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How valence affects language processing:

Negativity bias and mood congruence in narrative comprehension

Giovanna Egidi

The University of Chicago

Richard J. Gerrig

Stony Brook University

Address correspondence to:
Giovanna Egidi
Center for Cognitive and Social Neuroscience
Department of Psychology
The University of Chicago
5848 S. University Avenue
Chicago, IL 60637
g.egidi@gmail.com
www.egidi.eu

Abstract

This research examines how positive and negative moods affect readers' understanding of positive and negative story endings. It demonstrates how negativity bias and mood congruence emerge during narrative comprehension. Participants were induced to experience a positive or a negative mood and then read stories that could have either a positive or a negative ending. In Experiment 1, participants took longer to integrate negative endings than positive endings independent of their mood. In Experiment 2, participants judged as more surprising those endings that did not match their mood. These results illustrate that ending valence has strong influence on moment-by-moment reading, but readers' mood influences expectations for story outcomes once readers reflect on a complete representation of the story.

Keywords: mood congruence, negativity bias, valence, narrative comprehension, language understanding

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Imagine reading a story about two friends: They are rushing to a computer store to get a deal before the store closes. As you read, you know that the story permits one of two outcomes: Either they get their deal or they do not. Will you attend differently to the ending as a function of its positive or negative valence? Now suppose that this anecdote about the two friends occurs in the context of a novel. What you read in the earlier chapters may very well have induced you to be in a happy or a sad mood. Will the valence of your present mood—positive or negative—affect the way in which you process the outcome of the friends' sprint to the computer store? Will your mood influence your reading even though it was induced by content completely unrelated to the two friends' anecdote?

In this paper, we present two studies that explore whether the positive and negative content of story endings and readers' moods affect how people comprehend the stories they read. In particular, we focus on how the valence of story outcomes and readers' mood—either of which can be positive or negative—interact when readers process and reflect on happy and unhappy endings.

Consider the valence of story outcomes. Narratives permit both positive and negative endings: Teams win or lose; villains get captured or remain free. To date, theories of text processing have not focused on how the valence of story endings affects the processing of narratives. However, research suggests that this is a topic of much potential importance. In fact, positive information and negative information are known to be processed differently. In particular, researchers have documented a strong negativity

bias, or a heightened sensitivity to negative information, at different levels of cognitive processing (for a review, see Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001). For instance, negative attributes exert greater influence on judgments and persuasion (Herr, Kardes, & Kim, 1991), negative traits have greater influence on forming an impression of another person (Peeters & Czapinski, 1990), and negative information has a greater impact on evaluative categorizations than positive information (Cacioppo, Gardner, & Bernston, 1997; Ito, Larsen, Smith, & Cacioppo, 1998). These effects often rely on the fact that negative information has a strong attention-capturing quality: negative stimuli are detected faster (Dijksterhuis & Aarts, 2003), draw more attention (Pratto and John, 1991; Smith, Cacioppo, Larsen, & Chartrand, 2003), and are more difficult to divert attention from (McKenna & Sharma, 1995; Pratto & John, 1991). Thus, the research literature leads to the strong prediction that negative outcomes (as compared to positive outcomes) will command more attention in moment-by-moment comprehension.

Mood, however, may counteract or modulate this negativity bias. Prior research demonstrated that mood affects how people process information. In particular, people process information more carefully when it is consistent with their mood. This often results in facilitated recall of mood congruent information and in the formulation of mood congruent judgments and evaluations (for a review, see Martin & Clore, 2001). For this reason, we might expect, for example, that positive information would have a greater influence on comprehension than negative information, when a reader is experiencing a positive mood.

The influence of mood on judgments and on information processing depends crucially on the requirements of the process. The more extensively people have to process information to compute a response, the more likely mood will influence the process (Forgas, 1995; Bower & Forgas, 2000; Watkins, Mathews, Williamson, & Fuller, 1992). For example, mood does not affect the retrieval of already formed judgments (Fiedler,1991; Forgas, 1995), but it affects the formation of novel judgments and impressions (Forgas, 1992; Forgas & Bower, 1987). Mood does not affect *perceptual* implicit memory tasks, such as the identification of a word presented for only a few milliseconds and then masked. However, it affects *conceptual* implicit memory tasks where the level of elaboration of the stimulus is greater, such as forming word associations and finding words that fit a definition (Watkins, 2002; Watkins, Martin, & Stern, 2000). Mood also affects *explicit* memory tasks which involve even greater level of stimulus elaboration, such as the recall of word lists, personal experiences, or events from a narrative (Bower, 1981; Bower, Gilligan, & Monteiro, 1981).

Research prompted by the Affect Infusion Model (Forgas, 1995) has argued that the effect of mood on social judgments varies along a processing continuum, which has its strongest influence on *substantive processing*. This type of processing underlies the formulation of novel judgments for which people have to "select, learn, and interpret novel information about a target and to relate this information to preexisting knowledge structures" (Forgas, 1995, p.47). For example, substantive processing is not used in retrieving a judgment of a target for whom a prior opinion or stereotype exists, but it is used in the formulation of a completely novel judgment, where target information needs to be compared to and integrated with the judge's knowledge and beliefs. More complex,

atypical tasks or targets involve higher levels of substantive processing. More generally, tasks that require handling a larger amount of information at once or that need a more extensive search in long-term memory involve higher levels of substantive processing than do tasks that require handling less information or performing a narrower memory search. Tasks that involve a higher degree of substantive processing are also more sensitive to the effects of mood (Fiedler, 2001; Forgas, 1995; Bower & Forgas, 2001). [1]

This conceptual framework offers a useful framing for the potential effects of mood on the comprehension of valenced text. Specifically, mood should have a greater influence on readers' experience of valenced narrative endings when a higher degree of substantive processing is employed. To test this hypothesis, we used two tasks that required readers to engage in lesser or greater amounts of substantive processing: moment-by-moment integration and reflection. The measures collected were, respectively, reading latencies and judgments.

Theories of narrative processing have typically considered reading latencies and judgments to index the same cognitive process. For example, in prior work in our lab (e.g., Rapp & Gerrig, 2002, 2006) the patterns of data converge for moment-by-moment reading and reflective judgments. Still, such a convergence between the measures is not necessarily the rule. For example, it is well known that readers understand characters' actions in reference to the most local goal (Magliano & Radvansky, 2001; Suh & Trabasso, 1993). However, this generalization holds for moment-by-moment integration processes, but not necessarily for reflective processes. Readers understand characters' actions in reference to a recent, local goal during moment-by-moment reading, and in reference to a more urgent, distal goal when formulating judgments (Egidi & Gerrig,

2006). Recent neuroimaging studies also support the dissociation between natural comprehension and reflective processing of language as they show that the two rely, at least partially, on different functional networks (e.g., Hasson, Nusbaum, & Small, 2006). During sentence comprehension, frontal regions and left temporal regions show increased activation when participants judge the sensibility of sentences as compared to when they listen to the sentences for comprehension (Hasson, Nusbaum, & Small, 2006).

Based on this dissociation, we suggest that integration and reflection engage different levels of substantive processing because they differ in the amount of information they require readers to handle at once and in the type of elaboration applied to that information. Reading often prompts integration with a large amount of information, especially when access to distal portion of the text is necessary (Albrecht & Myers, 1995, 1998; Gerrig & O'Brien, 2005), but such access does not always take place (Egidi & Gerrig, 2006; McKoon & Ratcliff, 1992; O'Brien & Myers, 1999). In contrast, the judgment task we use involves the formulation of a novel judgment (that presupposes successful integration) and by definition requires evaluating the ending of a story with respect to a large amount of information—i.e., the entire story.

How then should ending valence and mood affect these two processes? Consider this brief story from our experiment:

Danny and Claire had rehearsed their dance several times. During the competition, Claire almost slipped once. They got right back on track and kept going. Afterward, they asked their coach how she thought they did. "We'll have to see if the judges think you made a mistake," she said. They waited for the judges to announce the scores.

To assess integration processes, we asked participants to read the narratives for comprehension and measured reading time on the ending sentence, "The judges gave Danny and Claire low marks." (Experiment 1). To assess reflective processes, we asked participants to judge how surprising they found the positive or negative ending (Experiment 2). In Experiment 1, because negative information tends to capture attention, we expected that negative endings would constrain integration processes during reading. However, we expected people's mood to have a limited influence on moment-by-moment reading comprehension, because integration requires a degree of substantive processing that may not be sufficient for mood to have a strong impact.

Depending on the task and the cognitive processes mediating it, negative information has been associated with either increased or decreased task latencies. For example, in visual searches negative stimuli are detected faster (e.g., Hansen & Hansen, 1988) because the attention-capturing quality of negative information makes negative stimuli easier to detect. However, in tasks such as the Stroop or lexical decision, negative words are associated with longer latencies, because attention is disengaged more slowly from negative words (e.g., Estes & Adelman, 2008; Pratto & John, 1991). As a consequence, responses to other aspects of the stimulus, such as its color or its lexical status, become more difficult. In the case of the moment-by-moment integration during reading, we expected that negative information would lead to longer latencies. We suggest that negative information would be devoted more attention and, therefore, it would either be processed more carefully or be integrated with greater difficulty.

By contrast, in Experiment 2, we expected the judgment task to engage sufficient substantive processing to yield mood effects. Thus, we expected to see a mood

congruence effect in which participants judge endings that are inconsistent with their mood as more surprising.

Experiment 1

The goal of this experiment was to investigate the possibility of negativity bias and mood congruence in readers' integration of story outcomes. We predicted that participants would take longer to read endings with negative valence (compared to positive valence). Because moment-by-moment reading involves a moderate degree of substantive processing, we did not expect to see a strong impact of mood on this bias.

This experiment had three phases. In the baseline test phase, participants read brief stories with positive or negative endings and we measured their reading times for those endings. This allowed us to assess the baseline impact of ending valence on reading time independent of readers' mood. The second phase was the mood induction phase. Participants read a separate group of stories that we intended would induce either a happy or sad mood. In the post-induction test phase, participants read additional stories with positive or negative endings and, once again, we measured their reading times. This allowed us to compare how participants read the endings when feeling in a positive or negative mood to how they had read these endings when feeling in a more neutral mood. Participants read half the stories in the baseline test phase and half in the post-induction test phase.

Method

Participants. Ninety-five undergraduates from Stony Brook University participated in this experiment for research credit (forty-seven in the positive and forty-eight in the negative mood group). All were native speakers of English.

Materials. We used 40 stories to induce moods and 20 neutral stories to test the effect of mood and ending valence on comprehension. The mood inducing stories consisted of jokes and sad stories of various lengths. Table 1 provides examples. We used a norming procedure to select stories that would be effective at making participants feel either cheerful or sad. We created a questionnaire that contained 34 funny stories and 22 sad stories in random order. Twenty-one native English-speaking undergraduates read these stories. For each story they indicated how it made them feel on two scales. The first scale ranged from 1 (*Happy*) to 7 (*Sad*) and the second one from 1 (*Cheerful*) to 7 (*Gloomy*). Because the two scales were highly correlated ($r = .99$), we combined them to create a single measure of affective response. On the basis of this norming we selected 25 positive ($M = 2.50$) and 15 negative stories ($M = 5.99$). This difference was statistically reliable in both participant (t_1) and item (t_2) analyses: $t_1(20) = -15.02$, $p < .001$; $t_2(38) = 45.53$, $p < .001$. The two groups of stories also differed in their distance from the extremes of the scale. Negative stories were closer to the negative extreme (7) of the scale than the positive stories were to the positive extreme (1) of the scale ($t_1(20) = 2.87$, $p < .05$; $t_2(38) = 6.35$, $p < .001$). This difference might indicate that negative stories generated a more extreme affective response. However, both groups of stories were significantly distant from the midpoint of the scale (Positive stories: $t_1(20) = -8.88$, $p < .001$; $t_2(24) = 35.81$, $p < .001$; Negative stories: $t_1(20) = 17.39$, $p < .001$; $t_2(14) = -28.28$, $p < .001$).

Finally, because we intended to induce different moods in different groups of participants, the stories we chose were also comparable in total number of syllables (positive stories = 4136; negative stories = 4227). For the mood induction phase of

Experiment 1, we distributed the stories in two questionnaires, one of which contained the happy stories and the other one the sad stories.

The test stories that appeared before and after the mood induction phase were 5 to 8 sentences long. The first few sentences introduced a scenario that was followed by one sentence stating either a positive or a negative ending. Each story had two versions: one with a positive ending and one with a negative ending. We constructed the stories so that each ending would be a natural conclusion and readers would not expect either one of them (on the basis of a norming study, as detailed below). In addition, the bodies of the stories were emotionally neutral and did not contain affectively valenced language (i.e., words such as sad, happy, worried, elated). For each story, we minimized the lexical and semantic overlap between the endings and the rest of the story. In those cases in which some overlap was inevitable, we ensured that both positive and negative endings shared the overlap. All ending sentences were between 9 and 11 syllables long, and shared similar syntactic structure. We took these precautions so that it would be possible to compare the reading times of these sentences. The stories ended with a final sentence that was neutral with respect to the prior context. Table 2 provides sample stories.

To ensure that participants would not find either ending more likely than the other, we normed the test stories. We wrote 26 candidate stories and distributed them into two booklets. Thirty native English speaking undergraduates read each story without its ending. They then rated how surprising they found either the positive or negative ending of the story on a scale from 1 (*Not surprising at all*) to 9 (*Extremely surprising*). To ensure that participants would use the entire range of the scale, we added 12 filler stories, half of which were followed by obvious endings and half by unexpected endings.

The distribution of positive and negative endings was counterbalanced and equated across questionnaires and the order of the stories was randomized for each participant. After this norming, we chose 20 stories such that the mean surprise ratings for the positive endings ($M = 3.63$) were quite similar to those for the negative endings ($M = 3.52$; $t_1(29) = -.650$, $p = .521$; $t_2(19) = 0.631$, $p = .535$). For most of these stories, the positive and negative endings had the same number of syllables and a few differed by one syllable only. Overall, the average number of syllables for positive and negative endings was identical ($M = 10.2$). We used 10 of these stories in the baseline-test phase and 10 in the post-induction test phase. Half of the stories used in each phase had positive endings and half had negative endings. We used a Latin square to distribute the stories to eight different lists in a counterbalanced fashion.

Additionally, we constructed five stories similar to the test stories in length and structure to be used as practice stories. For each of the practice and experimental stories we wrote comprehension questions that we used to ascertain that participants would read carefully. For the test stories half of the correct answers to the questions was "yes" and half was "no" in a counterbalanced fashion.

Design. Participants read stories with positive or negative endings after being induced into a positive or negative mood. Thus, the design consisted of a between-participants and within-items variable, Mood Valence (Positive, Negative) and a within-participants and within-items variable, Ending Valence (Positive, Negative).

Procedure. The experiment had three phases: a baseline test phase, a mood induction phase, and a post-induction test phase. The two test phases were conducted on a computer that recorded reading times and responses to comprehension questions. The

mood induction phase was conducted on paper. Our aim was to diversify the procedures

so that participants would not see a connection between the mood induction phase and the

test phases. As a cover story, we told participants that they would complete two separate

studies.

In the baseline test phase, participants read a set of stories on a computer screen.

Before each story the sentence "Press NEXT for the next story" appeared on the screen

and participants hit a key marked as "NEXT" to start. The stories appeared in a different

random order for each participant, line by line, in the center of the screen and in standard

upper and lower-case type. Participants pressed a key to advance the lines and continue

reading. At the end of each story, participants heard a warning sound from the computer

and saw the prompt, "Is the following statement true?", followed by a comprehension

sentence. If they thought that the sentence was true, they pressed the key marked as

"YES". If they thought it was not true, they pressed the key marked as "NO". After giving

their response, they received feedback (i.e., "CORRECT" or "INCORRECT"). Participants

were instructed to read everything carefully and to respond as quickly as they could

without making mistakes.

Participants began the experiment by reading the five practice stories. At the end

of the practice the software notified them that the experimental session was about to

begin. Then they proceeded to read the first block of stories, which consisted of the first

test phase. At the end of this block, when participants hit the key to begin a new story, a

fake error message appeared on the screen. When they notified the experimenter, she

apologized and suggested that they complete the other study—which consisted of reading

the mood induction stories—while she figured out the problem. The experimenter told

them that once they finished the other study, they could return to the computer and continue from where they had been interrupted. We intended this ruse to allow us to induce moods in participants without them suspecting that the mood induction stories were related to the test stories. In fact, directing people's attention to their affective states has been shown to give rise to demand effects and trigger strategic processing that reduces the effects of mood (Berkowitz, Jaffee, Jo, & Troccoli, 2000; Martin, 1990).

In the mood induction phase, participants moved to an adjacent room and completed one of the mood inducing questionnaires. To ensure that participants would read carefully, we asked them after each story to rate how interesting they found the story on a scale from 1 (*Boring*) to 9 (*Interesting*). We told participants that this was a norming study and briefly explained the general procedure and function of a norming. We instructed participants to read the stories carefully and to respond by expressing their opinion.

The order of the stories was randomized for each participant. However, the last page of each questionnaire was the same for all participants and contained four questions. Three were filler questions about the stories and one asked participants to rate how they felt at that time on a scale from 1 (*Happy*) to 9 (*Sad*). The purpose of this question was to assess whether the mood manipulation was successful. We introduced the filler questions to hide the real purpose of the questionnaires and avoid experimental demand effects on mood ratings. Finally, to ensure that the experimenter would remain blind to the mood manipulation, we stored and distributed the questionnaires text-side down so that the experimenter could not see which group of stories they contained and would not be aware of which mood they would induce.

When participants had completed this phase, they were given a fake debriefing about the purpose of the norming study they had just completed. Then they returned to the computer room to complete the interrupted study. This started the post-induction test phase. Participants were briefly reminded of the instructions and completed the reading of the test stories. Finally, participants completed a 4-question survey that again contained three fillers and a question asking participants to rate how they felt on a scale from 1 (*Happy*) to 9 (*Sad*). The aim of this question was to assess whether the mood induction was effective throughout the experiment. Immediately before the debriefing, participants were asked what they thought the study was testing. We intended this brief interview to assess whether participants had had any suspicion about the experimental manipulation of mood. None of them reported any suspicion.

Results and discussion

Mood induction. At both stages of the experiment, participants who read happy stories rated themselves as being in a better mood than participants who read sad stories. Following the mood induction mean ratings were 2.62 (smaller numbers indicate greater happiness) for the group who read happy stories and 7.02 for the group who read sad stories ($t(93) = -16.78$, $p < .001$). At the end of the study, participants gradually returned to more neutral moods, but still rated themselves differently: The average rating were 3.55 for participants who had read the happy stories and 4.19 for participants who had read the sad stories ($t(93) = -2.02$, $p < .05$).

Reading latencies. To measure how participants integrated positive and negative endings during reading, we collected their reading latencies for the ending sentences. We started the analysis by removing errors and responses more than three standard deviations

above and below each condition's mean. This procedure resulted in a loss of 1.94% of the data. Table 3 shows the pattern of results.

We had expected that a negativity bias would emerge in the reading latencies and that mood would not exert a great influence on this bias. Thus, we expected that negative endings would take longer to process than positive endings in both test phases. In fact, participants read negative endings 152 ms slower than positive endings across both test phases. This result was confirmed by analyses with participants (F_1) and items (F_2) as random variables ($F_1(1,79) = 44.07$, $MSe = 44992.85$, $p < .001$; $F_2(1,16) = 7.51$, $MSe = 119642.46$, $p < .05$)

Recall that the baseline test phase occurred before the mood induction phase. Therefore, the pattern of reading latencies of this phase reflects how participants processed positive and negative endings in a relatively neutral mood. In the post-induction test phase, however, participants had been induced into a positive or a negative mood. As a consequence, the reading latencies of this phase reflect how mood modulated participants' reading of positive and negative endings. As seen in Table 3, mood did not have a strong impact; there was no interaction of negativity bias with mood (interaction Fs < 1). Finally, in the post-induction test phase participants read the endings faster than in the first test phase ($F_1(1,79) = 15.62$, $MSe = 65822.23$, $p < .001$; $F_2(1,16) = 40.85$, $MSe = 10248.88$, $p < .001$). This difference most likely reflects practice effects in performing the experimental task. No other effect was reliable in both participant and item analyses.

In conclusion, this first experiment supported the prediction that, during moment-by-moment reading, participants would succumb to a bias to attend at greater length to

information with a negative valence. We did not find mood congruence. However, we expected that the relative impact of ending valence and mood would shift when readers engaged in evaluations of positive and negative endings. We investigated these circumstances in Experiment 2.

Experiment 2

The goal of this experiment was to investigate the impact of mood on participants' judgments of story endings. We predicted that participants' judgments would be influenced by mood valence because this kind of judgment requires a high degree of substantive processing. In particular, we expected that participants would find endings congruent with their moods to be more likely, thus showing mood congruence. This experiment had two phases. The first consisted in the mood induction. As in Experiment 1, we induced participants to experience positive or negative moods by reading happy or sad stories in a mock norming study. During the second phase—the test phase—participants read the test stories on paper and judged how surprising they found either the positive or negative endings. We later compared those ratings to those provided by a control group whose mood had not been experimentally manipulated. [2]

In Experiment 2, we only asked participants to rate their moods at the end of the experiment. We were unable to use a ruse like the fake error used in Experiment 1, but we still wanted to minimize the chance that participants would understand the purpose of the experiment. For this reason, it seemed prudent to assess mood just a single time at the experiment's conclusion (as in, e.g., Forgas 1998a, 1998c). Given that we used the same mood inducing method and materials as in Experiment 1, we believed that the manipulation would work just as well.

Method

  Participants. Sixty native English speakers, undergraduate students from Stony Brook University participated in this experiment for partial fulfillment of course requirements. Thirty were induced a positive mood and thirty a negative mood.

  Materials. We used the same mood induction and test stories from Experiment 1. However, we did not use the final sentences of the test stories.

  Design. Participants rated their surprise in reading positive or negative endings in the context of a positive, negative, or neutral mood induction. Thus, the design consisted of a between-participants and within-items variable, Mood Valence (Positive, Negative, Neutral) and a within-participants and within-items variable, Ending Valence (Positive, Negative).

  Procedure. Both the mood induction and post-induction test phase were conducted with paper and pencil. To diversify the two phases enough that participants would not see a connection, we told them that they would be completing two separate studies. These were presented as two norming studies for two different future experiments. After we explained the general procedure and function of a norming study, we gave participants the same mood induction stories as in Experiment 1. Care was taken to ensure that the experimenter would not influence participants by storing and distributing the questionnaires text-side down, as in Experiment 1.

  After participants had filled out the mood induction questionnaire, we gave them the second booklet containing the test stories. In this experiment, participants read each story and then rated how surprising they found the ending on a scale from 1 (*Not surprising at all*) to 9 (*Extremely surprising*). Note that this task was quite different from

the task in which participants engaged while reading the mood inducing stories. Here, participants evaluated how surprised they were by the endings with respect to the stories to which they belonged. In the mood induction questionnaire, they gave an overall judgment about how interesting they found each story in its entirety.

After participants completed this phase, we asked for their opinions about the purpose of the two future studies for which they had just read stories. We conducted this brief interview to assess whether participants had had any suspicions about the real purpose of the experiment. Only one participant had. The pattern of results was the same whether or not his data were included in the analysis. Therefore, we report here data from the total number of participants.

Finally, before the debriefing, participants completed a survey of ten questions allegedly about the experiments they had just completed. The survey actually assessed the success of the mood induction. The first question asked participant how they felt right after they had read the mood inducing stories; the second one asked participants how they felt at the end of the experiment. Participants rated their mood on a scale ranging from 1 (*Happy*) to 9 (*Sad*). The other questions were fillers that we introduced to hide the real purpose of the survey and, thus, minimize demand effects on the mood ratings.

Results and discussion

Mood induction. Participants who read happy stories rated themselves as being in a better mood after the mood induction, but this difference did not endure to the end of the experiment. The mean ratings to the question assessing how participants felt after reading the mood induction stories were 2.73 and 5.97 for participants in the positive and

negative mood conditions respectively ($t(58) = -8.34$, $p < 001$). However, participants'

responses to the question that assessed their mood after completing both stages of the

experiment were 4.77 and 4.63 for participants who had read the happy and the sad

stories respectively ($t < 1$).

Surprise ratings. To measure how participants evaluated story endings as a

function of their mood, we collected participants' ratings on how surprising they found

the endings. We expected that mood would influence these judgments in a mood-

congruent fashion, so that participants would judge as more surprising endings

mismatching their mood in valence. As Table 4 shows, participants in the positive mood

condition rated positive endings as less surprising than participants in the negative mood

condition. They also judged negative endings as more surprising than participants in the

negative mood condition.   This resulted in a reliable interaction between mood and

ending valence ($F_1(1,56) = 6.68$, $MSe = .371$, $p < .05$; $F_2(1,18) = 25.44$, $MSe = .066$, $p <$

.001). Thus, participants' level of surprise for positive and negative endings varied as a

function of their mood. No other effect was reliable in both the participant and item

analyses.

Additionally, we wanted to determine whether both moods created a shift in

surprise judgments with respect to a baseline neutral mood. Therefore, we conducted an

analysis that included data from a group of participants whose mood had not been

experimentally manipulated. These were the 30 participants who took part in the

norming of the stories and who, with the same procedure used in this experiment, had

rated these positive and negative endings as equally surprising. Although we did not

measure the moods of these participants, we assumed that, on average, their moods were

neutral (as in, e.g., Forgas, 1998b). For this analysis, we subtracted the ratings of this neutral norming group from those given by the participants in positive and negative moods. As shown in Table 4, participants in the positive mood condition found negative endings more surprising than did participants in neutral moods and found positive endings equally surprising (this difference was in fact 0). Conversely, participants in the negative mood condition found positive endings more surprising than did participants in neutral moods, and found negative endings equally surprising (this difference was also 0). This pattern resulted in a reliable interaction of these difference scores ($F_1(1,56) = 6.68$, $MSe = .371$, $p < .05$; $F_2(1,18) = 25.44$, $MSe = .066$, $p < .001$), indicating that surprise judgments for positive and negative endings were mediated by mood. Although the predicted interaction was reliable, post-hoc contrasts did not reveal significant differences between the pairs of means within each mood. However, the interaction pattern itself shows that surprise ratings for positive and negative endings were mediated by mood in a way that corresponds to mood congruence.

General Discussion

Our experiments investigated how the valence of story endings and readers' mood influenced readers' experience of a narrative. Our aim was to provide a broad perspective on reading processes, so we considered how mood and valence interact when readers are engaged in either moment-by-moment integration or deliberate reflection on the materials. These processes represent typical activities that occur when readers process narratives. Thus, our experiments provide a comprehensive picture of the reading process, from the emergence of moods generated by the text itself to the impact of such moods on further moment-by-moment reading and subsequent reflective

processes.

We hypothesized that during moment-by-moment reading, negative endings would attract greater attention and result in slower latencies. We also hypothesized that mood would be more likely to have an impact when a higher degree of substantive processing is required. Thus we expected that mood congruence would be more likely to emerge in readers' judgments of the stories' endings than during moment-by-moment integration. The experiments corroborated these predictions.

Our examination provides an initial step on a topic relatively unexplored by language comprehension theories, as this literature has largely overlooked the effect of mood or ending valence on comprehension. Only a few studies have focused on affective responses generated by narratives and even these studies have limited their scope to transient states such as preferences and desires (Allbritton & Gerrig, 1991; Rapp & Gerrig, 2002, 2006). For this reason, the theoretical basis for our predictions was largely drawn from studies that have examined negativity bias and mood congruence effects in other domains of cognition.

The current results show that the effect of mood differs in an important way from the effect of transient emotional states on language comprehension. Transient states (e.g., wishing for a specific plot outcome; Rapp and Gerrig, 2002, 2006) have been shown to affect both reading times and participants' judgments about what is likely to happen next in a story. In contrast, the effects of mood appeared to be more subtle and held only when participants were asked to reflect on the story in its entirety. One reason for the dissociation between transient states and mood effects might be the fact that in prior studies on narrative processing, transient wishes and preferences for one specific plot

outcome were related to the narrative in a way that moods are not. By including semantic content that can match or mismatch the actual outcome, readers' wishes for a specific story outcome bear directly on the integration process of a given outcome because they have direct relevance for the story. For example, in one story used by Rapp and Gerrig (2006) the text created a preference for a runner to lose a race by noting that she had taken steroids earlier. The content of this wish (e.g., "I hope she does not win!") is directly relevant to the actual outcome that the character wins or loses the marathon. To date, the evidence on the extent of the similarity between readers' wishes and mood is too sparse for us to be able to go beyond this speculation. We expect that, as research develops, the circumstances in which the influence of transient states and mood diverge or converge will become clearer.

In Experiment 1, participants read negative endings more slowly than positive endings. We suggested that, due to the attention-grabbing quality of negative information, negative endings are devoted more careful processing or are more difficult to integrate. It is possible, however, that increased latencies for negative endings may reflect readers' updating of characters' emotional status (as in Komeda & Kusumi, 2006). Readers may tend to attribute a mildly positive emotional state to the story characters as a default, and therefore need to update their model of characters' emotional status when the character experiences a negative event. Although readers can form representations of characters' emotional states (e.g., Gernsbacher, Goldsmith, & Robertson, 1992), updating effects of the type we outline above have only been documented with stories whose main theme was the emotions experienced by the character (Komeda & Kusumi, 2006). Note that we constructed our stories to be as emotionally neutral as possible; they never

mention characters' emotional states. In addition, as indicated by the results of the norming, our stories prepared readers equally well for positive and negative endings.

In Experiment 2, participants judged as more surprising those endings that mismatched their mood. We interpreted this pattern to be an instantiation of a mood congruency effect. An alternative explanation for these results is that once participants were induced into a given mood (by reading valenced materials), they later came to expect that the following materials would be of the same valence. On this explanation, surprise ratings reflected an expectancy mechanism rather than a genuine influence of mood. The main problem with this alternative account is that if the strategic expectancy mechanism were put into place because participants had read the mood-inducing stories, then similar expectancy effect should have held in Experiment 1 as well. Additionally, our test stories were very different in form from the mood inducing stories. We also presented the mood-inducing and the test phase as two separate studies, to minimize the possibility that participants would expect the second part of the experiment to be commensurable with the first.

In summary, the current results allow us to outline a model of how mood and text valence can affect narrative comprehension. The valence of the stimulus and the valence of people's mood weigh differently on moment-by-moment comprehension and subsequent reflection. It is possible that a replication with a different mood induction technique or a larger sample would show an emergence of mood effects during moment-by-moment reading. However, our experiments suggest that reflective processes are more sensitive to readers' mood than integration processes.

These findings also indicate that theories of text processing can benefit from considering the effects that reader's mood has on text comprehension. While the focus of such theories is prominently on the processing of information that readers encounter in the text, this research demonstrates that the internal emotional state of the reader influences some of the processes involved in narrative comprehension.

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Authors Note

Footnotes

[1] Mood can also have an impact on judgments if used as a heuristic that triggers a response bias (e.g., Schwarz & Clore, 1983). Also, negative mood leads to more careful processing of material (Forgas, Laham, & Vargas, 2005) and to longer processing times than does positive mood (Forgas, 1992; Forgas & Fiedler, 1996). We will not discuss these effects of mood here because they are not relevant for the current research.

[2] We take participants' *ratings* of story endings to be a measure of their estimates of the predictability of those endings given prior context, which is an intuitive way to ask for a probability judgment, a task that involves reflective processing. We are not measuring here surprise as a visceral or emotional response. To experience surprise, participants would have had to take the endings to be true in the context of the story and, as a consequence, experience that emotion. However, here participants read each story up to the ending and were told *before* they read the ending that they would have to evaluate it. Thus, the status of the ending was that of information to be evaluated.

Table 1

Two examples of mood inducing stories.

Story inducing a positive mood

The pill that makes you fly

A man went into a bar in a high rise. He saw another man take a pill, take a drink, walk to

the window and jump out. He flew around for a minute and zipped back into the bar.

As the amazed newcomer watched, the man repeated this twice more. Finally the man

asked if he could have a pill. The flier said it was his last one. The man offered five

hundred dollars to no avail, so he made a final offer of a thousand dollars. The man said

that it was all he had on him. The flier reluctantly gave in, took the cash, surrendered the

pill, and turned back to the bar. The man took the pill, took a drink, went to the window,

and jumped out only to fall to his death. The bartender walked over to the flier at the bar

and, wiping a glass, said, "You sure are mean when you're drunk, Superman."

Story inducing a negative mood

Darfur

When Alawi reached Kounoungo, the camp was already overcrowded. The militia had

burned down Alawi's village and he had to run away. He had hoped to find rest and

some food in the camp. But when he saw Kounoungo he understood that his hopes were

in vain. Although less than six months old, the camp already sheltered too many

refugees. Alawi had to beg for food in the nearby villages, because there was none left in

the camp. Tortured by stomach cramps, he had to wait in line for hours to get a half

gallon of water. Diseases had started to spread and the relief workers didn't know what

to do. Some of them had started to leave the camp. Alawi, and many others, understood

that the relief workers were giving up.

Table 2

Two examples of test stories.

Danny and Claire had rehearsed their dance several times. During the competition, Claire almost slipped once. They got right back on track and kept going. Afterward, they asked their coach how she thought they did. "We'll have to see if the judges think you made a mistake," she said. They waited for the judges to announce the scores.

Positive ending: The judges gave Danny and Claire high marks.

Negative ending: The judges gave Danny and Claire low marks.

Final sentence used only in Experiment 1: Then they announced the scores of the next couple.

Comprehension sentence: Danny and Claire danced together.

Ed and Frank were browsing the Internet to buy a new computer. Ten days earlier they had found sales on a couple of websites. One offer in particular seemed to match their needs and their budget, but they could not remember how long the offer would be valid. They went on the website and looked again.

Positive ending: The online deal was still available.

Negative ending: The online deal had already expired.

Final sentence used only in Experiment 1: It was a discount on a new model.

Comprehension sentence: Ed and Frank weren't sure whether the deal they wanted was still available.

Table 3

Results of Experiment 1: Participants' mean reading latencies and standard deviations by participant (in milliseconds) for story endings as a function of participants' mood.

Mood	Baseline Test Phase			Post-Induction Test Phase		
	Positive Ending	Negative Ending	*mean*	Positive Ending	Negative Ending	*mean*
Positive	1908 *(483)*	2019 *(456)*	*1963*	1800 *(475)*	1964 *(480)*	*1882*
Negative	2060 *(526)*	2205 *(618)*	*2133*	1916 *(515)*	2101 *(563)*	*2008*
mean	*1984*	*2113*		*1859*	*2033*	

Table 4

Results of Experiment 2: Participants' mean ratings of story endings as a function of participants' mood, standard deviations (by participant), and mean rating difference between participants in the two mood groups and a group of participants whose mood was not manipulated.

	Mean Ratings		Mean Ratings Difference	
Mood	Positive Ending	Negative Ending	Positive Ending	Negative Ending
Positive	3.60 *(1.03)*	3.83 *(1.07)*	-0.03	0.31
Negative	3.84 *(1.14)*	3.50 *(0.94)*	0.21	-0.02