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Abstract

We examined how readers' online affective and attentional experiences influenced comprehension after reading. Participants were periodically interrupted during reading to assess their affective valence (i.e., their feelings) and whether their minds had wandered away from the text. Results revealed that affective valence and mind-wandering influence levels of comprehension differently: wandering thoughts are overall negative for comprehension and positive valence negatively impacts shallow comprehension while increasing readers propensity to interpret emotion in a text.

Keywords: reading, emotion, mind-wandering, online processing

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To date, most of what we know about the influence of affect on reading comprehension comes from emotion inductions that occur *prior* to reading (Bohn-Gettler & Rapp, 2011; Mills, Wu, & D'Mello, 2019). Such emotion inductions are useful because they allow for direct comparisons of different emotional states. For example, we know that inducing positive emotions facilitates the generation of text-based inferences compared to negative emotions (Bohn-Gettler & Rapp, 2011); and negative emotions may lead to better deep reasoning during reading compared to positive emotions (Mills et al., 2019). These induction studies provide evidence that emotion can play a role in text comprehension, perhaps by influencing different levels of comprehension.

Apart from inducing specific emotion states prior to reading, less is known about how online (i.e., *during* reading) feelings or affect influence comprehension. This is important because emotion states are known to be ephemeral, and may change rapidly along the order of minutes. Our study thus focused on how moment-to-moment changes in individuals' feelings impact how they process a text. We find this a crucial contribution to add to the literature considering that affective states can alter the way we think and how often we stray off task; for example, more negative feelings are related to increased reports of task-unrelated thoughts (TUTs; Smallwood & O'Connor, 2011). Although, this research predominantly exists outside the context of reading comprehension.

The current study assessed how two factors – affective valence and task-unrelated thoughts (i.e., mind wandering) – influenced multiple levels of comprehension. Participants read a text while their affective states and valence were tracked throughout; various components of sentence-level and global comprehension were then assessed after reading (Kintsch, 1988).

Below we address the following research questions: 1) how does affective valence relate to task-unrelated thought during reading?; 2) do affective valence and task-unrelated thought, or an interaction between the two, predict reading comprehension scores at multiple levels?

Method

Participants

Data was collected from 224 students at a Northeastern university who participated for course credit (M_{age} = 19.36; range: 18-25).

Design and Procedure

Participants read six expository texts (6-8 sentences each; Flesh-Kincaid Grade Levels between 10th and 12th) presented one sentence at a time. Probes measured participants' thoughts and affective valence just prior to the interruption pseudo-randomly throughout reading: participants rated their current feelings/valence from 1 (*very negative*) to 9 (*very positive*) and whether their thoughts were wandering off-task from 1 (*fully on-task*) to 6 (*completely off-task*).

After reading, shallow comprehension (memory for surface-level, factual details) was assessed with two multiple choice questions pertaining to surface level details for each text. Participants also wrote one-sentence summaries of each text, which were scored on: *generalizations* (the degree to which the entire text was generalized, or reduced, into meaningful, superordinate terms; Ritchey, 2011), *over-generalizations* (whether participants' generalizations were too superordinate to be specific to a text), *sentence integration* (how many sentences in each text were referenced), *emotion inclusion* (whether participants inserted emotion [textual or non-textual] into their summaries), and *rate of misremembering* (whether participants misremembered the text).

Results

How does Affective Valence Relate to Task-Unrelated Thought during Reading?

A Spearman's correlation test examined the relationship between TUT and affective valence during reading. There was significant negative correlation; more reports of TUT was associated with more reports of more negative affect during reading, $\rho = -.245$, $p < .001$.

How does Comprehension Relate to Affective Valence and Task-Unrelated Thought?

We regressed each comprehension measure of reading comprehension onto affective valence, task-unrelated thought, and their interaction term. All results were computed using linear mixed-effects regression analyses to control for within-subject variability. See Table 1 for a summary of all results.

Affective valence. Participants' affective valence while reading was predictive of two aspects of their reading comprehension. Participants who were feeling more positive had worse shallow comprehension scores, $\beta = -.075$, $p = .019$. Similarly, participants tended to include emotional information in their summaries of the text when having reported feeling more positive during reading, $\beta = -.113$, $p < .001$. There were no effects of affective valence on generalizations, over-generalizations, sentence integration, and misremembering (see Table 1).

Task-unrelated thought. TUT significantly predicted all aspects of comprehension measured in the current study. As expected, TUT had a negative effect on shallow comprehension ($\beta = -.097$, $p = .001$), generalizations ($\beta = -.111$, $p < .001$), sentence integration ($\beta = -.265$, $p < .001$), and included emotion ($\beta = -.080$, $p = .004$). However, reports of TUT were positively related to participants over-generalizing information from the text ($\beta = .057$, $p = .046$) and their tendency to misremember information from the text, $\beta = .216$, $p < .001$.

Possible interaction. No significant effects were found for the interaction term for any of the comprehension measures.

Discussion

We tested six different outcome measures representing various levels of comprehension in an attempt to better understand the impact of momentary changes in readers' thoughts and feelings. Negative feelings during reading were related to better shallow comprehension and less emotion included in readers' interpretations of the text. Experiencing TUT during reading had negative effects on reading generally speaking—this is reflected in both decreased comprehension and increased over-generalizing and misremembering. These results suggest there is an experiential component to reading that continuously impacts how information is updated into readers' situation models. Emotion and thought may continuously change how individuals build their understanding of a text throughout their reading.

Table 1.

Regression output for all models.

Outcome Variables	Task-Unrelated Thought		Affective Valence		Interaction	
	β	p	β	p	β	p
Shallow Comprehension	-.097	**.001***	-.075	**.019***	-.042	.143
Generalizations	-.111	**.000***	.026	.418	.006	.831
Over-Generalizations	.057	**.046***	.009	.743	-.016	.574
Sentence Integration	-.265	**.000***	.027	.390	.033	.241
Included Emotion	-.080	**.004***	-.113	**.000***	.047	.085
Rate of Misremembering	.216	**.000***	-.008	.781	.013	.651

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