Journal review

Interactive Dimensions in the Construction of Mental Representations for Text

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Introduction

- Traditional models of text comprehension outline the three types of memory representations that readers may construct.
- Surface-level representation
  - The specific words described in a text
- Text-based representation
  - Meaning in a text
- Situation model representation
  - The information described by a text but not directly mentioned

Introduction

- Situation models are believed necessary for readers to construct inferences and adequately comprehend text.
- Readers have to potentially encode many different dimensions
  - Character goals
  - Temporal sequences of events
  - Spatial relations between locations

Introduction

- The event-indexing model
  - About the dimensions readers track while reading
  - Readers monitor discrete dimensions for the passage of time, the organization of space, the relations and intentions of characters and objects, and the causal structure of events in narratives.

Introduction

- The structure-building framework
  - About the processes by which readers construct representations of events described in texts.
  - When new events are read, new mental substructures are constructed, old structures may become less accessible from memory

Introduction

- Researchers have examined the linguistic cues in texts that help readers build mental structures for particular dimensions.
- Temporal markers
  - Zwaan (1996) demonstrated that particular discrepancies in chronological distance can differentially influence the accessibility of text information prior to the time shift.
  - Explicit time shifts such as “a minute later” vs. “a day later”

Introduction

- Temporal cues are but one dimension for which readers may construct representations in situation models.
- Text representations are constructed through the interactivity of multiple text dimensions

Introduction

- An example of interactivity:
- Character' activity
  - Joe decided to get something to eat from the diner.
  - Outside, he noticed a stick on the ground.
  - He pulled out a small pocket knife from his bookbag.
  - Joe began to whittle away at the stick while he walked.
  - He carved the stick into a small flute. (1)
  - He carved his initials right on the stick. (2)
  - He put the finishing touches on it just as he arrived.
- (1) suggested that there was longer time and distance than (2) without explicit cues.

Introduction

- The purpose of this study
  - To examine the validity of interactive claim, authors evaluated whether expectations about character activity can provide readers with an indication about the relations between locations.

Introduction

- The rigid-boundary hypothesis
  - Event shifts result in uniform decreases in the accessibility of prior text information.
  - Accessibility for the prior information on should decrease in a consistent fashion regardless of the passage of time or amount of spatial movement by the character.

Introduction

- The flexible-boundary hypothesis
  - Changes in accessibility should be a function of the relevant magnitude associated with an event shift.
  - Accessibility for the prior information should decrease as a function of the relevant magnitude of the event shift.

Introduction

- Experiments were designed to test the notion that non-spatial text dimensions influence representations of spatial locations.

Outline

- Experiment 1A and 1B
  - Explicit spatial statement
  - To provide a baseline for evaluating the interactive effects
- Experiment 2
  - Implicit time statement
  - To test whether time dimension would influence the accessibility of location information
- Experiment 3
  - No movement statement
  - To verify Exp.2

Experiment 1A

Method

- Participants: 36 undergraduates
- Materials
  - Authors wrote 20 stories
  - Each 12 sentences long

Sample Story From Experiment 1A

1 Joe was working diligently on his term paper.
2 Joe had been laboring for quite some time in the library.
3 He began to feel kind of hungry.
4 He decided to get something to eat from the diner.
5 Joe gathered his things and left.
6 Outside, he noticed a stick on the ground.
7 He pulled out a small pocket knife from his bookbag.
8 Joe began to whittle away at the stick while he walked.
9 Joe walked for four miles. (long-distance statement, Experiment 1A)
9 Joe walked for four blocks. (short-distance statement, Experiment 1A)
10 He put the finishing touches on it just as he arrived.
11 The smells of cooking burgers and french fries made his mouth water.
12 He stepped up to the counter and ordered a grilled cheese sandwich.

Location probes: library [start location], diner [final location]

Method

- The 9th sentence
- Distance
  - Long: "Emily walked <u>four miles</u>."
  - Short: "Emily walked <u>four blocks</u>."
- Always either "4 blocks" or "4 miles"

Method

- Recognition Task
  - Following each story, participants completed
- Location
  - Start: "library"
  - Final: "diner"
  - YES responses are correct answers

Method

- 20 filler stories
  - 12 sentences long.
  - a single recognition probe
  - No responses
- Three practice stories
- Secondary task
  - To ensure that participants carefully read the stories
  - After 10 randomly selected stories (5 experimental and 5 filler), participants were instructed to write down a sentence to continue the story

Method

- Design
  - Distance statement (Long vs. Short)
  - Location probe (Start vs. Final)

Method

- Procedure
  - Participants read each story line-by-line at their own pace, pressing the space bar to advance.
  - Recognition task instruction
    - YES: if the word appeared in the story
    - NO: if the word did not appear in the story

Method

- The rigid-boundary hypothesis
  - main effects
  - Recognition times
    - Start/Long = Start/Short > Final/Long = Final/Short

Method

- The flexible-boundary hypothesis
  - An interaction between distance and location
  - Recognition times
    - Start/Long > Start/Short > Final/Long = Final/Short

Results and Discussion

- The results were consistent with the flexible-boundary hypothesis.
- The interaction between location and distance was reliable.
  - $F1(1, 35) = 13.68$, $p < .005$
  - $F2(1, 19) = 6.62$, $p < .05$.

Results and Discussion

Table 1
Means and Standard Deviations for Correct Recognition Probe Times and Distance Statement Reading Times for Start Locations (L1) and Final Locations (L2) in Experiment 1A

	Correct recognition probe times		Distance statement reading times	
	L1	L2	L1	L2
Long-distance statement				
M	1,420	1,284	1,288	1,320
SD	291	314	618	709
Short-distance statement				
M	1,347	1,368	1,393	1,373
SD	266	287	631	638

Note. All probe and reading times in ms.

Results and Discussion

- Planned comparisons using paired t tests (Bonferroni corrected)
  - Following long-distance statements
    - Start location probe > Final location probe
    - $t1(35) = 4.39, p < .005$
    - $t2(19) = 3.09, p < .01$.
  - RT for start location probes
    - Long-distance condition > Short-distance condition
    - $t1(35) = 1.95, p < .059$
    - $t2(19) = 2.02, p < .058$

Results and Discussion

- RT for final location probes
  - Short-distance condition > Long-distance condition
  - $t1(35) = 1.96, p < .058$
  - $(t2(19) = 1.41, p > .10)$
- No other comparisons were significant

Results and Discussion

- Reading times for distance statements
  - "Emily walked for four blocks." vs. "Emily walked for four miles."
- Short-distance statements > Long-distance statements
  - $F1(1, 35) = 4.53, p = .05$
  - $(F2(1, 19) = 2.30, p > .10)$
- No other effects were significant

Results and Discussion

- The pattern of recognition times is more consistent with a flexible-boundary hypothesis.
- However, although both hypotheses suggest that final locations will be equally accessible following either short- or long-distance statements, but
  - RT for final location probes
    - Short-distance condition > Long-distance condition

Results and Discussion

- One possibility is that the long-distance statements may have been particularly effective at instantiating expectations that characters had reached their final destinations and had been other places, whereas short-distance statements may have been less effective completed movement.
  - Reading time results
- Experiment 1B was conducted to address this possibility directly.

Experiment 1B

- Participants: 42 undergraduates(but six participants were eliminated)
- Design: The design was identical to Experiment 1A.
- Procedure: The procedure was identical to Experiment 1A.

- Authors revised the 9th sentence of each story
  - To change distance magnitude (i.e., "Emily walked three blocks to her destination." vs. "Emily walked five miles to her destination.")
  - To include the words "to his/her location" at the end of the sentence.

Sample Storiy From Experiment 1A and 1B (Including Recognition Probes)

Joe was working diligently on his term paper.
Joe had been laboring for quite some time in the library.
He began to feel kind of hungry.
He decided to get something to eat from the diner.
Joe gathered his things and left.
Outside, he noticed a stick on the ground.
He pulled out a small pocket knife from his bookbag.
Joe began to whittle away at the stick while he walked.
Joe walked for four miles. (long-distance statement, Experiment 1A)
Joe walked for four blocks. (short-distance statement, Experiment 1A)
Joe walked for five miles to his destination. (long-distance statement, Experiment 1B)
Joe walked for three blocks to his destination. (short-distance statement, Experiment 1B)
He put the finishing touches on it just as he arrived.
The smells of cooking burgers and french fries made his mouth water.
He stepped up to the counter and ordered a grilled cheese sandwich.
Location probes: library [start location], diner [final location]

Recognition time

- The data were, again, supportive of the flexible-boundary hypothesis.
- This interaction was significant.
  - $F1(1, 35) = 8.78, p < .005$
  - $F2(1, 18) = 2.99, p < .098$

Table 2
Means and Standard Deviations for Correct Recognition Probe Times and Distance Statement Reading Times for Start Locations (L1) and Final Locations (L2) in Experiment 1B

	Correct recognition probe times		Distance statement reading times	
	L1	L2	L1	L2
Long-distance statement				
M	1,452	1,256	2,118	2,173
SD	249	232	471	566
Short-distance statement				
M	1,322	1,256	2,080	2,164
SD	210	203	406	542

Note. All probe and reading times in ms.

- The main effect of location probe
  - Start locations > Final locations
    - $F1(1, 35) = 33.39, p < .001$
    - $F2(1, 18) = 16.26, p < .005$
- The main effect of distance
  - Long-distance > Short-distance statements
    - $F1(1, 35) = 8.78, p < .01$
    - $(F2(1, 18) = 2.86, p > .10)$

- Planned comparisons using paired t tests (Bonferroni corrected)
  - Following long-distance statements
    - Start location probe > Final location probe
    - $t1(35) = 5.82, p < .001$
    - $t2(18) = 3.78, p < .001$
  - Following Short-distance statements
    - Start > Final
    - $t1(35) = 2.68, p < .05$
    - $t2(19) = 1.50, p > .10$

  - RT for start location probes
    - Long-distance condition > Short-distance condition
    - $t1(35) = 5.04, p < .001$
    - $t2(19) = 2.58, p < .05$
  - RT
    - Start/Long > Final/Short
    - $t1(35) = 5.42, p < .001$
    - $t2(19) = 3.85, p < .001$
  - RT
    - Start/Short > Final/Long
    - $t1(35) = 2.53, p < .05$
    - $t2(19) = 1.90, p = .074$

- The accumulated evidence from Experiments 1A and 1B support a flexible-boundary interpretation rather than a rigid-boundary hypothesis.
- As both hypotheses suggest that final locations will be equally accessible following either short- or long-distance statements,
  - RT for final location probes
    - Short-distance condition = Long-distance condition

Experiment 2

- In Experiment 2, authors examined whether character activities, implicitly cuing distance, would result in effects similar to those demonstrated for explicit spatial cues
- A pattern of data similar to that observed in Experiments 1A and 1B would suggest that cues from nonspatial dimensions can also influence the accessibility of spatial information from readers' situation models.

- Participants: 36 undergraduates
- Design: The design was identical to that in Experiment 1A.
- Procedure: The procedure was identical to that in Experiment 1A.

Sample Stories From Experiment 2 (Including Recognition Probes)

Joe was working diligently on his term paper.
Joe had been laboring for quite some time in the library.
He began to feel kind of hungry.
He decided to get something to eat from the diner.
Joe gathered his things and left.
Outside, he noticed a stick on the ground.
He pulled out a small pocket knife from his bookbag.
Joe began to whittle away at the stick while he walked.
He carved the stick into a small flute. (long-activity statement)
He carved his initials right on the stick. (short-activity statement)
He put the finishing touches on it just as he arrived.
The smells of cooking burgers and french fries made his mouth water.
He stepped up to the counter and ordered a grilled cheese sandwich.
Location probes: library [start location], diner [final location]

- Interaction was significant
  - F1(1, 35) = 9.24, p < .005
  - F2(1, 19) = 3.02, p = .098.

Table 3
Means and Standard Deviations for Correct Recognition Probe Times and Activity Statement Reading Times for Start Locations (L1) and Final Locations (L2) in Experiment 2

	Correct recognition probe times		Activity statement reading times	
	L1	L2	L1	L2
Long-activity statement				
M	1,496	1,337	2,616	2,555
SD	249	257	867	738
Short-activity statement				
M	1,375	1,338	2,566	2,452
SD	243	304	891	620

Note. All probe and reading times in ms.

- The main effect of location probe
  - Start location > Final location
  - F1(1, 35) = 11.48, p < .005
  - F2(1, 19) = 13.04, p < .005
- The main effect of activity statement
  - Long activity > Short activity
  - F1(1, 35) = 6.19, p < .05
  - F2(1, 19) = 6.61, p < .05

- Planned comparisons
- Following long activities,
  - Start location > Final location
  - t1(35) = 4.30, p < .001
  - t2(19) = 3.19, p < .005
- RT for start locations
  - Long activity > Short activity
  - t1(35) = 4.12, p < .001
  - t2(19) = 2.86, p < .01

- RT
  - Start/Long > Final/Short
  - $t1(35) = 3.79$, $p < .001$
  - $t2(19) = 4.17$, $p < .001$
- No other comparisons were significant

- The overall pattern of recognition times from Experiment 2 is in line with that of the previous experiments.
- This pattern is suggestive that other dimensions (such as time and character activity) may provide cues for encoding spatial representations, supporting the notion that interactivity among text dimensions facilitates situation model construction.

- However, another viable possibility is that participants encoded events solely based on the passage of time associated with activities, without reference to the spatial organizations implied in stories.
  - Activity implied time as well as space.
- Experiment 3 was conducted to address this possibility directly.

Experiment 3

- Participants: 36 undergraduates
- Design: The design was identical to that in Experiment 1A.
- Procedure: The procedure was identical to that in Experiment 1A.

- Authors rewrote the stories so that characters remained in start locations while completing their activities.
- That is, texts maintained temporal differences but eliminated the spatial components of those shifts.

Sample Stories From Experiment 3 (Including Recognition Probes)

Joe was working diligently on his term paper.
Joe had been laboring for quite some time in the library.
He began to feel kind of hungry.
He thought about getting something to eat from the diner.
He was still on his diet.
From his bag he retrieved a small stick.
He also removed a pocket knife from his back pocket.
Joe began to whittle away at the stick while he sat.
He carved the stick into a small flute. (long-activity statement)
He carved his initials right on the stick. (short-activity statement)
He put the finishing touches on it and then stood up.
Thinking about eating a burger and french fries made his mouth water.
He decided he would go and order himself a grilled cheese sandwich.
Location probes: library [start location], diner [final location]

- If readers' representations are structured purely by the passage of time
  - we can predict a pattern of data similar to that found in previous experiments
- If, however, readers' representations are also influenced by character movement
  - we can predict a null effect of activity length.

Table 4
Means and Standard Deviations for Correct Recognition Probe Times and Activity Statement Reading Times for Start Locations (L1) and Final Locations (L2) in Experiment 3

n.s.	Correct recognition probe times		Activity statement reading times	
	L1	L2	L1	L2
Long-activity statement				
M	1,384	1,405	2,623	2,551
SD	233	301	866	652
Short-activity statement				
M	1,406	1,379	2,468	2,562
SD	255	301	770	747

Note. All probe and reading times in ms.

- Recognition time
  - *n.s.* (all Fs < 1.1)
- There was no evidence of the earlier accessibility pattern with the removal of the spatial cue.

- Reading times
- Neither of the main effects nor the interaction were reliable.

- Authors found no differences in reaction latencies for start or final location probes.
- This null result should, of course, be interpreted with caution, but authors point out that the main effects and interaction for recognition times were not significant with all p values exceeding .30.

- Experiment 3 used the same number of participants, the same methodologies and procedures, and similar stimuli to that from the previous three experiments.
- Therefore, authors have reason to believe that had there been effects of our location and distance manipulations similar to those obtained in Experiments 1A, 1B, and 2, authors would have obtained similar results.
- (* There are much discussion about the null effect)

- Authors take these findings as suggestive that, at least for previous experiments, readers' representations of text events rely on the interactivity of movement (space) and character activities (time) in the construction of a situation model.

General Discussion

General Discussion

- The purpose of this set of experiments
  - To evaluate the interactive nature of the cues that influence readers' construction of multidimensional situation models.

General Discussion

- The results call into question the notion of discrete representational dimensions in event-indexing model accounts of text processing.
  - Non-spatial text dimensions influence representations of spatial locations.

General Discussion

- The results also suggests a necessary updating of structure-building theory to account for data supporting the flexible-boundary hypothesis.
  - Authors argue that expectations about the range or duration of events are largely a function of readers' beliefs about the concomitants of space and time.
  - The construction processes may be more flexible than originally described

General Discussion

- Future work might also be designed to address whether text dimensions such as time and space are nested within one another or whether these dimensions are truly independent.
- Traditional studies have tended to treat these dimensions as separate indices. However, the alternative view is that space and time are subsumed under a larger dimension, has also been of interest, although it has received less empirical support.

General Discussion

- Readers rely on the interactive nature of linguistic cues and their background knowledge to help them "fill in" the missing information from text descriptions.

Comments

- I understand phenomenon. The data of this study clearly suggested that there is interactivity in situational dimensions and how they are interacted.
- However, how do we decide to construct new situation model from these interactive implicit cues? Does "Based on knowledge" satisfy the explanation?