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# Inflexibility of experts—Reality or myth? Quantifying the Einstellung effect in chess masters ☆

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**Abstract**

How does the knowledge of experts affect their behaviour in situations that require unusual methods of dealing? One possibility, loosely originating in research on creativity and skill acquisition, is that an increase in expertise can lead to inflexibility of thought due to automation of procedures. Yet another possibility, based on expertise research, is that experts' knowledge leads to flexibility of thought. We tested these two possibilities in a series of experiments using the Einstellung (set) effect paradigm. Chess players tried to solve problems that had both a familiar but non-optimal solution and a better but less familiar one. The more familiar solution induced the Einstellung (set) effect even in experts, preventing them from finding the optimal solution. The presence of the non-optimal solution reduced experts' problem solving ability was reduced to about that of players three standard deviations lower in skill level by the presence of the non-optimal solution. Inflexibility of thought induced by prior knowledge (i.e., the blocking effect of the familiar solution) was shown by experts but the more expert they were, the less prone they were to the effect. Inflexibility of experts is both reality and myth. But the greater the level of expertise, the more of a myth it becomes.


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## 1. Introduction

The knowledge base of the expert permits feats that seem incredible to the novice. An expert chess player, for example, can play several games simultaneously without sight of the boards. But, paradoxically, it has been argued that experts may fail on problems that novices solve. When a novel approach is required, the experts' knowledge can make them unable to adapt to the new task demands. Sternberg (1996) summarised this view of the inflexibility of experts: "...there are costs as well as benefits to expertise. One such cost is increased rigidity: The expert can become so entrenched in a point of view or a way of doing things that it becomes hard to see things differently." (p. 347).

In this paper, we will explore the question of expert (in)flexibility using the Einstellung paradigm of Luchins (1942) with expert chess players. Given that the empirical evidence for expert (in)flexibility is rather sparse, we will first look at potential theoretical arguments for both possibilities—experts' flexibility and inflexibility. We will briefly review research in creativity and skill acquisition that is cited to predict the paradoxical possibility that experts, for all their knowledge, may become inflexible. The theoretical arguments for expert flexibility from research based on the natural study of experts will then be presented. We will then review empirical evidence suggesting that experts may indeed become inflexible in situations where a novel method or at least a modification of the existing method of dealing with the problem at hand is necessary. We will sketch out a possible theory for expert flexibility based on the previous empirical evidence and will finally present empirical evidence which provides new insight into the issue of expert (in)flexibility. Our main goal, however, will be to try to uncover the mechanisms behind experts' (in)ability to resist the Einstellung effect. This effect occurs in situations where people are unable to choose a less familiar, but optimal solution, rather than a familiar but non-optimal solution.

## 2. Creativity

When looking for possible reasons for expert inflexibility, researchers often point to work on creativity where a tension between knowledge (expertise) and inventive problem solving seems apparent (e.g., Frensch & Sternberg, 1989; Hesketh, 1997; Sternberg, 1996; Sternberg & Frensch, 1992; Zeitz, 1997). Although there is no universally accepted definition of creativity, most researchers agree that a creative product should be original and useful (see Sternberg, 1999). Given such characteristics, the creative product should go beyond previous knowledge and expertise, break links with the past and move away from stereotypical thinking. Implicit in this notion of creativity is that knowledge is necessary but not sufficient (for a different view see Hayes, 1989; Kulkarni & Simon, 1988; Weisberg, 2006).

The ambivalent role of prior knowledge in creativity can be seen in many different research traditions. Gestalt psychology distinguished between reproductive thinking as the application of previously acquired knowledge and productive thinking as the ability to go beyond past experience and produce something new (Wertheimer, 1959); James