Reader's changing emotions related to the construction of a situation model

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When we read a story, we feel several emotions, which change continually. Previous studies have examined the emotions of characters in narratives, but few studies have targeted the emotions of readers. We hypothesized in a situation model that readers' emotions arise from a mismatch of dimensions. In this study, we used word association to investigate the emotions that readers experienced. The time sequential data showed that "surprise" disappeared as the participants read to the end of the story. "Anxiety" arose throughout the story, while "relief" increased when the readers neared the end. "Fear", "thrill", and "romantic" were grouped; "glad", "longing", and "happy" were grouped; and "surprise", "unexpected", and "shock" were grouped. In future studies, we will manipulate the dimensions of causation and time. We hypothesize that emotion will be greater in causally implicit sentences than in causally explicit ones, and that emotion increases in temporally discontinuous sentences versus temporally continuous sentences.

Key words: reading, comprehension, story, emotion, situation model

Introduction

When we read narratives, we often feel several continuously changing emotions. Moreover, we experience one emotion while reading and another after reading. Komeda, Nihei, and Kusumi (2002) found a change in emotions between the first and second readings of a mystery novel. However, no one has studied the emotions that readers feel while reading. One reason may be the difficulty in measuring readers' emotions, since there is no established way to measure emotions during reading. For example, the semantic differential method can obtain affective images, but cannot detect changing emotions of readers. A second problem is the individual differences in readers, who may each feel different emotions when reading the same story. Third, emotions are ambiguous. It can be difficult to distinguish whether an emotion belongs to the reader or to the character in the narrative.

Previous studies have examined the emotions of characters in narratives, but few studies have targeted the emotions of readers. Vega (1996) studied the emotions of characters, and by measuring reading times found that a reader controls his or her reading pace. She concluded that "emotion representations are incidentally constructed and updated to the point where subjects detect whether the protagonist's actions or reactions are emotionally appropriate to the

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situation." Moreover, Vega (1996) found that if characters feel happy, the reader also feels happy, and if they feel sad, the reader also feels sad. Miall (1989) insisted that a reader's affect played an important role in understanding narratives. To demonstrate the importance of emotion, Norman (1981) insisted, "Emotion is a sophisticated set of states reaching its highest pinnacle in the human. The study of emotion is an important field, with important findings and implications for the study of cognition."

Readers construct a situation model when they tie text-based information to world knowledge (van Dijk and Kintsch, 1983). The situation model has five dimensions : "Space", "Causation", "Intentionality", "Protagonists and Objects", and "Time". Emotions are included in the situation model within the dimension "Protagonists and Objects" (Zwaan and Radvansky, 1998).

Many previous studies have investigated the dimensions in situation models, although few studies have investigated more than two dimensions. Friedman and Miyake (2000) showed that spatial and causal information were independent in a situation model. They found that the former was correlated with a measure of spatial working memory and the latter was correlated with a measure of verbal working memory. On the contrary, Zwaan and Radvansky (1998) insisted that time is the most crucial dimension in a situation model. "Narratives can have temporal discontinuities, when writers omit events not relevant to the plot" (Zwaan, 1999).

In this study, we used an association method to collect readers' emotional responses. We think that this method has three merits. First, we can record emotions as a reader reads each sentence and thereby understand changes in the readers' emotions between sentences. Second, we can comprehend which sentences generate a change of emotions. Third, we can visualize the reader's emotions in two dimensions using a correspondence analysis of associated words.

Method

Participants.

The participants in the experiments were 14 Japanese undergraduate students.

Materials.

This study used the short love story in Albrecht and O'Brien (1991)'s study. The story was translated into Japanese and contained 24 sentences (Table 1). We selected this story for three reasons: First, Rizzela and O'Brien (2002) also used it, allowing us to compare our results with theirs. Second, while reading this story, it is important that readers experience a time shift. It is reasonable to use this story to manipulate time sentences. Third, the plot is thrilling and it is not difficult for readers to feel several emotions.

Procedure.

This experiment was a group experiment. The participants read the sentences as they were projected sequentially on a screen. Each sentence was presented for 30 seconds. All the participants were instructed to write down words that they associated with each sentence on reading it (adjectives, adverbs, verbs, nouns, etc.). These words were supposed to reflect what they anticipated in the story, the character's feelings, the reader's affect, and so on. The participants were given 30 seconds to write down the words elicited by each sentence and were instructed to write down as many words as possible.

Table 1. Passage Used in This Experiment

1. サラは，20年以上も前に起こったことを今でも信じられない
   (Sara couldn't believe that it had happened over twenty years ago)
2. サラは，高校生活最後の年に，ジョンと恋に落ちた
   (When she was a senior in high school, she fell in love with John)
3. 二人は結婚したかったが，どちらの両親も大学に行かせたがった
   (They wanted to get married but both of their parents wanted them to attend college)
4. 二人は，駆け落ちをして結婚することを決意した
   (They decided that they would elope and get married)
5. ある晩の遅く，サラは窓からはしごで降りた
   (Late one night, Sara climbed down a ladder outside her window)
6. サラは，夕食後こっそり抜け出して窓の外にはしごを置いたのだ
   (She sneaked out and put the ladder there that everything after dinner)
7. 二人は，夜8時に繁華街で落ち合う計画を立てていた
   (Their plan was to meet downtown at 8:00 p.m)
8. 二人はそれぞれ持っているお金を全部持ってきていた
   (They each had scraped together all the money that they had and took it with them)
9. 彼らは列車でおよそ200マイル離れた小さな町に行こうとした
   (They wanted to take a train to a small town about two hundred miles away)
10. サラは列車に乗ったときのことをまだ覚えている
    (Sara can still remember riding it)
11. その時は，彼女はそれをとてもロマンティックな駆け落ちだと思っていた
    (At the time, she thought it was a romantic way to elope)
12. 列車に乗っていると，彼女は，2人の恋人が別の世界に向かうという内容の昔の映画を思い出した
    (The train reminded her of the old movies in which the two lovers would escape from the rest of the world)
13. 彼女は，客室の光景をまだ覚えている
    (She still remembers the burning coal from its engine)
14. 二人ほどロマンティックな人は誰もいなかった
    (There were very few people on it which made it even more romantic)
15. 目ざした町で降りたとき，サラは泊まるあてがなかったのに気づいた
    (As it came to a stop in the town, Sara realized that they did not have a place to stay)
16. 他に選択肢がなかったので，彼らは，最も安いホテルに泊まることに決めた
    (Having no choice, they decided to stay in the cheapest hotel they could find)
17. 幸運にも，彼らは，泊まる場所を見つけるのにそれほどさまよう必要はなかった
    (Luckily, they didn't have to wander far before they found a place)
18. 朝になって，町役場に行って婚姻証をもらうことにした
    (In the morning, they would go to town hall and get their marriage license)
19. 彼らは，証明書に10ドルかかるとは知らなかったが，結婚するのにそれは必要だった
    (They didn't realize that the license would cost them ten dollars but they needed it to get married)
20. 彼らは，最後の10ドルをそれに費やした
    (They spent their last ten dollars on it)
21. 彼らが駆け落ちして結婚した一週間後，彼らの両親に無事でいることを知らせるために電話をした
    (A week after they eloped and got married, they called their parents to let them know that they were all right)
22. どちらの両親も，結婚の事実をすぐに受け入れた
    (Both of their parents quickly accepted the fact that they were married)
23. 実際に，ジョンの両親は，彼らが他に住む場所を見つけるまで農場に住む場所を提供してくれた
    (In fact, John's parents offered them a place to stay on their farm until they could find another place to live)
24. あれから20年経ったが，サラは，もし農場がなかったとしたらどういう生活をしていたのか，想像することもできない
    (Now twenty years later, Sara couldn't imagine life without the farm)

Note. The sentences used in this experiment were Japanese translation from Albrecht and O'Brien (1991)

Results and Discussion

We used correspondence analysis to locate associated data in two dimensions. We used WordMiner software (Japan Information Processing Service Co.) to extract information from the text, which allowed us to visualize information, count word frequencies, determined temporal sequences, and so on.

There were a total of 982 associated words, 309 (31.5%) of which indicated emotion. Table 2 showed the frequency of varieties of emotion words by reader. The emotion that participants experienced most was anxiety.

Table 2. The Frequency of Emotional Words

Emotional Words	Frequency
Anxiety	14
Happy	9
Glad	6
Relief	5
Hope	5
Expect	5
Regret	5
Fear	4
Surprise	4

Table 3 shows the shifts of the main emotion words. 'Opening' includes from the first to the eighth sentence; 'middle' includes from the ninth to the seventeenth, and 'final' includes from the eighteenth to the end. The temporal data show that "surprise" and "fear" disappeared as the participants reached the end. "Anxiety" was present throughout the story. "Relief" increased as the readers neared the ending.

Table 3. The Shifts of Emotional Words

Emotional Words	Position in The Story			Total
	Opening	Middle	Final	
Anxiety	7	7	7	21
Happy	3	4	8	15
Relief	0	6	6	12
Surprise	7	0	4	11
Glad	3	3	5	11
Regret	0	3	2	5
Fear	4	0	0	4

Figure 1 shows the results of the correspondence analysis. The emotional words were located in two-dimensional space. As a result, "fear", "thrill", and "romantic" arose at the opening and grouped on the positive side of the first component, while "surprise", "unexpected", and "shock" arose at the ending and were grouped on the negative side of the second component. In contrast, "glad", "longing", and "happy" were grouped on the opposite side. Thus, we found that the reader's emotions temporarily changed to two directions while reading.
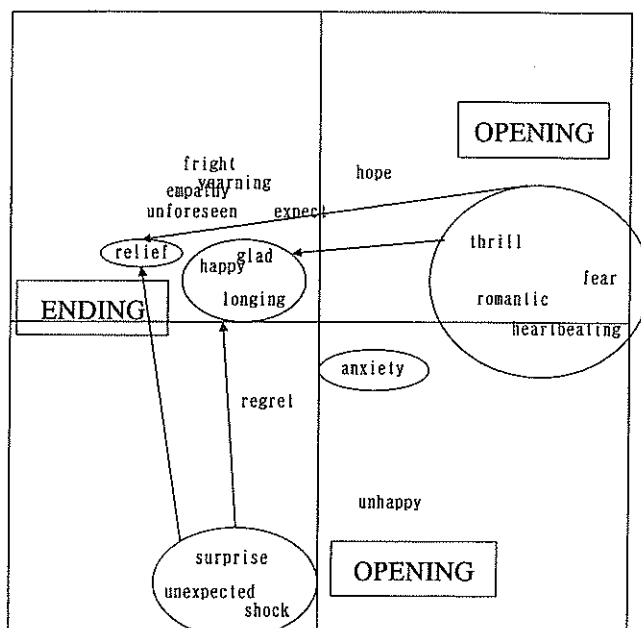

Figure 1. The configurations of emotional words from the association task are plotted by correspondence analysis. The solid curves indicate clusters, and the arrows indicate temporal relations in the story.

Time was the crucial dimension. Many researchers have explored the dimension of time in situation models (e.g., Zwaan, Madden, & Whitten, 2000; Zwaan, Magliano, & Graesser, 1995). However, there are no studies of how other dimensions relate to time. We believe that readers experience feelings of strangeness when there is a mismatch with causation. Thus, we will investigate these two dimensions–time and causation- in a future study.

The suggestion that there is an important link between the way we cognize about the world and our emotional responses to that same world is by no means new (Dalgleish and Power, 1999). As a way to think of the emotions evoked by the interplay between the two systems, Norman (1981) insisted "Emotional systems might very well be an interplay between the cognitive systems and the regulatory system." Moreover, in the heuristic field, some researchers think that affect plays an important role in high-level cognition. Slovic, Finucane, Peters, and MacGregor (2002) suggested that our representations were tagged with affect to varying degrees. Affect may serve as

a cue for many important judgments. Schwarz (2002) introduced "Feelings as Information", and hypothesized that people use affective reactions to a target as a basis of judgments.

We hypothesize that when readers construct a final situation model, there is no longer a mismatch. As a result, they feel emotions such as relief. In a future study, we will manipulate causally implicit/explicit information and continuous/discontinuous time. We postulate that emotion will be greater in causally implicit sentences than in causally explicit ones, and that emotions will increase with temporally discontinuous sentences versus continuous sentences. We will also study whether the dimensions of causation or time produce stronger emotions.

We predict that the causation and time dimensions are not separate. Freidman and Miyake (2000) separated the dimensions space and causation and explained their finding using a framework with two working memory systems: spatial working memory and verbal working memory. Causation between one event and another necessarily includes time shifts, while time shifts do not necessarily include causation between the two events. We think that the time dimension is based in a situation model. It is possible that the causation dimension is located above the time dimension in a situation model.

In a future study, we will study the mismatch of different dimensions in situation models. Emotion arises out of a mismatch between constructed representations (Damasio, 1994; Kintsch, 1998). We believe that emotions such as anxiety arise from a mismatch of dimensions; in particular, the time and causation dimensions may be important in evoking emotion in a sentence.

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