Structural vs. syntactic matching: Analogy entails common relations.

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Keane (in press) studied people's ability to form correspondences between sentence sets that shared no semantic similarity. For example, the set [John is tall, John is smart and Sam is smart] might be compared to the set [Rover is frisky, Rover is black, Fido is black]. These mappings could only be done by attending to the syntactic structure of the sentence sets. Two significant findings were that (1) there were more mapping errors for relational problems (e.g, *John is beside MaryLera employs Rachel*) than for attribute problems (e.g., *John is tallRover is frisky*); (2) that the addition of causal structure only to the base facilitated solving relational problems. Keane suggests that these results are more consistent with the IAM model (Keane, Ledgeway, & Duff, 1994) than with the ISME model (Incremental SME) (Forbus, Ferguson, & Gentner, 1994).

However, these mappings do not utilize common relational content. Consistent with structure-mapping theory, which postulates that analogies involve the alignment of common relational structure, SME operates over common relational content. We have argued elsewhere that syntax-only matches should be viewed as logical puzzles, not analogies (Forbus, Gentner & Law, 1995).

To test the claim that analogies crucially involve common relational content, we gave subjects Keane's (in press) mapping task in two versions (1) *Syntax-only* (using Keane's materials); and (2) *Common content* (created by substituting synonyms into Keane's materials so that the sentence sets had similar content. We used the same dependent measure as Keane, number of mistakes during mapping. We also measured solution time using a stop watch. (Keane used this measure but did not report the results.) After the session, we asked subjects whether they thought the problems were analogies or logical puzzles.

In the Syntax-only condition, the causal problems were by far the most difficult. Both the error rates (E) and the solution times (T) were higher for causal problems (E = 7.0; T = 155 sec.) than for attribute (E = 2.29; T = 83.4 sec.) and relational (E = 2.07; T = 72.6 sec.) problems. The pattern reversed in the Common-content condition. The causal problems (E = 1.7; T = 28.7 sec.) showed comparable error rates and considerably lower solution times than the attribute (E = 1.07; T = 53.6 sec.) or relational (E = 2.93; T = 89.7 sec.) problems. The contrast between conditions was striking for causal problems. Subjects made four times as many errors and took five times as long to solve the Syntax-only versions as the Common content versions. This accords with the systematicity predictions of structure-mapping theory and with SME's pattern of performing best with deeply structured representations.

Asked to categorize the problems, subjects rated the Common content problems as analogies (100% of responses) and the Syntax-only problems as logical puzzles (93% of responses). These results are consistent with structure-mapping's claim that analogical processing involves an implicit search for common relational structure. Although syntax-only matches may be interesting as logical puzzles, they are not informative in distinguishing among models of analogy.

Table 1. Results of Experiment

Syntax Only			
	Causal	Attribute	Relational
Errors	7.00	2.29	2.07
Time (sec)	155	83	72
Common	**Content**		
	Causal	Attribute	Relational
Errors	1.70	1.07	2.93
Time (sec)	29	53	90

References

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