Comprehension of Spatial Relations Under Survival Conditions

Paul J. Schroeder, David E. Copeland, & Kris Gunawan
University of Nevada, Las Vegas

UNLV
University of Nevada Las Vegas

20th annual meeting of the Society for Text & Discourse

1

The Event-Indexing Model

- **5 situational dimensions**
  - Protagonist
  - Goals/intentions
  - Time
  - Causation
  - Space*

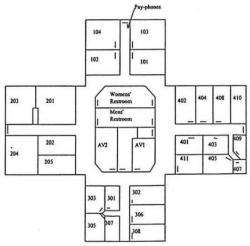
Zwaan, Langston, & Graesser (1995)

2

2

Situation Models

- **Space**
  - Fan effect
  - Gradient of spatial accessibility
  - Spatial updating

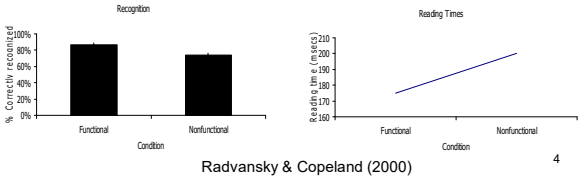


3

3

Situation Models

- **Functionality**
  - Spatial terms (Coventry, 2003; Carlson-Radvansky & Radvansky, 1999)
  - Narratives (Radvansky & Copeland, 2000)
  - Causality / Danger (Jahn, 2004)



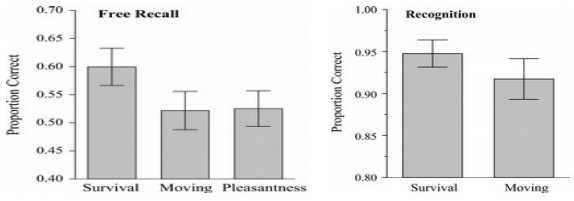
Radvansky & Copeland (2000)

4

4

Survival recall advantage

Adaptive memory hypothesis (Nairne et al., 2007; 2008)
- Human memory is attuned to survival-relevant information
- Evidence from surprise word-recall / recognition experiments

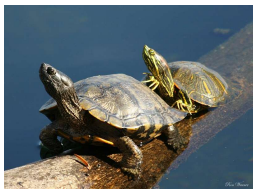


Outcomes from Nairne et al. (2007)
Source: *JEP:LMC*

5

The present experiments

- **Research questions**:
  - How does functionality and danger (survival) influence memory for spatial relations?
  - Is danger / survival context important for enhancing memory, or is functionality sufficient?



6

6

Experiment 1

Participant Characteristics

n	Age	Gender	Comp %
40	21.02 yrs (3.74)	*M* = 18 *F* = 22	87 (.08)

Note. All participants were recruited from the UNLV Psychology subject pool & awarded class credit for their participation. Only native English speakers participated in the study & were 18 years +.

Experiment 1

Materials

- 32 original narratives (20 experimental + 12 fillers)
- Stories = 15 sentences long

	Survival	Non-survival
Functional	5	5
Nonfunctional	5	5

Sample story

Tyler loved digging around in an old junkyard – it was one of his favorite pastimes. His friends told him that vicious dogs sometimes guarded the place, but Tyler never saw one. The junkyard was filled with all sorts of stuff. There was everything from stuffed animals to construction equipment. But, it was mostly filled with scrap. He could usually find something salvageable. Today he needed to find a used part for his car. He carefully scanned the area, keeping an eye out for the small part.

Survival sentence: Tyler saw a big growling dog and had to find higher ground.
Non-survival sentence: Tyler had to get a better view from someplace higher.

He quickly looked around to find something to help him out. He noticed an old truck in the distance. Without hesitating, he ran quickly towards the truck.

Functional sentence: Tyler was standing on top of the old truck.
Nonfunctional sentence: Tyler was standing right next to the old truck.

Just then he heard a loud crashing sound. It was the owner – he must be returning from his lunch break.

Sample story

Comprehension questions:

Was Tyler looking for a used part for his car?
Was it raining that afternoon?

Recognition question
Which of the following sentences appeared in the story?

(1) Tyler was standing on top of the old truck.
(2) Tyler was standing right next to the old truck.
(3) Tyler was standing on top of the old stove.
(4) Tyler was standing right next to the old stove.

Experiment 1

To ensure that the stories were well written, and that the conditions were manipulated appropriately, story ratings were collected from a different sample of participants.

Experiment 1

Story ratings:

- Survival rating:
  - Survival stories rated more survival-related / dangerous than non-survival stories ($p < .001$)
  - Survival ($M = 4.94$, $SE = .19$)
  - Nonsurvival ($M = 2.69$, $SE = .19$)

Experiment 1

Story ratings:

- Functionality / Fit of spatial relation sentences
  - Functional sentences rated as more functional than nonfunctional sentences ($p < .05$)

	Survival	Nonsurvival
Functional	6.03 (.33)	5.98 (.23)
Nonfunctional	4.76 (.27)	5.14 (.27)

13

13

Experiment 1

Story ratings:

- Acceptability of spatial relation sentences (i.e., is it acceptable for this sentence to be a part of this story?)
  - Functional & nonfunctional sentences (regardless of survival condition) were equally acceptable (ps > .31)
  - Thus, nonfunctional sentences were not interpreted as unusual or weird

14

14

Experiment 1

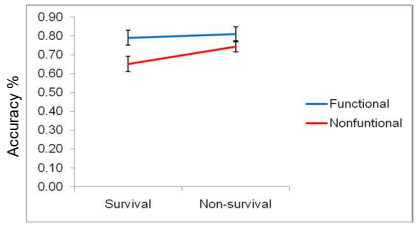
Story ratings:

- Readability / Flow of Stories:
  - No difference between conditions (all ps > .13)

15

15

Recognition

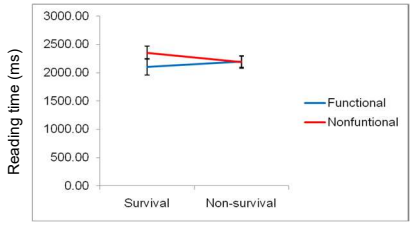


Functionality $p < 0.01$*
Survival $p < 0.05$*
Interaction $p = 0.23$

16

16

Reading Time



Functionality $p = 0.05$*
Survival $p = 0.71$
Interaction $p < 0.05$*

17

17

Discussion

- Comprehension of spatial relations depends more on functionality (Radvansky & Copeland, 2000; Radvansky et al., 2003) than survival (Jahn, 2004).
- Survival context can create a functional relation, but memory for spatial relations were not improved by simply including this context (i.e., survival context only helped if it created a functional relation).

18

18

Experiment 2

- While Experiment 1 used narratives to examine memory for spatial relations (Radvansky & Copeland, 2000; Radvansky et al., 2003), other studies that have shown effects with survival / danger have used sentence pairs (Jahn, 2004)
- Also, Nairne's (Nairne et al., 2007; 2008) studies rely on simpler materials – a basic scenario and word lists
- Experiment 2 used critical sentence pairs from the narratives that were used in Experiment 1 (minus the rest of the story)

19

19

Experiment 2

Participant Characteristics

n	Age	Gender
42	23.55 yrs (3.63)	*M* = 14 *F* = 28

Note. All participants were recruited from the UNLV Psychology subject pool & awarded class credit for their participation. Only native English speakers participated in the study & were 18 years +.

20

20

Experiment 2

- Stories from Experiment 1 trimmed to 2 sentences:
  - Survival / Non-survival sentence
  - Functional / Nonfunctional sentence
  - Participants were told that these were sentences from a story that appeared in that order (although there could be intervening sentences)
- Recognition Test (same as Experiment 1)

21

21

Sample story

Tyler loved digging around in an old junkyard – it was one of his favorite pastimes. His friends told him that vicious dogs sometimes guarded the place, but Tyler never saw [illegible] junkyard was filled with all sorts of stuff. There was everything [illegible] stuffed animals to construction equipment. But, it was mostly filled with scrap. He could usually find something salvageable. Today he needed to find a used part for his car. He carefully scanned the area, keeping an eye out for the small part.

Survival sentence: Tyler saw a big growling dog and had to find higher ground.
Non-survival sentence: Tyler had to get a better view from someplace higher.

He quickly looked around to [illegible] something to help him out. He noticed an old truck in the distance. Without hesitating, he ran quickly towards the truck.

Functional sentence: Tyler was standing on top of the old truck.
Nonfunctional sentence: Tyler was standing right next to the old truck.

Just then he heard a loud [illegible] sound. It was the owner – he must be returning from his lunch break.

22

22

Sample story

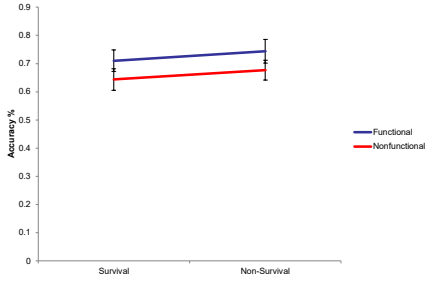
Survival sentence: Tyler saw a big growling dog and had to find higher ground.
Non-survival sentence: Tyler had to get a better view from someplace higher.

Functional sentence: Tyler was standing on top of the old truck.
Nonfunctional sentence: Tyler was standing right next to the old truck.

23

23

Recognition

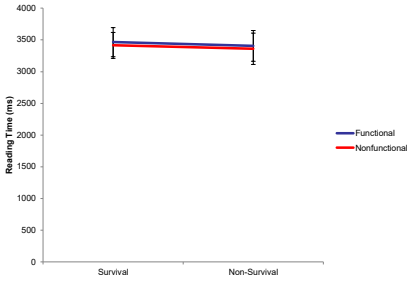


Functionality ***p* < 0.05***
Survival ***p* = 0.20**
Interaction ***p* = 1.00**

24

24

Reading Time



Functionality $p = 0.58$
Survival $p = 0.59$
Interaction $p = 0.98$

25

25

Discussion

- Experiment 2 replicated basic findings from Experiment 1:
  - Survival / danger context can be used to create a functional relation, but…
  - …functionality itself was more important for better memory, whereas survival / danger context was not necessary.

26

26

Discussion

- Grassland danger vs. modern danger
- Narrative perspective (1st or 2nd person vs. 3rd person perspective)
- Temporal perspective (past, present, future tense)

27

27

Conclusion

- Outcomes support situation model perspective for spatial information (Zwaan & Radvansky, 1998).
- Functional spatial relations better remembered than non-functional spatial relations (Radvansky & Copeland, 2000).
- Survival context did not enhance memory for spatial relations; if anything, it worsened memory.
- Survival context may contribute to memory as a functional or causal factor (Jahn, 2004), but functionality itself seems to be more important.

28

28

References

- Carlson-Radvansky, L.A., Covey, E. S. & Lattanzi, K. M. (1999). "What" effects on "where": Functional influences on spatial relations. *Psychological Science, 10*(6), 516-521.
- Coventry, K. R., Venn, S. F., Smith, G. D. & Morley, A. M. (2003). Spatial problem solving and functional relations. *European Journal of Cognitive Psychology*, 15(1), 71-99.
- Glenberg, A. M., Meyer, M., & Lindem, K. (1987). Mental models contribute to foregrounding during text comprehension. *Journal of memory and language, 26*, 69-83.
- Haliday, M.A. & Hasan, R. (1976). *Cohesion in English*. New York: Longman.
- Jahn, G. (2004). Three turtles in danger: spontaneous construction of causally relevant spatial situation models. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30*(5), 969-987.
- Johnson-Laird, P.N. (1983). Mental models: towards a cognitive science of language, inference, and consciousness. Cambridge, MA: Harvard University Press.
- Millis, K.K. & Just, M.A. (1994). The influence of connectives on sentence comprehension. *Journal of Memory and Language, 33*, 128-1 47.
- Nairne, J.S. & Pandeirada, J.N.S. (2008). Adaptive memory: is survival processing special? *Journal of Memory and Language, 59*, 377-285.
- Nairne, J.S., Pandeirada, J.N.S., & Thompson, S.R. (2008). Adaptive memory: the comparative value of survival processing. *Psychological Science, 19*(2), 176-180.
- Nairne, J.S., Thompson, S.R., & Pandeirada, J.N.S. (2007). Adaptive memory: survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 33*(2), 263-273.
- Radvansky, G.A. & Copeland, D.E. (2000). Functional and spatial relations in memory and language. *Memory and Cognition, 28*(6), 987-992.
- Radvansky, G.A., Copeland, D.E., & Zwaan, R.A. (2003). Aging and functional spatial relations in comprehension and memory. *Psychology and aging, 18*(1), 161-165.
- Radvansky, G.A., Spieler, D.H., & Zacks, R.T. (1993). Mental model organization. *Journal of experimental psychology: learning, memory, and cognition, 19*(1), 95-114.
- Radvansky, G.A. & Zacks, R.T. (1991). Mental models and the fan effect. *Journal of experimental psychology: learning, memory, and cognition, 17*(5), 940-953.
- Rinck, M. & Bower, G.H. (1995). Anaphora resolution and the focus of attention in situation models. *Journal of memory and language, 34*, 110-131.
- Trabasso, T., Secco, T., & van den Broek, P. (1984). Causal cohesion and story coherence. In H. Mandl, N. Stein, & T. Trabasso (Eds.), *Learning and comprehension of text*. Hillsdale, NJ: Erlbaum.
- van Dijk, T.A. & Kintsch,W. (1983). *Strategies in discourse comprehension*. New York: Academic Press.
- Weinstein, Y., Bugg, J.M., & Roediger, H.L. (2008). Can the survival recall advantage be explained by basic memory processes? *Memory and cognition, 36*(5), 913-919.
- Zwaan, R. A., Magliano, J. P., & Graesser, A. C. (1995). Dimensions of situation-model construction in narrative comprehension. *Journal of Experimental Psychology: Learning, Memory, & Cognition, 21*, 386–397.
- Zwaan, R.A. & Radvansky, G.A. (1998). Situation models in language comprehension. and memory. *Psychological Bulletin, 123*(2), 162-185.

29

29