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# The Effects of Perceptual Cues and Extrinsic Motivation on Creative Problem Solving

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## Introduction

This paper examines the effect of perceptual cues and extrinsic motivation on the establishment and breaking of psychological “set” (Einstellung) in Luchins’ (1942) water jar task (WJT). Einstellung (E-effect) occurs when participants become habituated to a particular solution strategy and persist in using it even when problem structure changes and a simpler and more economical solution is available. Many studies have shown that the blinding E-effect is quickly established, hard to break, and exacerbated by extrinsic constraints such as time pressure. Luchins and Luchins (1950) have further suggested that adding a perceptual element to the basic abstract task and limiting the resources available to participants might reduce the E-effect. We conducted a 2x2x2 factorial experiment to study the separate and combined effects of these variables on problem solving performance in the WJT.

## Method

### Participants

Participants were 104 undergraduate students in an introductory marketing course at the University of Wisconsin-Madison who received extra course credit for participating.

### Design

The experiment was a 2x2x2 between-subjects factorial design. The manipulated variables were perceptual cues (present/absent), time pressure (high/low), and limited resources (unlimited/limited liquid to solve problems).

### Procedure

Participants were randomly assigned to one of the eight experimental conditions. All were told that they were workers at a campus health clinic and had to use sets of three sterile vials (with no graduated markings) to measure needed amounts of flu vaccine for distribution to other clinics. Perceptual cues consisted of scaled visual representations of the three containers and target amount to be obtained for each problem and were presented together with the standard numerical representation of the problems. In the high time pressure condition participants were given one minute to solve each problem while in the low time pressure condition they were given the standard 2.5 minutes to solve each problem. In the limited resources condition participants were told that they had a total of 543 cc of vaccine and that this would be exactly enough to fill all of the orders

if they used the most economical solutions. All participants were given booklets containing Luchins’ (1942) 10 basic water jar problems (5 habituation problems and 5 critical problems) and an 11<sup>th</sup> “extreme obvious” solution problem (in which the first container was equal to the target amount).

## Results and Discussion

The experimental manipulations resulted in significant differences among groups in the size of the Einstellung effect (E-effect) on the set of six critical test problems. Time pressure was found to be a “creativity killer” (Amabile 1987), resulting in an E-effect of 54%. Adding perceptual cues to the time pressure condition strengthened the tendency toward mechanization and rigidity, producing an overall E-effect of 62%. In contrast, the E-effect was reduced to 32% in the limited resources condition and further reduced to 17% when perceptual cues were added. Intermediate-size E-effects, ranging from 28% to 42%, resulted when time pressure and limited resources were either both present or both absent.

Thus, we find that typical real-world decision making conditions such as time pressure and limited resources may have a significant impact on creative problem solving in dynamic contexts. When problem structure changes, time pressure may prevent problem solvers from seeing more direct and economical solutions. However, E-effects may be offset by problem solvers’ attention to resource limitations. The presence of perceptual cues may further help performance in the latter case and hinder performance in the former.

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