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Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 3(0)

Authors

Smith, Edward E.
Collins, Allan M.

Publication Date

1981

Peer reviewed

Use of Goal-Plan Knowledge
In Understanding Stories

Edward E. Smith & Allan M. Collins
Bolt Beranek and Newman Inc.

There seems to be a growing consensus among researchers that understanding a story involves constructing a representation of the characters' goals and plans (e.g., Rumelhart, 1977; Schank & Abelson, 1977; Wilensky, 1978). There is, however, relatively little experimental evidence for people's on-line construction of such goal-plan representations, and the purpose of the present experiment was to provide such evidence.

In our paradigm, subjects are presented a five-line story, one line (or sentence) at a time. Subjects press a button as soon as they understand a sentence, and the sequence of reading times obtained with a particular story is assumed to offer a line-by-line description of the process whereby a representation is constructed for that story. The general idea behind our study was to systematically delete mention of certain goals and plans needed to understand the story, and to see if readers then took longer at lines where they would have to infer these missing goals and plans.

To get more specific, we have to deal with a story in detail. Consider then the following story about an operation.

1. While John was laid off, his wife became seriously ill.

2. John needed money to pay for an operation.

3a. He decided to borrow money from his Uncle Harry.

3b. He would give his Uncle Harry a quick call.

3c. He had to find out Uncle Harry's phone number.

4. John reached for the most recent suburban directory.

5. John was overjoyed Uncle Harry agreed to the loan.

By our analysis, this story can be represented by four levels of embedded goals and plans, where each level contains one goal and its associated plan. At the first or top level would be John's goal of his wife getting better (an inference from line 1) and his plan of getting her an operation (inference from line 2). A precondition for the "operation" plan, however, is that the person have money, and this precondition becomes the goal at the second level (it is explicitly stated in line 2), while the plan at the second level is to borrow money (see line 3a). The "borrow" plan also has a precondition, namely being in contact with the lender, and this becomes the goal at the third level (see line 3b); the plan at this level is to phone the lender (see line 3b). Finally, the "phone" plan has as a precondition that one know the telephone number, and this is the goal at the fourth level (see line 3c); the plan at this level is to use the directory (see line 4).

None of our subjects saw this full version of the operation story. Rather they saw a version with two lines deleted. As an example, some subjects read the story with lines 3a and 3b deleted. We expected these subjects to be relatively slow in reading line 3c because there is a sizeable gap between the goal mentioned in it and the goal and plan given by the directly preceding line 2. That is, by deleting lines 3a and 3b, we gapped a couple levels of goals and plans and our subjects must fill this gap when reading line 3c, which should take time. When these subjects get to line 4, however, they should read it relatively quickly; for now there is no gap in the underlying goal-plan representation that needs to be filled. In contrast to the case just described, other subjects read the operation study with lines 3b and 3c deleted. These subjects should read line 3a relatively quickly (there is no gap to fill in the goal-plan representation), but read line 4 relatively slowly (two levels of goals and plans have been gapped, and need to be filled at this point).

So, by varying which lines of the story are deleted, we can manipulate the size of the gap that a reader must fill when reading a particular story line. Since these gap-sizes are measured in units of underlying goals and plans, a finding that reading time increases with gap size would be evidence for the on-line construction of a goal-plan representation.

With stories like the operation one, we have obtained the predicted gap-size effect -- the time to read a line increases monotonically with the number of goals and plans that have to be filled in at that point -- though its magnitude tends to be greater on some lines than others. We were concerned, however, that the gap-size effect might only occur with stories that explicitly emphasize characters' intentions, i.e., readers might only construct goal-plan representations for stories that explicitly use intentional constructions like would give and decided to. For this reason (and others) we rewrote our stories so that sentences that were once intentional in tone now became actional. This required changing the order of the rewritten sentences, since the chronological order for actions is the reverse of that for intentions. In the actional version of the operation story, for example, John first reaches for the directory, then finds Uncle Harry's new number, then calls him, and then asks him for a loan -- the opposite order of lines 3a, 3b, 3c, and 4 in the original story.

Once having created these actional versions of the stories we then varied which lines were deleted, thereby varying the size of the goal-plan gap that the reader had to fill. We again found that the time to read a sentence increased with its associated gap size (though again the effect's magnitude depended on the exact line being read). These results suggest that people construct roughly the same goal-plan representation of a story regardless of whether the story emphasizes the characters' actions or intentions.

References

Rumelhart, D. E. Understanding and summarizing brief stories. In D. LaBerge & J. Samuels (Eds.), Basic processes in reading: Perception and comprehension. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.

Schank, R., & Abelson, R. Scripts, plans, goals, and understanding. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.

Wilensky, R. Why John married Mary: Understanding stories involving recurring goals. Cognitive Science, 1978, 2, 235-266.