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Do Emotions Facilitate Integration During Reading?

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Abstract

This project examined how positive versus negative emotions influenced integration and memory for text. This study utilized an emotion induction procedure followed by an experimental reading task from O'Brien and Cook's inconsistency paradigm (2014). The results replicated traditional inconsistency effects. In addition, positive emotions had a delayed facilitative effect on integration during reading. After reading, positively induced participants were more likely to comment on the inconsistency during immediate recall, but less likely during delayed recall.

Keywords: Emotion, Comprehension, Processing, Integration

Do Emotions Facilitate Integration During Reading?

Students experience emotions that can enhance or hinder their understanding of a topic. This study focuses on how emotions might augment the processes of comprehension during integration and memory. The PET (Process, Emotion, Task) Framework (Bohn-Gettler, 2019) considers how emotions affect comprehension, and can be used to generate hypotheses to examine how emotions may influence the reading processes of resonance, integration, and validation (O'Brien and Cook, 2014). Within the PET framework (Bohn-Gettler, 2019). Positively-valenced emotions facilitate assimilative and top-down processing, including the use of prior knowledge, the generation of inferences, and applying flexible representations. Negatively-valenced emotions facilitate bottom-up, accommodative processing, enhancing attention to detail, including attention to both task-relevant and task-irrelevant stimuli. In addition, research demonstrates that memories based on a negative experience are often recalled more vividly than those based on a positive experience, sometimes called a *negativity bias* (Egidi & Gerrig, 2009).

This study examined integration by measuring whether participants noticed inconsistencies in text, as well as their post-reading immediate and delayed recall. We expected to replicate prior work on the inconsistency effect (Cook & O'Brien, 2014). Second, based on the PET Framework (Bohn-Gettler, 2019), we must consider the process, emotion, and task when examining how emotions influence reading. If positive emotions facilitate integration, happy-induced participants should be more likely to notice inconsistencies in text. However, the local processing associated with negative emotions could enhance the noticing of inconsistencies.

Method

A total of 106 college-aged participants read a practice story, presented one line at a time, and then answered a yes/no question. They completed the PANAS-X (Watson & Clark, 1994) to obtain a baseline rating of emotions. Participants watched 5-6 minutes of short video clips to induce the emotions of sadness or happiness. They then read 20 stories with comprehension questions (10 experimental, 10 filler; Albrecht & O'Brien, 1993) in the same manner as the practice story. Each contained a target sentence with an event that was consistent or inconsistent with earlier text. A second target sentence measured spillover effects. Slower reading times for an inconsistent target sentence, relative to a consistent target sentence, would suggest the participant noticed an inconsistency. Readers wrote a brief summary of each experimental story at the end of the session (immediate recall) and one week later (delayed recall).

Results

Emotion Manipulation Check. To evaluate the effectiveness of the emotion manipulation, we ran 2 (emotion condition) x 3 (administration time) mixed-model ANOVAs. The dependent variables were the PANAS ratings for sadness (see Figure 1) and joviality (see Figure 2). The results supported the effectiveness of the emotion induction (p-values < .05). This is shown in Table 1.

Table 1

Joviality and Sadness Ratings on the PANAS-X

		Joviality Ratings			Sadness Ratings		
Emotion Condition	PANAS-X Administration	*n*	*Mean (SE)*	*95% CI*	*n*	*Mean (SE)*	*95% CI*
Happy	Baseline	35	3.1 (.15)	[2.81, 3.39]	35	1.74 (.10)	[1.54, 1.95]
	Post-Induction 1	35	3.38 (.15)	[3.10, 3.67]	35	1.49 (.11)	[1.27, 1.72]
	Post-Induction 2	35	3.41 (.16)	[3.10, 3.73]	35	1.43 (.11)	[1.20, 1.65]
Sad	Baseline	38	2.95 (.14)	[2.67, 3.23]	38	1.76 (.10)	[1.58, 1.96]
	Post-Induction 1	38	2.02 (.14)	[1.74, 2.30]	38	2.56 (.11)	[2.35, 2.78]
	Post-Induction 2	38	1.84 (.15)	[1.54, 2.15]	38	2.48 (.11)	[2.27, 2.70]
Neutral	Baseline	33	3.03 (.15)	[2.73, 3.33]	33	1.58 (.11)	[1.37, 1.79]
	Post-Induction 1	33	2.94 (.15)	[2.64, 3.24]	33	1.34 (.12)	[1.11, 1.57]
	Post-Induction 2	33	2.70 (.17)	[2.37, 3.02]	33	1.24 (.12)	[1.01, 1.47]

Figure 1

Sadness Ratings Indicated on the PANAS-X

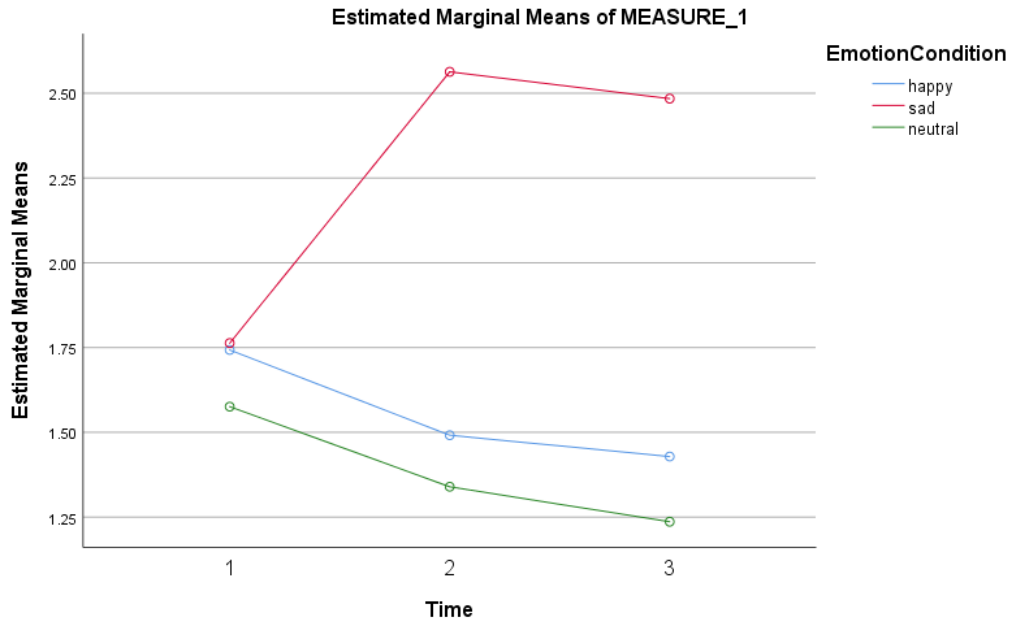
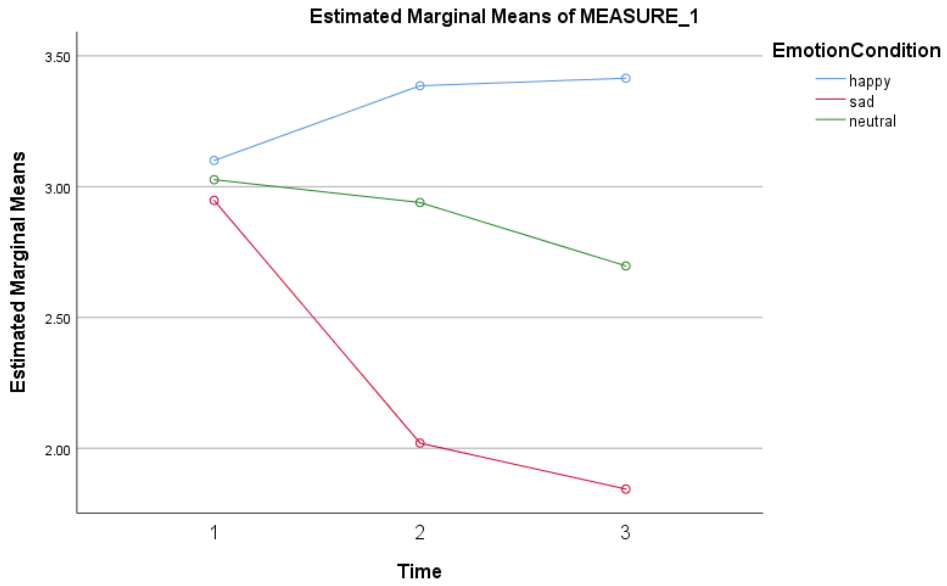


Figure 2

Joviality Ratings Indicated on the PANAS-X



Reading Times. We ran 2 (consistency) x 2 (emotion condition) mixed model ANOVAs. The dependent variables were reading times per word (in milliseconds) for the critical sentences. The results are displayed in Table 2 and Figure 3.

Table 2

Reading Times (in milliseconds) for Critical Sentence 1 and Critical Sentence 2

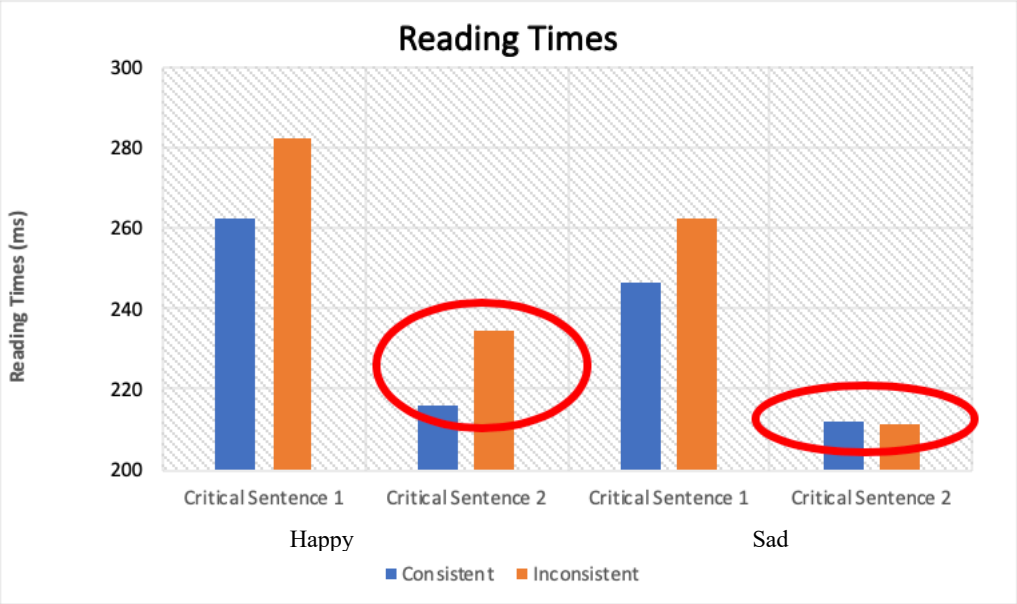
			Critical 1		Critical 2	
Emotion Condition	Consistency	*n*	*Mean (SE)*	*95% CI*	*Mean (SE)*	*95% CI*
Happy	Consistent	35	262.26	[241.54, 282.99]	216.04	[198.18, 233.89]
	Inconsistent	35	282.31	[259.95, 305.67]	234.80	[216.82, 252.79]
Sad	Consistent	38	246.85	[226.96, 266.74]	212.32	[195.19, 229.46]
	Inconsistent	38	262.49	[240.08, 284.91]	211.22	[193.96, 228.48]
Neutral	Consistent	33	245.89	[244.55, 267.24]	209.36	[190.97, 227.75]
	Inconsistent	33	272.59	[248.54, 296.64]	222.83	[204.31, 241.35]

Critical Sentence 1. Participants read inconsistent sentences more slowly than consistent sentences, $F(1, 71) = 6.46$, $p = .01$, $\eta^2 = .08$. No other effects were significant. The results are displayed in Table 2.

Critical Sentence 2. There was a non-significant pattern that inconsistent sentences were read more slowly than consistent sentences, $F(1, 71) = 2.63$, $p < .11$, $\eta^2 = .04$. The interaction was approaching significance, $F(1, 71) = 3.33$, $p = .07$, $\eta^2 = .045$. Happy-induced (but not sad-induced) participants read inconsistent sentences more slowly than consistent sentences. The results are displayed in Table 2.

Figure 3

Reading Times (in milliseconds) for Consistent and Inconsistent Critical Sentences



Recall. The recall data, in terms of how much was remembered, is being coded and analyzed to be presented at the conference. Three codes were also applied to the recall. First, if a participant remarked on the inconsistency during recall, it was marked "commenting". If the participant included the two inconsistent text events in the same or adjacent sentences of their recall, it was marked "local both". If the participant included the two inconsistent text events, but separated by at least one sentence in their recall, it was marked "distal both".

To examine the hypotheses related to noticing and remembering inconsistencies during the recall, we ran two (time: immediate versus delayed; within subjects) x 2 (emotion condition: happy versus sad; between subjects) mixed model ANOVAs. The dependent variables were the frequency with which participants commented on the inconsistency, the frequency of local both codes, and the frequency of distal both codes.

Commenting. The main effect of time was not significant, although there was a trend that more participants made comments at immediate than delayed recall, $F(1, 66) = 3.12$, $p = .08$, $\eta^2 = .045$. The interaction between time and emotion condition was approaching significance, $F(1,66) = 3.12$, $p = .08$, $\eta^2 = .045$. At immediate recall, the participants in the happy condition were more likely to comment on the inconsistency than participants in the sad condition. At delayed recall, participants in the happy condition were less likely to comment on the inconsistency than participants in the sad condition. There was no change in commenting from immediate to delayed recall for the sad-induced participants, but commenting decreased for happy-induced participants. The results are displayed in Table 3.

Local Both. The interaction between time and emotion was not significant, $F(1, 66) = 1.09$, $p = .30$, $\eta^2 = .02$. Although the interaction was not significant, the pattern indicated that at immediate recall, there were no differences between the happy and sad conditions. However, at delayed recall, sad-induced participants' scores increased, whereas happy-induced participants did not change. The results are displayed in Table 3.

Distal Both. The main effect of time was significant, $F(1, 66) = 31.28$, $p < .001$, $\eta^2 = .32$. Participants had higher scores at immediate compared to delayed recall. There were no interactions with emotion. The results are displayed in Table 3.

Table 3

Comments, Local Both, and Distal Both Ideas Recalled

			Commenting		Local Both		Distal Both	
Emotion Condition	*n*	Time	*Mean (SE)*	95% *CI*	*Mean (SE)*	95% *CI*	*Mean (SE)*	95% *CI*
Happy	33	Immediate	.04 (.02)	[.01, .07]	.09 (.02)	[.04, .13]	.38 (.05)	[.28, .47]
		Delayed	.01 (.02)	[-.02, .05]	.08 (.02)	[.03, .13]	.16 (.04)	[.09, .23]
Sad	35	Immediate	.03 (.02)	[-.002, .06]	.09 (.02)	[.04, .13]	.30 (.05)	[.20, .39]
		Delayed	.03 (.02)	[-.004, .06]	.13 (.02)	[.08, .17]	.15 (.03)	[.08, .22]
Neutral	29	Immediate	.03 (.02)	[-.01, .06]	.08 (.02)	[.04,.13]	.39 (.05)	[.29, .50]
		Delayed	.01 (.02)	[-.02, .05]	.07 (.03)	[.02, .12]	.21 (.04)	[.13, .28]

Discussion

Participants read inconsistent sentences more slowly than consistent sentences for the first target sentence, supporting traditional inconsistency effects (O'Brien & Cook, 2014). There was a pattern that inconsistent sentences were read more slowly than consistent sentences for happy-induced participants (although $p > .05$), but only for the second critical sentence. This suggests a delayed but facilitative influence of positive emotion, which may be a function of the assimilative processing associated with positive emotions. After reading, a trend indicated that positively induced participants were more likely to comment on the inconsistency during immediate recall, but less likely during delayed recall. Because these effects were trends, it may suggest that the task was not open-ended enough to be sensitive to the effects of emotion (Bohn-Gettler, 2019). A task requires more constructive processing, such as validation (O'Brien & Cook, 2014), may be more sensitive to emotion. The results can help inform educators regarding how emotions and tasks interact to support learning. Theoretically, this study helps to understand how and whether emotions influence the processes of integration and memory.

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