Analogical Transfer in the Perspective of Insight Problem Solving: A Study on Duncker's radiation problem

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Background

The primary aim of this study is to provide a new perspective to look at the transfer of analogical problem solving in terms of the theory of contemporary studies on insight (Knoblich, 1999).

Many research in analogical problem solving made use of insight problems, for example Duncker's radiation problem and weight-the-elephant problem (Gick & Holyoak, 1980; Chen, 2002). However, most of the research was on the similarity between base problem and target problem in terms of structure and superficial features; few had taken an approach to address these problems and the transfer between them in terms of insight problem solving theories.

In this study, transfer was defined in terms of constraint relaxation and chunk decomposition, the processes that Knoblich et al (1999) used to describe the problem solving performance of matchstick arithmetic problems. Subjects were predicted to be more able to solve the target problem if they were exposed, in the base problem, the same type of constraint to be relaxed and/or the same type of chunk to be decomposed that were necessary for solving the target problem.

Method

198 undergraduates at the University of Hong Kong participated in the experiment as part of their course requirement. None of them had been exposed to the problems used in the study.

Every subject was given a booklet with the problems inside and the process was timed.

Procedures

Duncker's radiation problem was used as the target problem and the base problem was the fortress disperse-and-conquer problem. Constraint and chunk for Duncker's radiation problem were identified as followed: *Constraint to be relaxed*: there can only be a single x-ray source; *Chunk to be decomposed*: the intensity property of x-ray is non-additive and it has to be operated as one

In order to incorporate the above constraint and chunk, base problem was modified into four versions (2x2): *For constraint:* easy-to-relax (multiple-roads leading to fortress) and difficult-to-relax (single road leading to fortress); *for chunk*: easy-to-decompose (soldiers in separate groups) and difficult-to-decompose (soldiers in a single group)

Prior to experiment, each participant was instructed to write their answers in word or diagram format on the space provided on the worksheet and was told to write on different specified areas for different time intervals of the timed process. Problem solving performance was assessed by a number of factors:

1. Was the answer correct and complete?
2. Was hint provided after a 4 minutes time of non-productive work?
3. Was the general idea of answer matching the solution?
4. Was the score high under the efficiency scale?

Result and Discussion

The condition of constraint-easy-to-relax and chunk-easy-to-decompose was found to be least promising to facilitate a complete and correct answer for the target problem (α = .032) while there was no significant difference between the other conditions. The efficiency of base problem was found also to have an effect on target problem efficiency (α = .027). The presence of hint in base problem had an effect on the need of a target problem hint (α = .019)

The results showed that solvers could not effectively deal with the target problem if they had not experienced the impasse triggered by the same kind of constraint and chunk in the base problem. In previous studies, there was not a focus on whether a base problem requires us to break the type constraint or chunk that are present in the target problem. Also, usually these constraint and chunk were actually not present in the base problem.

References

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