ANOVA was performed on these data. Unrelated to our main hypotheses, there was a main effect of task, $F(1,46) = 60.42$, $p < .001$, $\eta_p^2 = .57$, reflecting that the rule-based task was learned more quickly on average ($M = 32.4$ trials) than was the information-integration task ($M = 114.8$). Of central importance to our hypotheses, however, was a significant task × focus interaction, $F(1,46) = 5.54$, $p < .05$, $\eta_p^2 = .11$. This interaction reflects that participants reached the criterion more quickly on the rule-based task when they had a prevention focus ($M = 27.0$) than when they had a promotion focus ($M = 37.8$), though this difference was not significant, $p < .15$. In contrast, participants reached the criterion significantly more quickly in the information-integration task when they had a promotion focus ($M = 95.2$) than when they had a prevention focus ($M = 134.4$), $t(46) = 2.51$, $p < .05$.

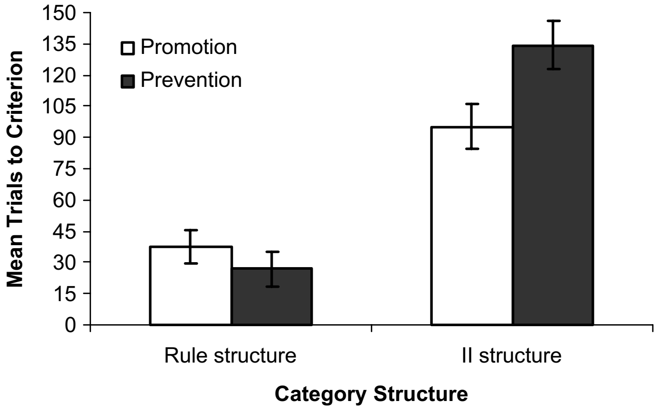

Fig. 4. Mean trials to criterion in the rule-based and information-integration tasks in Experiment 2.

Discussion

In Experiment 2, we reversed the focus × task interaction found in Experiment 1. In Experiment 1, the promotion participants were in a regulatory fit, but in Experiment 2 the prevention participants were in a fit. Consistent with Experiment 1, the regulatory fit participants outperformed the mismatch participants in the rule-based task, but underperformed them in the information-integration task.

General discussion

We found a significant interaction between regulatory fit, task, and reward structure in this study. In the rule-based task with gains, a promotion focus led to faster learning than a prevention focus, while in the information-integration task with gains, a prevention focus led to faster learning than a promotion focus. In contrast, in the rule-based task with losses, a promotion focus led to slower learning than a prevention focus, while in the information-integration task, a prevention focus led to slower learning than a promotion focus.[5] Participants experiencing a regulatory mismatch performed better in the information-integration task relative to those in a regulatory fit while participants in a regulatory fit performed better in the rule-based task relative to those in a regulatory mismatch. These data are consistent with our hypothesis that participants in a regulatory fit demonstrate

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[4] We also analyzed the final criterion for each subject for each task because the ending criterion is also a reflection of the number of task errors. The results match those of the trials to criterion analysis. There was a main effect of task, $F(1,46) = 63.2$, $p < .001$, $\eta_p^2 = .58$, and a task × focus interaction, $F(1,46) = 7.4$, $p < .01$, $\eta_p^2 = .14$.

[5] In these studies, the effect of regulatory fit on the rule-based task was smaller than it was for the Information-integration task. In previous work, though, the effect of regulatory fit on a rule-based task was large (Maddox et al., 2006). In that study, however, the rule to be learned was more complex than the simple unidimensional rules learned here. We expect larger motivational effects when tasks are difficult than when they are easy.

greater flexibility than do those experiencing a regulatory mismatch.

This pattern of data is similar to one observed in a study of "choking under pressure" (Markman, Maddox, & Worthy, 2006). This term refers to cases in which people perform worse than expected based on their abilities when put under pressure (Baumeister, 1984). Typically, pressure is manipulated by giving participants a performance goal, often similar to those used in studies of regulatory focus. Therefore, it seems reasonable to propose that choking may have a motivational component. Much work has been devoted to understanding the conditions of choking in both cognitive (e.g., math test performance: Beilock & Carr, 2005; Beilock, Kulp, Holt, & Carr, 2004) and motor control (e.g., athletic performance: Beilock, Carr, MacMahon, & Starkes, 2002; Liao & Masters, 2002) domains. One theory of choking behavior is the *distraction hypothesis* (Beilock & Carr, 2005; Beilock et al., 2004), which posits that pressure reduces the amount of available working memory, which in turn causes a decrease in performance in tasks that require explicit memory demanding processes.

Our data are potentially consistent with the distraction hypothesis. Research has demonstrated decrements in performance on rule-based tasks as well as improvements in performance on information-integration tasks when working memory is limited (e.g., DeCaro, Thomas, & Beilock, in press; Zeithamova & Maddox, 2006).To provide further support for this view, future research must explore whether the interaction between regulatory focus and reward structure affects available working memory capacity.

One obvious facet of the present data is that the information-integration task is more difficult than the rule-based task. In other studies, we have used more difficult rule-based tasks whose overall difficulty is about the same as that of the information-integration task and we have obtained similar results. Furthermore, while task difficulty may account for why the information-integration task was learned more slowly overall than the rule-based task, it cannot account for the entire interaction between regulatory focus, reward structure, and task.

Our research fits with a growing body of evidence examining the interaction between motivational states and task environments. One strength of our approach to studying the motivation–cognition interface is that the learning tasks that we have used are well studied and understood (see Ashby & Maddox, 2005, for a review). Both mathematical models of people's performance in these tasks (Ashby & Gott, 1988) and neurobiological models of the processes involved (Ashby, Alfonso-Reese, Turken, & Waldron, 1998) have been developed to further our understanding of learning behavior. The mathematical models help identify the strategies that people use in these tasks, and the neurobiological models help constrain our theories about the processes involved.

Finally, this study highlights the importance of taking motivational factors into account in studies of processing. Motivational factors are ubiquitous in the laboratory and in the real world. Laboratory subjects worry about earning their course credit while employees worry about performing well enough to keep their jobs. We demonstrate that motivational factors interact with the reward structure of the environment and the tasks that are being performed. Further, Experiment 2 suggests that losses need not just be negative points. Losses can be construed as any negative state. As the present data make clear, however, the same motivational state or reward structure can improve or hinder learning depending on the nature of the learning task. Thus, it is crucial for psychologists to explore the complex motivational influences on even simple tasks.

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