

# Returning to Unsolved Creative Problems

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Incubation refers to the effect in problem solving that spending time away from a creative problem may be beneficial to performance compared to continuous problem solving. The Opportunistic Assimilation theory (Seifert et al., 1995) explains this phenomenon with benefits from cuing from the environment during time away from the problem. The theory states that reaching an impasse on problems will encode 'failure indices' in memory that will trigger memory of the problem if the subject later opportunistically encounters information that is relevant to solving the problem. The theory has so far received mixed empirical support. The present research tested hypotheses derived from the Opportunistic Assimilation theory of incubation using insight tasks and an innovative design that allowed for testing analogical retrieval and analogical mapping separately in the same design.

In particular, the theory predicts that presenting analogous cues during time away from a problem will 1) trigger immediate analogical retrieval of the relevant problem, and 2) enhance performance (through analogical mapping) on the relevant problem.

## Methods

Forty undergraduates at the University of Pittsburgh participated in the experiment as part of a course requirement. They were given 45 minutes to solve 8 paper-and-pencil insight puzzles (presented in a booklet) taken from the literature. The subjects could freely move between puzzles, and could return to previous puzzles at any time. Every 5 minutes the subjects were handed an insight puzzle - with the answer included - to rate for difficulty. A cover story presented during the instructions ensured that the subjects were not expecting a relationship between the puzzles they were trying to solve, and the ones they would be rating for difficulty. In fact, these puzzles could be either an unrelated puzzle, or a puzzle with an analogous solution to one of the puzzles the subject was trying to solve. These 'cues' were handed to the subjects at a time when they had worked on the relevant problem, and moved on (i.e. after reaching an impasse). Cues and problem order in the booklet were varied across subjects. Subjects were asked to think-aloud during problem solving, and progress on the problems was videotaped.

## Results

For each subject a resolution score was calculated for the cued problems and the uncued problems respectively:

$$\frac{\# \text{ problems solved ultimately} - \# \text{ problems solved before impasse}}{\# \text{ unsolved problems at impasse}}$$

For the cued problems a mean of .53 (SD=.34) problems were resolved, whereas the uncued problems had a mean of .17 (SD=.23) problems resolved. A paired *t* test showed a significant difference between these scores ( $t(39)=5.62$ ,  $p<.001$ ). This shows that the cues were highly effective, and produced a large effect over a control of uncued problems that were initially unsolved and left. This finding could potentially be explained away if the subjects spent more time on the cued problems, but that appeared not to be the case.

To test if the subject retrieved the relevant problem immediately upon seeing the cue, it was coded whether the very next problem the subject physically turned to in the booklet was the previously unsolved relevant problem, or some other problem. Problems solved prior to impasse were excluded from this analysis. For each subject an immediate return rate was calculated (mean=0.50, SD=.34). The baseline was set conservatively to 1/3. A one sample *t* test still showed a significant difference between these scores ( $t(39)=3.11$ ,  $p=.003$ ).

Because the present design tested for both retrieval and mapping in the same design, it was possible to look at whether there was a performance increase on the problems that the subject did not retrieve immediately (see table 1).

Table 1: Resolution rates

|                 | Cued             |                | Not Cued |
|-----------------|------------------|----------------|----------|
|                 | Immediate return | Delayed return |          |
| Resolution rate | .67              | .32            | .16      |

Note. All relationships were at  $p=.02$  or better.

In conclusion, support was found for the Opportunistic Assimilation theory in that analogous cues from the environment lead to immediate analogous retrieval of previously unsolved problems, and increased performance through mapping. However, it was also found that on some problems where the subjects did not retrieve the relevant problem immediately, they still had a significant benefit of being cued, when they eventually did return to the relevant problem.

## References

Seifert, C. M., Meyer, D. E., Davidson, N., Patalano, A. L., & Yaniv, I. (1995). Demystification of cognitive insight: Opportunistic Assimilation and the prepared-mind perspective. In R. J. Sternberg & J. E. Davidson (Eds.), *The nature of insight*. Cambridge, MA: The MIT Press