

## Mood and the Use of Scripts: Does a Happy Mood Really Lead to Mindlessness?

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The authors tested whether happy moods increase, and sad moods decrease, reliance on general knowledge structures. Participants in happy, neutral, or sad moods listened to a “going-out-for-dinner” story. Happy participants made more intrusion errors in recognition than did sad participants, with neutral mood participants falling in between (Experiments 1 and 2). Happy participants outperformed sad ones when they performed a secondary task while listening to the story (Experiment 2), but only when the amount of script-inconsistent information was small (Experiment 3). This pattern of findings indicates higher reliance on general knowledge structures under happy rather than sad moods. It is incompatible with the assumption that happy moods decrease either cognitive capacity or processing motivation in general, which would predict impaired secondary-task performance.

Recent research suggests that happy moods are associated with heuristic processing strategies, whereas sad moods are associated with systematic elaboration of information (for an overview, see Clore, Schwarz, & Conway, 1994; Schwarz & Clore, in press). Several of the accounts offered for such findings assume that happy moods reduce the amount of processing. Accounts based on cognitive capacity (Isen, 1987; Mackie & Worth, 1989) argue that being in a good mood limits processing capacity, because of the activation of a large amount of interconnected positive material stored in memory. Hence, individuals in a good mood may not have the cognitive resources required by systematic processing strategies and may therefore default to less taxing heuristic strategies. Accounts based on mood maintenance motivation (Isen, 1987; Wegener, Petty, & Smith, 1995) argue that individuals in happy moods avoid investing cognitive effort in tasks unless doing so promises to maintain or enhance their positive mood. Hence, individuals

in a good mood are not motivated to engage in systematic processing and are likely to resort to heuristic processing for that reason. A third account is based on the affect-as-information hypothesis (Schwarz & Clore, 1983). According to this view, negative affect signals that the environment poses a problem, whereas positive affect signals that the environment is benign. As a result, negative affective cues may motivate detail-oriented, systematic processing, which is usually adaptive in handling problematic situations. In contrast, positive affective states, by themselves, signal no particular action requirement, and happy individuals may hence not be motivated to expend cognitive effort unless called for by other goals (see Schwarz, 1990, for a more detailed discussion).

Mood-induced differences in processing strategy have been most reliably observed in research on mood and persuasion (see Schwarz, Bless, & Bohner, 1991, for a review) and person perception (see Sinclair & Mark, 1992, for a review), but despite empirical support for an association between heuristic processing and happy moods the evidence that heuristic processing is due to the hypothesized motivational or capacity deficits is less conclusive than is often assumed. First, the amount of processing—the crucial mediating variable—has rarely been directly assessed. Most often it has only been inferred that increased use of heuristics must result from some motivational or capacity deficit.

Second, a close look at the evidence supporting reduced processing reveals some ambiguities. For example, in persuasion studies, the attitudes of happy individuals were less influenced by quality of argument than were the attitudes of individuals in neutral or sad moods (e.g., Bless, Bohner, Schwarz, & Strack, 1990; Bless, Mackie, & Schwarz, 1992; Mackie & Worth, 1989; Worth & Mackie, 1987). It has been argued that, because of motivational or capacity deficits, happy participants do not

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elaborate the message content and hence are not influenced by message quality. However, it has been shown (e.g., Bless et al., 1990; Worth & Mackie, 1987) that, when explicitly asked to evaluate message quality, happy participants differentiate between strong and weak arguments as much as neutral or sad mood participants. If happy participants fail to detect differences in message quality when making their attitude judgment, it is not clear how they could have this information available later on, when asked to rate the strength of the arguments. Similarly, in several studies (e.g., Bless et al., 1990) happy, neutral, and sad mood participants did not differ in their ability to recall the content of a message. These results suggest that happy participants noticed the quality of the arguments presented to them but did not use this information when making an attitude judgment.

Third, the conclusion of reduced processing under happy moods seems at odds with some other available evidence. For example, happy participants outperform participants in a neutral or sad mood in creativity and problem-solving tasks (for an overview, see Isen, 1987). In a related vein, Martin and his colleagues (Martin, Ward, Achee, & Wyer, 1993) found that good mood could decrease as well as increase processing depending on how participants interpreted the implications of their mood.

In sum, the evidence for reduced processing under happy moods due to motivational or capacity constraints seems less conclusive than is often assumed, although happy individuals' reliance on heuristic strategies appears to be a rather consistent finding.

### A Mood-and-General-Knowledge Assumption

Bless (1994) proposed an alternative model that accounts for increased heuristic processing under happy mood without making assumptions about the amount of processing. On the basis of previous theorizing that applied the affect-as-information view (Schwarz & Clore, 1983) to task situations (Schwarz, 1990; Schwarz & Bless, 1991), it is assumed that negative affect informs the individual that the current situation is unproblematic, whereas positive affect signals the absence of a particular problem. Our position in the present article departs from previous theorizing, however, with respect to how the information about the current situation is interpreted.<sup>1</sup>

The present approach holds that it would be highly adaptive for individuals to differentially rely on their general knowledge structures as a function of their current psychological situation (Bless, 1994). If a situation is characterized as benign, individuals may rely on their general knowledge structures, which usually serve them well. In contrast, if a situation is characterized as problematic, relying on one's usual routine may be maladaptive, and attention to the specifics of the situation is called for. Hence, benign situations may invite top-down processing with considerable reliance on preexisting general knowledge structures, whereas problematic situations may invite bottom-up processing, with less reliance on general knowledge structures. Assuming further that individuals' affective states provide information about the benign or problematic nature of their current situation, it follows that moods may influence the degree to which individuals rely on general knowledge structures. Spe-

cifically, individuals in positive affective states may feel more confident about relying on activated general knowledge structures that are potentially applicable to the situation. In contrast, individuals in negative affective states may feel less confident about relying on general knowledge structures and may focus more on the specific data at hand. Such a mood-dependent reliance on general knowledge structures versus the data at hand would direct individuals' attention toward the information that is presumably most adequate given the nature of the situation signaled by their affective states.

In addition to directing attention toward useful information, two additional advantages seem worth mentioning. First, relying on general knowledge structures will require fewer processing resources. It would be highly adaptive if these spared resources could be more beneficially allocated to other tasks (note that this assumption does not imply that the reduced processing is causing the reliance on general knowledge structures; see Experiment 2). Second, general knowledge structures can serve to enrich the stimulus information at hand and can provide a basis for making inferences beyond the information given (Bruner, 1957). Moreover, going beyond the information given may sometimes lead individuals to new, creative inferences. Given the risky nature of new solutions, it seems highly adaptive to rely on general knowledge structures as a basis for inferences, particularly if the situation is safe rather than already characterized as problematic.

The assumed adaptive function of relying on general knowledge structures versus relying on the specifics of the situation is shared by other theorists. Although coming from a different starting point, Gray (1971) made analogous suggestions with respect to the role of positive and negative affect. According to his position, positive affect leads organisms to behave on the basis of habits, and negative affect leads them to engage in learning. In a related vein, Piaget (1955) differentiated between *assimilation* processes, that is, the application of general structures to the current situation, and *accommodation*, that is, the adaptation of knowledge structures to fit the data at hand. It is important to note that Piaget assumed that unsuccessful assimilation attempts are often associated with negative affective states. In other words, individuals in negative affective states are less likely to rely on general knowledge structures. The notion that negative situations are associated with more specific representations is also part of Vallacher and Wegner's (1987) action-identification theory, which assumes that successful actions are represented on a more general level, whereas unsuccessful actions are represented on more specific levels. Finally, Fiedler's (1990) dual-force model also incorporates similar assumptions. Fiedler (1990) argued that positive moods encourage individuals to go beyond the given data, to generate new information, and to focus on this internally generated information, whereas negative moods support "conservation" processes of externally provided information.

Although the various approaches differ in details, they all share the notion that relying on general knowledge structures in unproblematic situations, and relying on the data at hand in

<sup>1</sup> Evidence for the diversity of possible implications was reported by Martin et al. (1993).

problematic situations, reflects a useful adaptation to the current situation. However, none of these positions assume differences in the general motivation to engage in or to avoid cognitive processing.

The mood-and-general-knowledge assumption is compatible with much of the available evidence. If we consider heuristic processing as the application of general knowledge structures to specific information (Nisbett & Ross, 1980), including the use of schemas, scripts, or global categories, then the use of heuristics in happy moods and the assumption that happy individuals rely on general knowledge structures are compatible.

The presented approach is also compatible with evidence bearing directly on the mood-dependent impact of general knowledge structures. For example, recent research suggests that activated stereotypes have more impact on the processing of happy than of sad individuals (Bless, Schwarz, & Kimmelmeier, in press; Bodenhausen, Kramer, & Süsner, 1994; Bodenhausen, Sheppard, & Kramer, 1994; see also Edwards & Weary, 1993, for analogous differences between depressed and nondepressed participants). Similarly, in the persuasion domain, happy participants are more likely than sad participants to rely on a previously formed global representation of a persuasive message (Bless et al., 1992). However, much of the available evidence is not only compatible with the mood-and-general-knowledge assumption but also with competing hypotheses that trace reliance on general knowledge structures to happy participants' tendency to simplify processing. To test these competing assumptions, in the present studies we investigated the impact of mood on the use of scripts, that is, a form of general knowledge structure that has not been investigated previously in research on affect and cognition.

### Experiment 1

Event schemas or scripts are a form of general knowledge structure containing "a standard sequence of events characterizing typical activities" (Abelson, 1981, p. 715; Schank & Abelson, 1977; see also Fiske & Taylor, 1991; Schwarz, 1985). The generic structure allows individuals to rely on a relevant script when interpreting specific information.

The effects and efficiency of script-based processing depend largely on the relation between the script and the specific information. Specific information that is *typical* of the script, that is, information that is already part of the individual's generic knowledge, can be processed efficiently. It can also be "recalled" easily, because it can be reconstructed from the general knowledge structure. However, the advantage of this reconstruction process comes at the cost of increased intrusion errors. Because it is difficult to differentiate between information that is part of the generic knowledge structure and the specific information that has been presented, reliance on a script increases the erroneous "recall" of script-consistent information that has not been presented (Graesser, Gordon, & Sawyer, 1979; Snyder & Uranowitz, 1978; for various explanations see Fiske & Taylor, 1991; Trafimow & Wyer, 1993). Hence, script-based processing increases the recall of typical information, independent of whether it has been presented.

A different picture emerges for information that is not part of the script. Information that is atypical, irrelevant, or inconsis-

tent with the script cannot be reconstructed. In contrast to typical information, recall of atypical, irrelevant, or inconsistent information requires more processing. Consequently, the recall of such information depends on whether individuals are willing and able to invest extra effort (see Wyer & Srull, 1989, for a review). Accordingly, we can use the recall of information that is typical or atypical in the context of a given script to gauge the impact of moods on the use of generic knowledge structures and on the amount of processing effort expended.

To determine whether individuals in happy or sad moods are more likely to rely on scripts, we presented participants in a happy or sad mood with a story about "going out for dinner" and assessed recognition memory. If happy participants rely more strongly on the activated script than sad participants, they should be more likely to erroneously recognize typical information that was not part of the story, resulting in higher intrusion errors under a happy than a sad mood. The impact of mood on the recognition of presented typical information, on the other hand, is more difficult to predict.

Happy participants' reliance on the script should facilitate their recognition of presented typical information through a reconstruction process, and the systematic elaboration of the story under sad mood should increase recognition of all presented information. Hence, happy participants' reconstruction processes as well as sad participants' elaboration of the specific information are likely to result in a high rate of correct recognition of presented typical items.<sup>2</sup>

Whereas the erroneous recognition of typical items (intrusion errors) bears on participants' reliance on the script, their recognition performance for atypical items bears on the amount of processing extended. Specifically, atypical items cannot be reconstructed from the script and will be correctly recognized only if they received sufficient elaboration at encoding. Hence, happy participants should show poorer recognition memory for atypical items if they are less motivated or have less processing capacity than sad participants. On the other hand, if happy and sad participants do not differ in their willingness or ability to elaborate on atypical information, few differences in recognition memory for atypical items should be obtained.

As an alternative, mood may influence guessing strategies on the recognition task. To control for this possibility, we varied the timing of the mood induction such that participants were in a happy or a sad mood either only at encoding or only at recognition. Mood effects can be attributed to mood-dependent guessing strategies only if participants are in a pronounced mood at recognition, but not if the mood is present only at encoding. Accordingly, the timing of the mood induction allows us to differentiate between these possibilities.<sup>3</sup>

<sup>2</sup> The amount of presented information is probably a crucial mediator. It is more likely to impair the performance of sad participants, as they are actually elaborating on the presented information. Thus, the more information is presented, the "better" the recognition of happy participants for presented typical items relative to the recognition of sad participants.

<sup>3</sup> Although the encoding as well as retrieval stages have been found to be influenced by schemas, schemas tend to be more effective when activated prior to encoding (see Fiske & Taylor, 1991). Note, however, that in the present study the script is always activated prior to encoding, so that the timing of the mood induction may influence how much par-

In summary, we exposed participants to a restaurant story and activated the relevant script at encoding in all conditions. To explore the impact of moods, we induced participants into happy or sad moods either only at encoding or only at recognition. Participants' recognition memory for typical or atypical information that was or was not presented as part of the story served as the dependent variable. We expected that happy participants would show more intrusion errors for nonpresented typical information than sad participants, reflecting their increased reliance on general knowledge structures at encoding. Moreover, we used happy and sad participants' recognition performance on presented atypical information to gauge the amount of processing effort extended.

### Method

#### Participants, Design, and Overview

Eighty-two students of the University of Illinois at Urbana-Champaign participated in partial fulfillment of their course requirement. Participants were randomly assigned to the conditions of a 2 (happy vs. sad mood)  $\times$  2 (mood induction before encoding vs. before retrieval) factorial design. Participants were received in groups of up to 6 by the experimenter, who briefly explained that participants would be completing various independent tasks that had been combined into one session. These tasks (described below) included (a) the mood induction, (b) the presentation of the restaurant story, (c) a neutral filler task, and (d) the recognition task.

#### Mood Induction

For the mood induction task, participants were asked to provide a vivid written report of either a happy or a sad life event, purportedly to help with the construction of a "Life Event Inventory." Reporting a happy event was intended to induce a happy mood, whereas focusing on an experienced sad event was intended to induce a sad mood. Participants were given 12 min to complete their reports and were then asked several questions about the task. Embedded among these questions was a manipulation check question that read "How do you feel right now?" (1 = *very bad*, 9 = *very good*).

#### Stimulus Information: The Restaurant Story

In this task participants listened to a tape recorded story entitled "Going out for dinner." To activate the relevant script for all participants, the recording started with the title followed by a short break of about 3 s. The story was almost completely based on materials that had successfully been used by Graesser et al. (1979) to investigate script-based processing. The story included information that was typical, atypical, or irrelevant with respect to participants' restaurant script.

After listening to the tape, participants answered several questions about the presentation of the story (e.g., about the quality of the tape recording, about the speaker's voice, etc.). The questions were designed to make participants believe that the task involving the restaurant story was completed in order to suppress a possible elaboration of the story after presentation. Therefore none of the questions referred to the content of the presented story.

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Participants rely on the activated script only while encoding or while working on the recognition task.

#### Filler Task

Participants worked for 12 min on a filler task, which required them to rate various geometrical figures in regard to their similarity or dissimilarity. As in one of the two timing conditions, this task should ensure that the mood differences induced before encoding had dissipated before the recognition task. Participants' moods were assessed after this task on the same scale described above.

#### Timing of Mood Induction

The order in which the mood induction task and the filler task were presented was counterbalanced to induce happy or sad moods either before message encoding or before the recognition task. Because participants spent the same amount of time on the filler and the mood induction task (12 min), there was the same interval between encoding and retrieval for all participants. This procedure should ensure that mood was either present at encoding but not at recognition, or vice versa. This general procedure has been successfully used in other studies (see Bless et al., 1992).

#### Dependent Variables: The Recognition Task

Participants sat in front of a PC, were presented with 30 items, and were asked to indicate for each item whether it had been included in the tape recorded story. The items appeared one at a time, and participants answered by pressing a "yes" or a "no" response key on the keyboard. Participants had been familiarized with use of these keys before any experimental manipulation, in the beginning of the session. After each response, participants were asked to indicate how sure they were about their answer on a scale that ranged from 1 (*not sure at all*) to 9 (*very sure*). Responses and response latencies were automatically recorded by the computer.

One third of the items in the recognition task were typical, one third were atypical, and one third were unrelated to the script about "going out for dinner." Half of the items had been included in the tape recorded story, and half of the items had not been included.

### Results and Discussion

#### Effectiveness of Mood Manipulation

Participants' ratings of how happy or sad they felt after the mood induction task indicated that the mood manipulation had been successful. Participants who had described a positive life event reported being in a better mood than participants who had described a negative life event ( $M = 7.1$  vs.  $M = 5.4$ ),  $F(1, 78) = 16.19$ ,  $p < .001$ , and this effect was independent of whether the mood induction occurred prior to the presentation of the restaurant story or prior to the recognition task ( $F < 1$ ).

As expected, no mood differences were obtained after participants worked on the filler task (which was designed to eliminate further mood effects), independent of whether the filler task preceded the restaurant story or preceded the recognition task. For all mood comparisons after the filler task,  $F < 1$ .

#### Recognition

We had hypothesized that happy participants would be more likely than sad participants to believe that a typical item had been originally presented on the tape. This tendency to judge an item as having been presented was not expected for atypical and unrelated items. We therefore computed the percentage of

"yes" responses for each participant and analyzed the three types of items separately in a 2 (mood)  $\times$  2 (order of presentation) factorial analysis of variance (ANOVA).

As expected, happy participants were more likely to judge a *typical* item as having been previously presented than were sad participants ( $M_s = 67.0\%$  vs.  $57.9\%$  "yes" responses),  $F(1, 78) = 5.64, p < .02$ . More detailed analyses revealed that this effect was more pronounced for items that had not been presented ( $M_s = 58.2$  vs.  $45.2$ ),  $F(1, 78) = 8.14, p < .01$ , than for presented items, ( $M_s = 75.8$  vs.  $70.8$ ),  $F(1, 78) = 1.27, ns$ . No interaction with the order of mood induction was revealed for any of these analyses (all  $F_s < 1$ ).

These findings support the assumption that happy individuals are more likely to rely on general knowledge structures than are sad individuals. Presumably, by relying on their script, happy participants inferred that the typical information had previously been presented. This resulted in correct responses if the item had been presented but also in a higher number of intrusions if the item had not been presented.

Note that reconstructive processes based on the script may influence presented as well as not-presented typical items, whereas elaborating the specifics can affect only presented items. Thus, not-presented items may be more sensitive for capturing the impact of script-based processing, and presented items may be more sensitive for capturing the amount of attention devoted to specific information. This may account for the smaller differences for the presented than for the not-presented items. We assume that the sensitivity of presented items should increase with the amount of the specific information (see also footnote 2, and Experiment 2).

The absence of any interaction of mood and order suggests that the observed pattern is not due to different mood states eliciting different response tendencies. If this had been the case, mood effects should have been more pronounced if mood was induced prior to recognition than if mood was induced prior to encoding. However, the absence of any interaction suggests that mood-dependent reliance on the script influenced encoding as well as recognition.

A complementary picture emerged for the other types of items. The recognition for *atypical* items was not affected by happy or sad mood ( $M_s = 46.0$  vs.  $43.8, F < 1$ ) or order ( $F < 1$ ). Similarly, the recognition of unrelated items was not affected by happy or sad mood ( $M_s = 50.9$  vs.  $48.5$ ),  $F(1, 78) = 1.54, p < .21$ . The absence of any effect held also when presented and not-presented items were analyzed separately (all  $p_s > .22$ ), with a high degree of overall correct responses ("yes" responses for presented atypical and unrelated items were  $84.4\%$  and  $92.8\%$ , and "yes" responses for not-presented atypical and unrelated items were  $5.6\%$  and  $6.8\%$ ).

Note that an accurate recall of atypical or unrelated items requires a considerable amount of processing. Thus, the high accuracy independent of participants' mood suggests that all participants were sufficiently able and willing to elaborate on the information that was not part of the script.

Finally, treating typical, atypical, and unrelated items as three levels of a repeated measures analysis resulted in a marginally significant interaction with mood,  $F(2, 160) = 2.37, p < .09$ , as would be expected on the basis of the reported analyses.

### *Latencies and Confidence Ratings*

The analyses of the response latencies revealed no effect of the experimental conditions (all  $p_s > .30$ ). Overall, participants were highly confident about their recognition judgments. Experimental conditions, however, did not affect participants' confidence (all  $p_s > .15$ ).

### *Summary*

In combination, the obtained findings support the assumption that happy individuals are more likely than sad individuals to rely on global knowledge structures. Although this notion has also been suggested in the domain of stereotyping (Bless et al., in press; Bodenhausen, Kramer, & Süsler, 1994) and persuasion (Bless et al., 1992), the present findings go beyond these studies in two respects.

First, the present study provides evidence for the interplay of mood and scripts, a form of general knowledge structure that has so far received little attention in the domain of affect and cognition. Second, the present study focuses on memory aspects, whereas the previous studies have concentrated on judgments as the main dependent variable.

Although the findings of Experiment 1 strongly suggest that mood may influence reliance on scripts, they are less conclusive about the underlying mediating processes. Indirect evidence may be derived from the finding that a rather high accuracy was observed for the atypical and unrelated items, independent of participants' mood. An accurate recall of atypical and unrelated items cannot be due to reconstructive processes that are based on prior generic knowledge. Therefore, their recall requires cognitive effort during encoding. The high levels of accuracy suggests that happy participants elaborated sufficiently on these items, which were mostly not essential for understanding the story. The conclusion that happy participants were willing and able to spend cognitive effort on these items seems difficult to reconcile with the notion that happy mood reduces processing motivation or processing capacity.

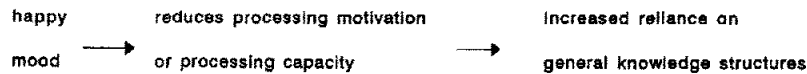
In addition, a reduced amount of processing under happy mood presumably should have had more impact on the encoding than on the retrieval task, which was empirically not the case, as indicated by the absence of any interaction of mood and order for the presented items. Therefore, the data seem more compatible with the mood-and-general-knowledge assumption, which suggests that happy mood increases, and sad mood decreases, reliance on generic knowledge structures without implying that decreased processing resources or motivation among happy-mood participants is causing the effect.

However, the evidence for this conclusion is rather indirect, and one could argue that the recognition task was too easy. In that case, the mood-independent high-accuracy data for the atypical and unrelated items would reflect a ceiling effect rather than evidence for the mood-and-general-knowledge assumption. We conducted Experiment 2 to investigate the reliability of the findings of Experiment 1 and to obtain more direct evidence for the underlying processes.

### Experiment 2

The findings of Experiment 1 indicate that happy individuals are more likely than sad individuals to rely on available scripts,

## Alternative A:



## Alternative B:

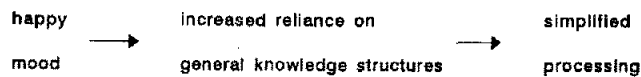


Figure 1. Two alternative processes mediating the impact of mood on the use of general knowledge structures.

thus supporting recent studies on the link between mood and general knowledge structures in other domains (e.g. Bodenhausen, Kramer, & Süsler, 1994). Two different approaches could account for the available evidence. First, it has been argued that happy individuals simplify cognitive processes; in the following discussion we do not differentiate whether happy mood reduces processing motivation (Schwarz, 1990; Wegener et al., 1995) or processing capacity (Mackie & Worth, 1989). Because general knowledge structures often allow efficient and parsimonious processing, they can contribute to a simplification of processing. From this perspective, reliance on general knowledge structures is a *consequence* of the reduced elaboration of happy-mood participants, as characterized in Alternative A of Figure 1.

Second, according to the suggested mood-and-general-knowledge assumption, happy individuals rely on general knowledge structures. In contrast to the first approach, no assumptions about mood directly influencing the amount of processing are made. Because general knowledge structures often allow efficient and parsimonious processing, happy moods will lead to a more parsimonious processing than sad mood in many situations. Thus, from this perspective, happy individuals' reliance on general knowledge structure is considered an *antecedent* of simplified processing, as shown in Alternative B of Figure 1.

The two accounts thus differ with respect to what follows from what. Does reliance on general knowledge structures result from reduced capacity or motivation, or does simplified processing result from reliance on general knowledge structures? One way to disentangle these possibilities is to assess the cognitive effort individuals are willing or able to spend in a dual-task paradigm (see Navon & Gopher, 1979).

In the dual-task paradigm, participants work simultaneously on two tasks, with one often being the primary task and the other the secondary task. It is assumed that efficient processing of one task enables individuals to allocate more resources to the other task, resulting in improved performance on that task. The dual-task paradigm has already been used to investigate whether relying on general knowledge structures allows individ-

uals to allocate resources to the other task. For example, Macrae and his colleagues (Macrae, Milne, & Bodenhausen, 1994) asked participants to form an impression about a person based on a list of adjectives. While performing this task, half of the participants worked on a second task. Prior activation of a category label resulted in a better recall of adjectives that were consistent with the label but had no impact on inconsistent or irrelevant adjectives. Most important, the activation of the category label led to better performance on the second task. Presumably, the category label allowed simplified processing of the consistent items, enabling individuals to allocate additional resources on the second task.

The two approaches discussed above (Alternatives A and B) have different implications with respect to performance on a secondary task in a dual-task paradigm. If happy participants' reliance on general knowledge structures is due to motivational or capacity constraints (Alternative A), these constraints should also influence the second task. Thus, happy individuals should show poorer performance on the secondary task than sad individuals.

A different prediction results from the mood-and-general-knowledge assumption. Given that no assumptions about mood-dependent differences in processing motivation or processing capacity are made, happy participants' reliance on general knowledge structures should free additional resources relative to sad participants, who are less likely to rely on general knowledge structures. These resources can then be allocated to another task, so happy individuals should show better performance on a secondary task.

It is important not to overlook a potential caveat in evaluating the two alternatives. Superior secondary task performance by happy participants could also be explained by a motivational or capacity deficit hypothesis, which assumes that the amount of cognitive resources freed up by the script-based processing was greater than their deficit caused by happy mood. That interpretation, however, necessarily requires (a) that the secondary task captures motivational and capacity differences and (b) that happy individuals should show poorer performance when the "secondary" task is the only task.

To investigate these considerations we presented participants in different affective states with information about familiar activities and assessed recognition after a delay, as in Experiment 1. However, we changed the approach of Experiment 1 in various aspects. First, in Experiment 2 we focused solely on mood influences on encoding. Second, we added a neutral-mood condition. Third, we made recognition more difficult by increasing the amount of information presented. Fourth, and most important, while participants were encoding the information they were also working on a secondary task.

We expected to replicate the recognition pattern of Experiment 1. Because happy participants are assumed to rely more on general knowledge structures, they should have a greater tendency to judge typical, but not atypical, items as having been presented.

On the secondary task, happy participants should show poorer performances than sad participants if happy participants' reliance on general knowledge structures is mediated by reduced processing motivation or capacity. In contrast, if happy participants' reliance on general knowledge is not mediated by a decrease in the amount of processing, they should perform better than sad participants on the secondary task. (As noted above, the evaluation of the secondary task performance depends on how this task is affected by mood when it is presented as the only task.)

## Method

### *Participants, Design, and Procedure*

Sixty-one students of the University of Heidelberg (Heidelberg, Germany) received DM 5 (approximately \$3) for their participation and were randomly assigned to the happy, neutral, or sad mood condition. Participants were run in groups of up to 5 and were informed that they would be working on different independent tasks. They were told that within the session they would be watching two video clips and that they would work on one of the tasks several times. They also were informed that after some of the tasks they would be asked several standard questions about the task situation. The sequence of the various tasks (described below) is listed in the Appendix.

After receiving this general information, participants were given instructions for the secondary task. We refer to this task as the *d2 task* (described below). To familiarize participants with this task, and to get an initial baseline, we had participants work on the *d2 task* prior to any manipulation. Then participants were presented with the first video clip (depending on the mood condition). After an assessment of mood, participants worked again on the *d2 task*. Next, the dual-task situation was described. Participants were told that they were going to hear two tape-recorded stories and that while listening they would be working on a second task, the already-known *d2 task*.

Because at this point several minutes had passed since the mood induction, we wanted to reinduce mood. The experimenter pretended to have some problems with getting the tape recordings started and suggested that during the delay participants should watch another video clip. Participants watched a second video clip of the same mood valence they had seen before. After assessing mood, we had participants listen to the tape recording of the story and simultaneously work on the second task. After a filler task, participants' moods were assessed prior to the recognition task. Finally, all participants were debriefed.

### *The Secondary Task: d2*

After receiving the general instructions, participants were told that within this session they would be working on one task several times.

The experimenter provided participants with instruction sheets for that task. The task was the *d2 test*, a standardized test for measuring concentration (Brickenkamp, 1975). In this task, participants are provided with a work sheet on which several rows of the letters *d* and *p* are arranged in random order. The letters are presented with one, two, three, or four dashes, and respondents are asked to mark every *d* that has two dashes. The experimenter made sure that all participants had understood the instructions and started an initial trial that later served as a within-subjects baseline.

The *d2 task* was administered two more times within the session. After the first mood induction, participants again worked on the *d2* as their only task. This allowed us to assess mood effects on the *d2* performance that were independent of other co-occurring tasks. As discussed above, the performance on the *d2 task* in this situation has important implications for the interpretation of Alternatives A and B. Finally, the *d2 task* was part of the dual-task situation described below.

### *Mood Induction*

The experimenter told participants that she was pretesting brief video clips for use in a future study. Participants were told that within the session two clips would be presented, and after each clip they would answer some questions about it. The first clip was presented prior to administration of the *d2* as the only task, and the second clip of the same valence was presented prior to the dual-task situation. In the positive mood conditions, participants saw sequences from the movies "Dead Poets Society" and "Flashdance". In the sad mood condition, sequences were taken from "Der Liebe Verfallen" and "Cry for Freedom". In the neutral mood condition, participants saw two documentaries: one on "Roman History" and one on "Arts of the 19th Century".

All sequences had been pretested for valence, and each lasted for about 4.5 min. After watching a video, participants were asked several questions, among them an item that served as a check on the effectiveness of the mood manipulations. Participants responded to the question "How do you feel now?" by checking an 11-point rating scale anchored by 1 (*sad*) and 11 (*happy*).

### *Stimulus Information and the Dual-Task Situation*

Participants were informed that they would be listening to two tape-recorded stories. They were told that while listening they should also work on a second task, the *d2*. The experimenter explained thoroughly that the primary, more important task was listening to the tape recordings, because later there would be a number of questions about that information. Participants were told to consider the *d2* the secondary task.

After checking that all participants had understood these instructions, the experimenter claimed to have problems getting the tape recordings started. She explained that, to save time, she would now present the second video clip that had been scheduled for a later part of the experiment. After the presentation of the video clip (described above), participants listened to the tape recording and worked simultaneously on the *d2 task*.

The two stories on the tape recording contained activities that were familiar to participants. The first story was about "A ride on a tramway", and the second story was about "A telephone call from a public telephone booth". Both stories started with the title and comprised actions that were either typical or atypical<sup>4</sup> with respect to participants' script. The typicality of the information had been extensively pretested.

<sup>4</sup> In the pretest, participants judged items for their typicality with respect to the script. Because the ratings for atypical and irrelevant items did not differ, we combined all items that were not related to the script into the atypical category.

### Filler Task

After completing the dual-task part of the experiment, participants were provided with a filler task requiring them to rate various geometrical figures with respect to their similarity or dissimilarity. The filler task was designed to inhibit rehearsal of the presented information. Because it should also ensure that the mood differences induced prior to encoding had dissipated prior to the recognition task, participants' moods were assessed again after the filler task.

### Dependent Variables

**Recognition.** As in Experiment 1, participants were presented with one item at a time and were asked to indicate whether the item had been included in the tape-recorded story. Participants used "yes" or "no" response keys on a computer keyboard to record their answers. Responses and response latencies were automatically recorded.

Twenty typical and 16 atypical items were presented; half of the items had been included in the tape recorded story, and the other half had not been included. Participants were informed that the first half of the items referred to the "tramway ride" story. After half of the items were presented, participants read on the computer screen that the following items would refer to the "telephone call" story.

**Performance on secondary (d2) task.** According to the d2 test manual (Brickenkamp, 1975), various scores can be computed: (a) the total number of items worked on, (b) number of items correctly marked, (c) number of misses, (d) number of items marked incorrectly, and (e) a summary score resulting from (a) - (c) - (d).

## Results

### Effectiveness of Mood Manipulation

Mood was assessed three times and, as expected, significant mood differences were obtained after the videos but not after the filler task. After the first video, participants who had seen the happy video reported more positive feelings ( $M = 8.9$ ) than participants in the neutral mood ( $M = 7.6$ ) or sad mood conditions ( $M = 7.2$ ),  $F(2, 58) = 3.82, p < .03$ . Happy participants differed from sad ones,  $t(58) = 2.68, p < .01$ , and from neutral participants,  $t(58) = 1.88, p < .07$ , but neutral and sad participants did not differ reliably ( $t < 1$ ).

Similar results were revealed for participants' moods assessed after the second video (happy, neutral, and sad  $M$ s = 9.0, 7.7, 6.4, respectively). The happy mood condition differed from the sad mood condition,  $t(58) = 3.86, p < .01$ ; and the neutral mood condition,  $t(58) = 1.80, p < .08$ ; and the neutral mood condition differed from the sad mood condition,  $t(58) = 1.81, p < .08$ . Finally, no mood differences were detectable after the filler task but prior to the recognition task ( $M$ s = 7.7, 7.6, 7.3 for the happy, sad, and neutral mood conditions, respectively,  $F < 1$ ).

In sum, different mood states were successfully induced before participants worked on the d2 as the only task and before the dual-task situation. As expected, the mood differences were eliminated prior to the recognition task.

### Recognition

We expected to replicate the pattern obtained for Experiment 1, according to which happy participants were more likely than sad participants to believe that typical items had been originally

Table 1  
Percentage of Yes Responses as a Function of Mood, Typicality of Items, and Prior Presentation, Experiment 2

Items	Mood		
	Happy	Neutral	Sad
Typical			
Overall	75.7	72.4	65.2
Presented	88.1	82.9	77.4
Not presented	63.3	61.8	53.0
Atypical			
Overall	37.8	39.7	46.2
Presented	66.7	61.8	76.1
Not presented	08.9	17.7	16.3

Note. Higher numbers imply higher accuracy for the presented items and lower accuracy for the items not presented. No accuracy can be inferred from the combined overall percentage.

presented on the tape. Again, this tendency to judge items as having been presented was not expected for atypical items. We therefore computed the percentage of "yes" responses for each participant and analyzed the two types of items separately with one-way ANOVAs that compared happy, neutral, and sad moods. The means are presented in Table 1.

As expected, happy participants were more likely to judge a typical item as having been previously presented ( $M = 75.7\%$  "yes" responses) than were sad participants ( $M = 65.2\%$ ),  $t(58) = 2.49, p < .02$ , with neutral mood participants falling in between ( $M = 72.4$ ),  $F(2, 58) = 3.25, p < .04$ . More detailed analyses revealed differences between the happy and sad conditions for items that had been presented ( $M = 88.1$  vs.  $M = 77.4$ ),  $t(58) = 2.07, p < .04$ , and for items that had not been presented ( $M = 63.3$  vs.  $M = 53.0$ ),  $t(58) = 1.89, p < .06$ . In both cases the neutral mood participants fell in between ( $M$ s = 82.9 and 61.8, respectively), rendering the effect for these additional analyses across all mood conditions nonsignificant,  $F(2, 58) = 2.16, p < .12$ , and  $F(2, 58) = 2.05, p < .14$ , respectively.

These findings replicate the pattern of Experiment 1 in most respects. Most important, the data support the assumption that happy individuals are more likely to rely on general knowledge structures than are sad individuals. Presumably, by relying on their script, happy participants inferred that typical information had previously been presented. This resulted in more correct responses if the item had been presented but in a higher number of intrusions if the item had not been presented.

As in Experiment 1, a different picture emerged for the atypical items. Sad participants ( $M = 46.2$ ) tended to be more likely than happy ( $M = 37.8$ ) or neutral mood participants ( $M = 39.7$ ) to judge atypical items as having been presented,  $F(2, 58) = 3.11, p < .06$ ; sad versus happy mood:  $t(58) = 2.34, p < .02$ ; sad versus neutral mood:  $t(58) = 1.74, p < .09$ ; happy versus neutral mood:  $t < 1$ . As can be seen in Table 1, these effects are mainly due to sad participants being more likely to judge a presented item as presented and to happy participants being less likely to judge a not-presented item as not presented (effects for presented items:  $F[2, 58] = 2.57, p < .09$ , and for not-presented items  $F[2, 58] = 2.03, p < .14$ , respectively).



Presumably, happy participants could not reconstruct the atypical information, as this information was not part of their script. It is conceivable that happy participants were more likely to infer that an atypical item had not been presented, because it was not part of their script. This possibility would result in the observed better performance for the not-presented items and the worse performance for the presented items.

Finally, treating typical and atypical items as two levels of a within-subjects factor resulted in a significant interaction with mood,  $F(2, 58) = 5.23, p < .01$ , as would be expected on the basis of the reported analyses.

In sum, the recognition data support the hypothesis that happy individuals are more likely to rely on general knowledge structures than are sad individuals, with individuals in a neutral mood falling in between.

### Response Latencies

As in Experiment 1, no mood-dependent effects on response latencies were obtained (all  $p$ s  $> .25$ ).

### Performance on d2 Task

Only a small number of misses and incorrectly marked items were obtained on each trial. Accordingly, the analyses focus on the summary score computed according to the d2 test manual (Brickenkamp, 1975).<sup>5</sup> Overall, the d2 was administered three times. Because participants worked on the first trial before any mood manipulation, we could use their performance as a baseline for controlling individual differences (overall  $M = 101.2$ ). On the second trial, participants worked on the d2 as the only task after different mood states were induced. As usual, we observed a considerable training effect (increase from the first to the second trial); however, this increase in performance was independent of whether happy, neutral, or sad mood was induced ( $M = 20.7$  vs.  $M = 19.9$  vs.  $M = 17.6, F < 1$ ).

This finding is worth noting, because little research is available that directly addresses the amount of processing under different mood states. Because the task measures cognitive effort, the absence of mood effects is incompatible with the notion that happy but not sad individuals tend to simplify their processing.

In the third trial, the d2 test was the secondary task that participants performed while they listened to the tape-recorded stories. Happy participants ( $M = 376.8$ ) showed better performance than neutral ( $M = 336.8$ ) or sad mood participants ( $M = 322.9$ ),  $F(1, 42) = 11.68, p < .005$ . Moreover, treating the d2 performances on the second and third trials as two levels of a within-subjects factor revealed a significant interaction of mood and trial,  $F(2, 58) = 4.62, p < .02$ .<sup>6</sup>

This finding is compatible with the assumption that the reliance of happy individuals on general knowledge structures is not due to a reduction in processing. By relying on a script, happy participants freed up resources that could be applied to the secondary task, which resulted in improved performance.

If one looks solely at the findings for the third trial one would note that the pattern would also be compatible with models that assume reduced processing under happy moods. Because of their simplifying of cognitive processes, happy individuals may

have spared more cognitive resources than their initial deficit relative to sad individuals. However, if this had been the case, the motivational or capacity deficits should have also impaired performance when the d2 task was presented alone. The absence of such effects renders that possibility implausible.

In sum, reliance on general knowledge structures appears to have mediated the recognition performance of happy participants and their better performance on the secondary task. Apparently, the efficiency resulting from their script-based processing allowed happy participants to allocate additional resources to the second task, resulting in better performances. The additional capacity and effort spent on the second task is incompatible with the notion that happy moods reduce processing motivation or processing capacity, which in turn increases the reliance on general knowledge structures.

### Experiment 3

The findings of Experiments 1 and 2 suggest (a) that happy mood increases reliance on activated schemas and (b) that this increase is not due to reduced processing motivation or capacity in happy moods. Instead, the findings suggest that reliance on script-based processing frees up resources. If so, the resources that can be spared and allocated to a secondary task should depend on the extra effort required for encoding atypical information. If happy individuals are able and willing to provide the extra effort, their advantage on the secondary task should diminish as the information in the narrative that needs to be elaborated becomes more atypical.

As a test, we varied the amount of atypical information presented to participants. We expected that when little atypical information is presented, secondary task performance would be the same as in Experiment 2 but that the advantage of happy participants would diminish when a larger amount of atypical information is presented. This prediction assumes that happy participants will use the resources freed up by script-based processing to process the atypical information, leaving less available for the secondary task. Thus, when the amount of atypical information is high, the secondary task performance of happy participants should be reduced.

Moreover, if happy participants are able and willing to allocate the resources required for the processing of atypical information, the recognition pattern of Experiment 2 should replicate independent of whether a large or a little amount of atypical information is presented.<sup>7</sup>

### Method

#### Participants, Design, and Procedure

Eighty students of the University of Heidelberg received DM 5 (approximately \$3) for their participation and were randomly assigned

<sup>5</sup> Performed analyses, despite the relative few errors, revealed no mood effects for the number of misses or the number of incorrectly marked items.

<sup>6</sup> A significant interaction of trial and mood was also obtained, when the first trial was included in the analysis,  $F(4, 116) = 4.49, p < .02$ .

<sup>7</sup> Of course, increasing the amount of atypical information may eventually render a script not applicable, resulting in different predictions. This effect is most likely if *inconsistent* information is provided. However, the atypical information we provided was simply atypical but not

to the conditions of a 2 (happy vs. sad mood)  $\times$  2 (low vs. high level of atypical information) factorial design. The same procedures and materials as in Experiment 2 were used (see also the Appendix), with one exception, described below.

### Stimulus Information

Half of the participants were provided with the stories used in Experiment 2 (low-atypical-information condition). The other participants were presented with modified stories. These stories included all the information of the original stories, plus additional information that had been pretested as atypical for those stories. As a result, the stories with the larger amount of atypical information were longer, resulting in a mean duration of 155 and 258 s, respectively.

## Results and Discussion

### Effectiveness of the Mood Manipulation

Participants' moods were assessed three times and, as expected, significant mood differences were obtained when mood was assessed after the presentation of the videos but not when mood was assessed after the filler task. After viewing both videos, participants who had seen the happy videos reported feeling in a better mood than participants who had seen the sad videos ( $M = 8.7$  vs.  $M = 6.9$ ),  $F(1, 76) = 17.6, p < .01$ , after the first video and ( $M = 8.9$  vs.  $M = 6.0$ )  $F(1, 76) = 28.3, p < .01$ , after the second video. This suggests that different mood states were successfully induced before participants worked on the d2 as the only task, and prior to the dual-task situation, but that these mood differences were eliminated prior to the recognition task ( $M = 7.8$  vs.  $M = 7.2$ ),  $F(1, 76) = 1.48, p > .22$ .

### Recognition

We expected to replicate the pattern obtained for Experiment 2, with happy participants being more likely than sad participants to report that typical but not atypical items had been originally presented on the tape. We also computed the percentage of "yes" responses for each participant and analyzed the two types of items separately with 2 (happy vs. sad mood)  $\times$  2 (low vs. high level of atypical information) factorial ANOVAs. The means are presented in Table 2.

Again, happy participants were more likely to judge typical items as having been presented than were sad participants ( $M = 73.9\%$  vs.  $M = 65.1\%$  "yes" responses),  $F(1, 76) = 7.88, p < .01$ . More detailed analyses revealed that this effect held for items that had been presented ( $M = 84.8$  vs.  $M = 78.8$ ),  $F(1, 76) = 3.14, p < .08$ , as well as for items that had not been presented, ( $M = 63.0$  vs.  $M = 51.5$ ),  $F(1, 76) = 6.14, p < .05$ . No effect of the amount of atypical information was expected or observed (all  $p$ s  $> .25$ ).

As in Experiment 2, these findings suggest that happy participants were more likely than sad participants to rely on the applicable script, resulting in an increased tendency to judge typical items as having been presented. The absence of an effect of the amount of atypical information indicates that happy partic-

Table 2  
Percentage of Yes Responses as a Function of Mood, Level of Atypical Information, Typicality of Items, and Prior Presentation, Experiment 3

Items	Level of atypical information			
	Low		High	
	Happy mood	Sad mood	Happy mood	Sad mood
Typical				
Overall	74.8	66.0	73.0	64.5
Presented	86.5	80.6	83.0	77.3
Not presented	63.0	51.1	63.0	51.8
Atypical				
Overall	44.7	42.7	46.2	48.4
Presented	73.7	70.1	77.8	79.3
Not presented	15.6	15.3	14.5	17.5

Note. Higher numbers imply higher accuracy for the presented items and lower accuracy for the not-presented items. No accuracy can be inferred from the combined overall percentage.

ipants relied on the script even as a larger amount of atypical information was presented. Given that the atypical information was not inconsistent with the script, a script-based processing strategy could still be applied to the typical information.

For the atypical items, there was no effect of mood, regardless of whether the percentage of "yes" responses was analyzed for the presented, the not-presented, or all atypical items ( $p$ s  $> .25$ ).

The differential pattern for typical and atypical items renders it unlikely that the pattern obtained for typical items was due to a general tendency for happy participants to judge items as having been presented. The findings also suggest that happy participants were willing and able to allocate the resources necessary to recall atypical items.

Finally, treating typical and atypical items as two levels of a repeated measures design resulted in a significant interaction with mood,  $F(1, 76) = 7.78, p < .01$ , as would be expected on the basis of the reported analyses. In sum, the recognition data support the hypothesis that happy individuals are more likely to rely on general knowledge structures than are sad individuals.

### Performance on the d2 Task

We expected happy participants to perform better than sad participants on the d2 test when it was presented as a secondary task. This advantage should be diminished when a large amount of atypical information is presented, because script-based processing does not facilitate the encoding of atypical information. No mood effects were expected when the d2 was presented as the only task.

We computed the d2 performance as in Experiment 2. Again, no differences were obtained at baseline prior to any mood manipulation (overall  $M = 96.7$ ). As before, we found a training effect on the second trial, when the d2 was the only task, and this effect was independent of mood ( $M = 16.9$  vs.  $M = 13.2$ ),  $F(1, 76) = 1.18, p > .25$ . Again, the absence of any mood effects

inconsistent (e.g., in the "tram-way" story, the tram-way had to stop temporarily because of an automobile blocking the rails).

seems remarkable in itself (see *Discussion* section of Experiment 2) and is not compatible with the assumption that happy mood decreases processing motivation or capacity.

In contrast, participants' performances were affected by their moods when the d2 test was the secondary task in the third trial. Because participants worked longer on the d2 when a lot of atypical information was provided (155 vs. 258 s), we adjusted the d2 performance during the longer version by multiplying the actual performance with the ratio of the different durations. In a replication of Experiment 2, happy participants' performances were better than those of sad participants in the low-atypical-information condition ( $M = 371.4$  vs.  $M = 316.1$ ),  $t(76) = 2.85$ ,  $p < .05$ . As expected, this difference diminished when the amount of atypical information was increased, ( $M = 269.3$  vs.  $M = 277.8$ ,  $t < 1$ ), resulting in a significant interaction of mood and the amount of atypical information,  $F(1, 76) = 5.68$ ,  $p < .03$ .

In addition, participants performed better when low rather than high amounts of atypical information were presented ( $M = 345.2$  vs.  $M = 273.8$ ),  $F(1, 76) = 27.51$ ,  $p < .01$ . This main effect indicates that processing atypical information required more resources than processing typical information. Finally, treating the d2 performances on the second and third trials as two levels of a within-subjects factor revealed a significant interaction of mood, trial, and the amount of atypical information,  $F(1, 76) = 6.13$ ,  $p < .02$ .

In combination, the observed performance on the d2 task provides further support for our assumptions. First, when little atypical information was presented, the findings of Experiment 2 were replicated.

Second, the findings further support the assumption that happy participants' advantage resulted from their reliance on the script. When more atypical information was presented, happy participants could spare relatively fewer resources by their reliance on the script and consequently could allocate fewer resources to the secondary task. As a result, happy participants did not perform better than sad participants in the high-atypical-information condition.

Third, the differential effects observed when low versus high levels of atypical information were included renders it unlikely that happy participants' advantage resulted from happy participants being simply better in divergent thinking. If this had been the case, they should have had an advantage independent of the amount of atypical information.

Fourth, the results are again incompatible with the assumption that happy individuals simplified their processing because of motivational or capacity deficits and in turn spared more cognitive resources than their initial deficit. If this had been the case, happy participants should have shown impaired performance on the d2 task both by itself and when presented as a secondary task.

In sum, the present findings support the assumptions that happy mood increases reliance on activated general knowledge structures, and this does not seem to be due to the motivational or capacity deficits of happy participants.

## General Discussion

### *Mood and General Knowledge Structures*

The present findings strongly support the assumption that happy individuals are more likely to rely on general knowledge

structures than are sad individuals. Most important, the recognition data indicate that happy participants were more likely to judge items as being presented if the item was typical for the script. This effect was not observed for items that were atypical or unrelated to the respective scripts, or for an overall tendency to respond "yes". Moreover, if the pattern had been due to an overall response tendency, the effect should have been more pronounced when mood was induced prior to recognition than prior to encoding. This was not the case (Experiment 1).

By relying on their existing knowledge about the activities at hand, happy participants presumably inferred that the typical items must have been presented, whereas sad or neutral mood participants were less likely to do so. The assumed reconstruction process will lead participants to judge an item as having been presented only if that item is already part of the script. Consequently, atypical or unrelated items were not affected by participants' moods in the same direction.

The reliability of this general conclusion is supported by the observation that the effect was independent of variations in the method of mood induction and in the content of the scripts. The present findings extend previous knowledge by focusing on memory as the main dependent variable and by investigating the relation between mood and the use of scripts, a form of general knowledge structure that has so far received little attention in affect and cognition research.

The conclusion that happy individuals are more likely than sad individuals to rely on general knowledge structures is also consistent with findings in other domains. For example, general knowledge structures in the form of stereotypes have been found to have a greater impact on happy than on neutral or sad mood participants (Bless et al., in press; Bodenhausen, Kramer, & Süsler, 1994; Bodenhausen, Sheppard, & Kramer, 1994; Edwards & Weary, 1993). Similarly, Bless and Fiedler (1995) reported that specific judgments about a target person were more strongly influenced by preceding general trait judgments about the target when participants were in a happy mood rather than a neutral or sad mood. Moreover, happy but not sad participants have been found to rely on a global rather than on a specific representation of a persuasive message (Bless et al., 1992). Finally, if we consider the use of heuristics as applying general knowledge structures to specific situations, there are numerous findings in persuasion and other domains that suggest a higher reliance on general knowledge structures (heuristics) under happy moods (for overviews, see Clore et al., 1994; Isen, 1987; Schwarz et al., 1991; Schwarz & Clore, in press).

Nisbett and Ross (1980) contended that people's inferential errors about the world and themselves stem from the use of heuristics and general knowledge structures to understand particular cases, not from emotional or motivational causes. That is, inferential error generally involves cold rather than hot cognition. As Nisbett and Ross said, these phenomena "can be understood better as products of relatively passionless information-processing errors" (p. 12). Although their extensive argument is sound as far as it goes, it should be noted that studies of mood and processing, including the present one, make it evident that although the heuristics and general knowledge structures alluded to by Nisbett and Ross may themselves be passionless, their use may often have emotional causes.

### *What Mediates the Use of General Knowledge Structures?*

Different models have been offered to account for the differential impact of general knowledge structures under different mood states. On the one hand, it has been argued that reliance on general knowledge structures in positive moods results from reduced processing capacity (Mackie & Worth, 1989) or motivation (Schwarz, 1990, Wegener et al., 1995). On the other hand, the mood-and-general-knowledge assumption holds that happy individuals' reliance on general knowledge structures is not a *consequence* but an *antecedent* of simplified processing (Bless, 1994; see also Bless & Fiedler, 1995; Bless et al., in press). The present findings strongly support this latter assumption.

Most important, happy participants showed better performance on the secondary task in the dual-task situation than did sad or neutral mood participants. If happy participants' reliance on a script was mediated by reduced processing motivation or processing capacity, we should have observed impaired performance on the secondary task, but happy participants showed *better* performance on the secondary task. Presumably, relying on a script contributes to efficient and parsimonious processing, enabling happy participants to allocate additional resources to the secondary task. That they did so indicates that the relevant motivation and capacity were not impaired.

Although this is not a very parsimonious argument, one could argue that positive mood does create a processing deficit that does lead to the necessity of simplified processing through a focus on the script but that script processing is so efficient that it spares more cognitive resources than their deficit, resulting in an advantage for happy participants on the secondary task. If so, such a motivational or capacity deficit should have influenced the performance on the d2 task when it was the only task on which participants worked. Moreover, happy participants' initial deficits should have led to impaired performance when a larger amount of atypical information was included in the story, but neither effect was obtained, and the pattern of findings is therefore incompatible with the notion of reduced processing under happy moods. Finally, if happy mood reduced cognitive resources or motivation we should have observed poor recognition performance on the atypical and unrelated items, because encoding these items requires cognitive effort. The mood-independent high accuracy, however, suggests that happy participants did have sufficient resources to allocate to these items.

Could the presented findings be reconciled with the motivational assumption derived from the mood-as-information account despite the fact that we did not observe an overall tendency for a reduced amount of processing under happy moods? Given happy participants' improved performance on some tasks, it seems unlikely that a *general* tendency toward a reduced processing motivation under happy moods may account for the presented data.

One may apply a more confined assumption that happy moods reduce processing *specifically* for some tasks. In this respect it could be argued that the different tasks differentially motivated happy participants to process the respective information. If we assume that happy participants were motivated for one task (d2 task) but not for the other (script task), this would

explain why they did not show an impaired d2 performance on the one hand but were more likely to rely on the script on the other hand. For various empirical and conceptual reasons, we believe that such a reconciliation is not viable.

Happy participants did not only do equally well on the d2 task, but they actually *outperformed* sad participants. This pattern is nicely compatible with the present general knowledge assumption, as reliance on general knowledge structures may save processing resources that can be allocated toward another task. If, however, the different tasks elicited different processing motivations, we should have also observed happy participants outperform sad participants when the d2 task was presented as the only task, which was empirically not the case. From our perspective, the assumption that happy moods reduce processing motivation offers no explanation for why the amount of processing spared on one task is transferred to another task, as indicated by happy participants' better performance on the d2 task.

Note that assuming differential processing motivation for different tasks would require a specification of the tasks for which individuals are and are not motivated. For the present studies, this specification cannot be based on individuals' current affective states per se. If—as in the present studies—both tasks are simultaneously presented in the same situation, individuals' affective states are constant and should therefore result in similar implications. This latter argument becomes even more apparent with respect to the recall data. These results show that happy participants were also motivated to process the information provided in the script task. Their recall of the atypical information reflected learning equal to that of sad participants. Hence, the only finding left that may potentially reflect a reduced processing motivation under happy moods is the script-based processing of the typical information. To account for the observed set of findings, one would have to assume not only different processing motivations for different tasks but also different processing motivations within one task (typical vs. atypical information). As this cumbersome discussion indicates, the present findings are difficult to reconcile with the assumption that moods may influence processing motivation in some general way.

In addition to the present findings, other evidence also suggests that the increased reliance on general knowledge structures under happy moods is not necessarily due to a reduced amount of processing. For example, Bless and Fiedler (1995) found an increased impact of global trait judgments on specific judgments observed under happy mood. On the basis of analyses of response latencies, they concluded that this increased impact was not mediated by a reduced amount of processing. Similarly, in the stereotype domain, the processing of happy participants has been shown to be more strongly influenced by an activated stereotype than the processing of neutral or sad mood participants (Bodenhausen, Kramer, & Süsner, 1994; Bless et al., in press; Edwards & Weary, 1993). However, happy participants also showed the strongest impact of inconsistent individuating information (Bless et al., in press). Given that the impact of inconsistent information usually requires a considerable amount of processing (Stangor & Duan, 1991), its particular impact under happy moods suggests that happy participants were able and willing to expend the necessary resources.

Moreover, as noted in the beginning of the article, several persuasion studies have found that the quality of the arguments has less impact on happy than on sad participants' attitudes, whereas direct assessments of the quality of the arguments were independent of participants' moods (Bless et al., 1990; Worth & Mackie, 1987). The notion that happy moods reduce the amount of processing is again difficult to reconcile with this pattern. On the other hand, the mood-and-general-knowledge assumption may account for this pattern if we assume that happy participants could rely on general knowledge structures in making attitude judgments but drew on more specific information in evaluating the quality of arguments.

In sum, there is considerable evidence that questions the notion that happy individuals rely more on their general knowledge structures than sad individuals because happy mood reduces cognitive capacity or processing motivation. Given that the mood-and-general-knowledge assumption does not require this assumption, it provides a parsimonious alternative account for a large number of findings.

### *The Mood-and-General-Knowledge Assumption*

In light of the reviewed inconsistencies and the supportive present findings, we propose that the assumption that moods influence reliance on general knowledge structures provides a fruitful perspective for conceptualizing the impact of moods on processing strategies. As in our previous theorizing (Schwarz, 1990; Schwarz & Bless, 1991; Schwarz & Clore, 1983, 1988, in press), we assume that individuals' affective states inform them about the nature of the current situation. Whereas positive affective states signal a benign and unproblematic situation, negative affective states indicate that the situation is problematic and is characterized by a lack of positive outcomes or a threat of negative outcomes.

The information that the current situation is problematic implies that it is necessary to attend to specifics of the situation, whereas the information that the current situation is unproblematic implies that it is possible to rely on one's general knowledge structures, which usually serve one well. Accordingly, happy individuals, whose moods signal a benign situation, may feel confident<sup>8</sup> to base their processing on activated general knowledge structures—which results in a simplified processing as long as the specific information matches the activated knowledge structure. In contrast, sad individuals focus on the specifics of the situation, reflecting that their mood signals a problematic situation that renders it risky to rely on one's default routines. As discussed above, for various reasons such a mechanism would be highly adaptive for individuals because it directs the attention to that information that is presumably most useful for dealing with the current situation.

Although these assumptions imply that positive affective states should increase, and negative affective states should decrease, reliance on general knowledge structures, the effects elicited by the valence of mood can be overridden by other factors. For example, increasing individuals' processing motivation or increasing their processing capacity may decrease reliance on general knowledge structures independent of individuals' mood (see Fiske & Neuberg, 1990; Kruglanski, 1989, for overviews). Depending on the relative contributions of the

affective state and processing motivation and capacity, mood effects may not always be observable, as noted in studies that manipulated participants' processing motivation or processing capacity in addition to their mood (e.g., Bless et al., 1990; Bodenhausen, Kramer, & Süsner, 1994; Mackie & Worth, 1989).

Similarly, an increased reliance on general knowledge structures can also result from individuals' arousal levels being either very low (e.g., Bodenhausen, 1990) or very high (Kim & Baron, 1988; see also Broadbent, 1971; Hasher & Zacks, 1979). Because affective states may differ with respect to the associated level of arousal, the valence of the affective state may not be the only determinant of the use of general knowledge structures. For example, evidence by Bodenhausen, Sheppard, and Kramer (1994) suggests that sad participants were less influenced, and angry participants were more influenced, by an activated stereotype compared to neutral mood participants.

Finally, we note that the assumption that happy moods increase reliance on general knowledge structures may also account for the increase in creativity that has been observed under happy mood (see Isen, 1987). It is interesting that, in addition to allowing more efficient processing, general knowledge structures serve a second function, namely to enrich the stimulus information at hand and to provide a basis for making inferences that go beyond the information given (Bruner, 1957). Generic schematic knowledge can be applied creatively when a new specific situation is encountered. Thus, in dealing with a specific task, individuals may draw inferences and generate new concepts based on their prior general knowledge. This aspect of general knowledge structures may help us understand why happy individuals may rely on heuristics on the one hand but show improved performances on problem solving and creativity tasks on the other hand (Isen, 1987).

<sup>8</sup> Note that the differential confidence in the reliance on general knowledge structures is not the same as the confidence in the judgment. Thus, sad individuals may be as confident in their judgment as happy individuals—or even more—because they elaborated on the specific information.

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## Appendix

## Procedure of Experiment 2

0. General instructions
1. Instruction and first assessment of secondary task performance
2. Mood induction 1/assessment of mood
3. Assessment of secondary task performance
4. Instruction for dual-task situation
5. Mood induction 2/assessment of mood
6. Dual-task situation
7. Filler task/assessment of mood
8. Recognition task
9. Debriefing

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### Call for Nominations

The Publications and Communications Board has opened nominations for the editorship of *Developmental Psychology* for the years 1999–2004. Carolyn Zahn-Waxler, PhD, is the incumbent editor.

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