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Understanding the Role of Open Goals in Problem Solving: Impasses and Hints

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Introduction

Difficult problems often lead to an impasse where the problem solver does not know how to proceed. The work presented here examines the question of how people overcome impasses, and it does so by examining the relationship between impasses, fixation on prior ideas, and open goals. An open goal is a goal which has been set but one for which the associated task has not been completed. Recent work has shown that open problem solving goals bias people to acquire information relevant to the associated problem even when problem solving has been suspended (Moss, Kotovsky, & Cagan, in press).

In Experiment 1, verbal protocols were used to identify impasses in order to explore the relationship between open goals and impasses. Results from Experiment 1 led to a prediction about the relationship between hints and impasses that was tested in Experiment 2. The experiments employ a design where participants are implicitly shown hints for half of their previously unsolved problems during a lexical decision task which occurs between the first and second problem attempts. Both studies use compound remote associates problems (Bowden & Jung-Beeman, 2003).

Experiment 1: Protocol-Identified Impasses

The purpose of this study is to examine the effectiveness of implicit hints in relation to the representation of unsolved problems at the time problem solving is suspended. Verbal protocols were recorded while participants solved problems. These protocols were used to assess when participants were at an impasse as well as how fixated they were on distractor concepts which were related to the problem but not the solution. Our approach to defining impasses was to examine the rate of idea generation during problem solving, and to identify an impasse as the point where the problem solver is unable to generate a new idea for a given period of time.

Based on the fact that people are more likely to remember unsolved problems when an impasse has been reached (Patalano & Seifert, 1994), we hypothesized that the implicit hints would be more effective for problems where an impasse had been reached. It was found that the hint was most effective for non-impasse problems which was surprising given our initial hypothesis. Examination of the protocols led to an explanation of this surprising result in terms of the concepts of fixation and problem exploration. As work on a problem progresses, the problem solver develops a better representation of the problem. When an

impasse is encountered, the problem solver is unable to generate a new idea for how to proceed, and if work on the problem continues, a significant amount of fixation is built up because the problem solver often repeats prior failed attempts. Since participants often reached an impasse before the time limit for problem solving was up, they continued working on a problem after they had reached an impasse which led to a significant increase in the amount of fixation and impacted the effectiveness of the hint.

Given these results, if the problem is disengaged from at the point of impasse, then there would be some benefit from the prior problem exploration without fixation being built up through the repetition of failed problem attempts.

Experiment 2: Self-Identified Impasses

The purpose of this study was to investigate the prediction that implicit hints related to open goals would be most effective at the time of impasse. Participants were either allowed to abandon problem solving when they had reached an impasse or were forced to continue working on a problem after they indicated reaching an impasse.

Implicit hints were more effective when problem solving was suspended at the moment of impasse which supports the interpretation of the impasse and fixation results from Experiment 1. Even though the hint was presented after other problems had been worked on, the state at which problem solving had been suspended impacted the effect of the hint. Results from both studies begin to unpack the processes that are involved in impasses and show how impasses influence the acquisition and use of information related to open goals.

Acknowledgments

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