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# The role of selective attention in preschoolers' rule use in a novel dimensional card sort

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## Abstract

Preschoolers often fail in switching between dimensions in sorting cards. To evaluate proposed cognitive constraints, we introduced a “same-silly” task, not requiring an extra-dimensional shift. Instructions were to sort cards so that the shapes were the same (“same” game) or *not* the same (“silly” game) as targets. In Experiment 1, using b/w line drawings, 3-year-olds successfully played both “same” and “silly” games. In Experiments 2 and 3, with the irrelevant dimension of color added to cards, most children below 4;6 perseverated on the “same” game, revealing an effect of stimulus complexity on rule-based reasoning. Thus, with uni-dimensional stimuli, 3-year-olds flexibly alternated between “same” and “silly” rules, but could not follow identical rules with bi-dimensional stimuli requiring selective attention to shape. We suggest that preschoolers’ difficulties in selective attention, rather than the presence of an extra-dimensional shift, lead to card sorting failure.

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## 1. Introduction

Preschoolers often exhibit a striking inability to follow verbal instructions. For instance, when told to tap once if an adult taps twice, and twice if an adult

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taps once, [Diamond and Taylor \(1996\)](#) found that 3- and 4-year-olds were often unable to follow the rules of the game over an extended series of trials. Their failure was in spite of the fact that they demonstrated knowledge of the rules in a pretest. Rather than doing the opposite of what the adult did, preschoolers tended to imitate the adult's actions, complied with only one of the two rules, or tapped many times regardless of what the adult did. Diamond and Taylor suggested that young children cannot keep two rules in mind and simultaneously inhibit one rule to execute another. Preschoolers may lack an ability to exercise inhibitory control or selectively attend to the relevant features of the game.

Previous research on preschoolers' rule use (e.g., [Frye, Zelazo, Brooks, & Samuels, 1996](#); [Gerstadt, Hong, & Diamond, 1994](#); [Zelazo, Frye, & Rapus, 1996](#)) has questioned when and how children are able to integrate information to switch flexibly between sets of rules. Young children often experience difficulties in manipulating rules, with an inability to inhibit prepotent responses, such as imitating adult actions in the tapping task described above. Their errors have been attributed to a lack of development of executive functions responsible for self-regulation, inhibition, attention, planning, monitoring and modifying behavior, maintaining representations in working memory, learning conditional contingencies, and providing resistance to interference ([Livesey & Morgan, 1991](#); [Robin & Holyoak, 1998](#)). An important issue concerning executive functions has been to specify their role in mastery of rule-based behavior.

The anatomical correlate for the executive functions is believed to be the prefrontal cortex. [Luria \(1966\)](#) was among the first to argue that postnatal changes in the prefrontal cortex correlate with behavioral changes associated with inhibition, control, and self-regulation. Frontal lobe patients often show an inability to inhibit responses, perseveration of previous responses, and lack of planning. Tasks used to uncover frontal lobe functioning, such as the Wisconsin card sort, Stroop, and Luria's tapping task, have been modified for children to provide researchers with a clearer idea of the role of the prefrontal cortex in executive function development.

To assess executive function development, researchers have attempted to study the core abilities associated with problem representation, planning, rule execution, and evaluation. One commonly used task is the dimensional change card sort (DCCS) task of Zelazo, Frye, and colleagues (e.g., [Frye, Zelazo, & Palfai, 1995](#); [Zelazo & Reznick, 1991](#); [Zelazo et al., 1996](#)). In the DCCS, preschoolers are presented with bi-dimensional cards (e.g., with varying shapes and colors) to sort into piles according to explicitly stated sets of rules. Children are shown two model cards (e.g., a yellow flower and a green shoe) and are given sorting cards that differ from the model cards in one dimension (e.g., green flowers and yellow shoes). Children are asked to sort cards according to specific rules about a particular dimension. For example, when playing the "shape" game, children are instructed to place cards with flowers next to the yellow flower and cards with shoes next to the green shoe because they are the same shape. After a series of trials, children are told that they are to play a new game, the "color" game, and will no longer be playing the "shape" game. In the "color" game, they are instructed to place yellow

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