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PAPER

Indirect goal priming is more powerful than explicit instruction in children

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Abstract

This study examined the relative efficacy of explicit instruction and indirect priming on young children's behavior in a task that required a series of choices between a small immediate reward and a larger delayed reward. One hundread and six 4-year-old children were randomly assigned to one of four conditions involving one of two goals (maximize rewards or obtain immediate rewards) and one of two types of instruction (indirect priming using stories or explicit verbal instructions). Children were more likely to make goal-congruent choices as a result of indirect priming, but there was no effect of explicit instruction, suggesting that indirect approaches to changing young children's behavior may be more effective than direct approaches under some circumstances. These results have implications for understanding the dynamic interplay between bottom-up and top-down influences on self-regulation early in development.

Introduction

How we think and behave is the result of a complex interaction between internal goals and a constant stream of suggestions from the environment. In some cases, these suggestions are explicit, as when we follow a direct instruction, but in other cases, they are indirect, and they may affect our behavior with relatively little conscious control or awareness. In fact, Bargh and Williams (2006) suggest that much of our social behavior is influenced indirectly, in ways we cannot describe.

Work with adults suggests that a wide variety of relatively complex cognitive representations, including evaluations, attitudes, goals, motivations, and social perception, can be activated automatically and without awareness (Bargh & Morsella, 2008). For example, Bargh, Gollwitzer, Lee-Chai, Barndollar and Trotschel (2001) found that participants subtly primed with the goal of achievement subsequently found more words when asked to complete a series of word search tasks. Despite the growing body of research demonstrating the potentially powerful effects of subtle priming in adults, however, and despite emerging research that suggests that children can also be primed to behave in specific ways (Over & Carpenter, 2009), there has been no work examining the relative influence of implicit and explicit processes in childhood. Indirect priming may be a particularly effective way of influencing young children's behavior because it does not require the implementation of top-down, conscious control – something that is conspicuously immature during the preschool years and that continues to develop well into adolescence (Zelazo, Carlson & Kesek, 2008).

Research with adults suggests that implicitly and explicitly held goals can have comparable effects on thought and behavior. Bargh and colleagues (2001) compared how indirect priming and explicit instructions influenced behavior on a resource-dilemma task in which participants made a series of decisions to either contribute to a shared pool of resources or to maximize their own profit. Subtly priming the goal of cooperation, using a scrambled sentence task, was as effective at producing goal congruent behavior as explicitly instructing participants to be cooperative. However, even for adults, who are capable of higher-order reflective processing, there may be critical individual differences in the extent to which participants are able to implement an explicit goal (Zelazo, 2004). Williams, Bargh, Nocera and Gray (2009) found that for people who reported using emotion regulation strategies frequently in their daily lives, priming the goal of emotion regulation and providing explicit instructions to regulate emotion were equally effective at reducing physiological reactivity. For habitual reappraisers, reappraisal is likely

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to be a chronically accessible goal, automatically activated in emotionally stressful situations. Thus, either implicit or explicit instructions to reappraise may be implemented with relative ease. For participants who reported infrequent use of emotion regulation strategies, on the other hand, priming emotion regulation resulted in more successful emotion regulation than did explicit instructions. That is, indirectly activated goals were particularly effective for individuals who had little experience with intentional implementation of the goal. These results suggest that implicit instructions, which are likely less taxing on limited cognitive resources than explicit instructions, may allow for the efficient, indirect activation of self-regulatory goals in challenging situations.

Given extensive research suggesting preschool-age children have difficulty engaging in goal-directed behavior (Zelazo *et al*., 2008), there are reasons to believe that indirect suggestions may prove more effective than explicit suggestions at influencing children's behavior. In general, with development, children are thought to become increasingly reflective, concomitant with the development of prefrontal cortex (Zelazo, 2004). However, the brain follows a hierarchical pattern of development, with regions involved in relatively automatic responses to stimuli, such as basal ganglia and amygdala, developing earlier than regions associated with more controlled processing, such as lateral areas of prefrontal cortex (O'Reilly, Noelle, Braver & Cohen, 2002; Zelazo & Cunningham, 2007). This trajectory suggests that the associative learning required for the priming of relatively simple goal representations may be present early in life – earlier, perhaps, than the ability to act according to explicitly held goals.

In the current study we sought to investigate whether indirect primes would be effective at changing 4-year-old children's behavior in the context of a delay of gratification paradigm. Children were primed using stories in which the protagonist sought either to maximize rewards or to obtain immediate rewards. In order to determine the relative efficacy of indirect and explicit suggestions, these primes were contrasted with conditions in which children were given explicit instructions either to maximize or to obtain immediate rewards.

Method

Participants

One hundred and six 4-year-old children (55 females) participated. Children were recruited from a database of families who had previously expressed interest in participating in research. Two-thirds of the sample were younger 4-year-olds (M = 48.6 m; range: 47–52 m), and the remaining third were older 4-year-olds (M = 57.2 m; range: 57–59 m).

Implicit Most Condition	Implicit Immediate Condition
Story: Maximize rewards	Story: Immediate rewards
Explicit Instruction: None	Explicit Instruction: None
Explicit Most Condition	**Explicit Immediate Condition**
Story: Neutral	Story: Neutral
Explicit Instruction: Maximize rewards	Explicit Instruction: Immediate rewards

Figure 1 *An outline of the factorial design of the study.*

Procedure

Children were randomly assigned to one of four conditions in which they heard a recorded story with accompanying illustrations presented on a computer (see Figure 1 for an outline of the design). In all conditions, the story involved a boy named Jamie who spends the day with his grandfather and discusses an upcoming trip to the fair. In the *implicit maximize* condition, Jamie often uses the words 'most', 'lots', 'a lot' and 'as many' (e.g. 'Jamie loved his Grandpa, and wanted to spend the most time with him that he could'). In the final part of the story, Jamie expresses his desire to maximize rewards (i.e. 'After Grandpa left, Jamie thought about how he wanted to win the most prizes that he could, so he would have a lot of prizes to take home at the end of the day'). In the *implicit immediate* condition, Jamie often uses the words 'soon', 'right away', and 'couldn't wait' (e.g. 'Jamie loved his Grandpa, and wanted to spend time with him right away'). In the final part of the story, Jamie expresses a desire to obtain rewards immediately (i.e. 'After Grandpa left, Jamie thought about how he couldn't wait to start winning prizes, and how he wished he could have the prizes right away'). In the *explicit maximize* condition, children heard a neutral version of the story in which Jamie simply plays with his Grandpa (e.g. 'Jamie loved his Grandpa, and wanted to spend time with him') and then contemplates winning prizes (i.e. 'After Grandpa left, Jamie thought about the prizes he could win, and how fun it would be to play with them'). Children were then verbally instructed by the experimenter to, 'Get the most rewards that you can'. Children heard the same neutral story in the *explicit immediate* condition, but after the story, these children were instructed to, 'Get rewards as soon as you can'.

Immediately following the story (and, if applicable, the explicit instruction), children completed a delay of gratification task that required a series of decisions between smaller/immediate versus larger/delayed rewards (Prencipe & Zelazo, 2005; Thompson, Barresi & Moore, 1997). Children were told that they had to make a series of choices involving different rewards. Children made nine choices involving three different rewards (pennies, stickers, and candies) and three different ratios (1 now vs. 2 later, 1 now vs. 4 later, 1 now vs. 6 later). Each of the nine trial types was represented on a separate card that

graphically illustrated the choice to be made. Before the task began, children were allowed to sample each reward before the task began by eating one candy, placing one penny in their penny jar, and placing one sticker on a card. Two demonstration trials were used to illustrate the task. In each of these trials, the experimenter read a preselected card (i.e. 1 vs. 2 pennies or 1 vs. 4 pennies) aloud and made a choice. To illustrate both immediate and delayed response options, the experimenter chose the immediate reward on the first trial and chose the delayed rewards on the second trial. The consequences of the first decision were demonstrated by dropping the penny in a jar. The consequences of choosing the delayed rewards were illustrated by putting the pennies aside in an envelope. After the demonstration, the child was informed that it was his or her turn to play. Before each trial, the experimenter randomly selected a card that illustrated the choice for that particular trial and placed the corresponding potential rewards in two piles in front of the child. On each trial, children were reminded that they could have one reward now or they could have the larger pile if they waited until the end of the game. Specifying that children would receive the delayed rewards 'at the end of the game' provided a concrete, easily understood timeframe for the delay. Previous work with preschoolers suggests that children understand the contingencies associated with this task (e.g. Hongwanishkul, Happaney, Lee & Zelazo, 2005; Prencipe & Zelazo, 2005). Children indicated their responses verbally or by pointing.

Following the delay of gratification task, children were asked three memory questions designed to assess their memory for details from the story (e.g. 'Who did Jamie play with?'; 'What did they talk about doing the next time they played together?'; 'What did Jamie want to do at the fair?'), and three influence questions designed to determine whether they were aware of any influence from the story (e.g. 'Do you think the story had anything to do with your choices in the game?'; 'Did you think about Jamie while you made your choices in the game?'; 'Did thinking about Jamie have anything to do with your choices?'). Children were allowed to indicate their responses either verbally or by gesture (nodding or shaking their head).

Results

An initial analysis of variance (ANOVA) confirmed that for both older and younger children, there were no age differences between experimental conditions. The primary dependent measure was the proportion of times each child chose to delay. Preliminary analyses revealed no age differences between younger and older 4-year-olds, so data for the two age groups were combined, and there was also no effect of gender, so gender was not included in subsequent analyses. A 2 (Instruction type: indirect, explicit) × 2 (Goal: maximize rewards, immediate rewards) ANOVA revealed no significant main effect of instruction type, $F(1, 102) = .14$, *ns*, partial $\eta^2 = .01$, and a marginally significant main effect of goal type, $F(1, 102) = 3.71$, $p = .057$, partial $\eta^2 = .04$. This result was qualified by a significant interaction between instruction type and goal, $F(1, 102) = 6.27$, $p = .014$, partial $\eta^2 = .06$. Bonferroni-corrected *t*-tests revealed that children primed with the goal of maximizing rewards chose the larger, delayed reward more often ($M = .71$, $SE = .058$) than those primed with the goal of getting immediate rewards ($M = .41$, $SE = .066$), $t(54) = 3.36$, $p < .05$. In contrast, there was no difference between the *explicit immediate* condition ($M = .65$, $SE = .074$) and the *explicit maximize* condition ($M = .62$, $SE = .067$), $t(48) = .38$, *ns* (see Figure 2). This pattern of data suggests that children's choices on the task were influenced by indirect priming, but not by explicit instructions.

To assess whether memory for the story varied across conditions, a composite score was created by summing accurate responses to each of the three meaning questions. An ANOVA revealed that children's memory for details of the story did not differ across conditions, $F(3, 100) = 1.87$, *ns*. Across conditions, the mean score (and *SE*) was 1.5 (.11) accurate responses out of 3.

To examine children's perception of the story's influence on their responses, children were asked a series of three questions. A composite score was created by summing the number of times children responded affirmatively to each of the three influence questions. There were no differences across conditions $F(3, 100) = 1.78$, *ns*; the mean number of affirmative answers (and *SE*) was 1.08 (.10) out of 3.

Discussion

These results demonstrate that preschool-age children can be primed to act in accordance with a goal. In contrast to priming, explicit instructions did not influence children's choices on a delay of gratification task. Together, these results suggest something many parents may have learned: sometimes, indirect approaches to

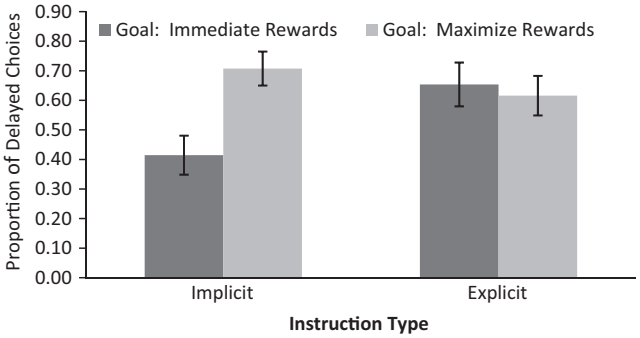

Figure 2 *Mean proportion of delayed choices, as a function of goal (maximize rewards or immediate rewards) and instruction type (indirect or explicit). Error bars indicate standard errors.*

changing young children's behavior may be more effective than direct approaches.

The power of indirect priming in childhood is consistent with the hierarchical nature of neural development, such that sub-cortical regions underlying relatively automatic responses develop earlier than areas of prefrontal cortex responsible for deliberate self-control. The implications of divergent trajectories of neural development have often been studied in the context of adolescence, when a distinct gap between cognitive and emotional reasoning is observed. Casey, Getz and Galvan (2008), for example, propose a model suggesting that thought and behavior tend to be biased by relatively functionally mature neural systems, with the imbalance between a relatively mature limbic system and a relatively immature prefrontal system driving risky decision-making in adolescents. Casey and colleagues suggest that this imbalance is not as evident in young children because both of these systems are relatively immature. The current findings suggest, however, that more subtle relative differences in functional maturity in childhood can be observed by investigating the extent to which behavior is influenced by indirect versus explicit instructions.

There is extensive research suggesting that priming manipulations can have powerful effects on the thoughts and actions of adults (Bargh & Huang, 2009). Furthermore, work with adults suggests that in some circumstances, implicit suggestions may even be more effective than explicit suggestions at changing behavior (Williams *et al*., 2009). The current results provide support for the hypothesis that indirect goal activation may be particularly effective in changing the behavior of children, who have difficulty consciously changing thought or behavior. Difficulty with intentional goal implementation does not seem to preclude the possibility of effective implicit influence, and it may even potentiate such influences, although this possibility remains to be tested directly.

The suggested dissociation in the developmental trajectories of implicit and explicit processes supported by the current results may provide insight into other, age-related changes in implicit and explicit knowledge. Specifically, there is evidence that young children are sometimes able to deduce simple rules but have no explicit access to those rules, and are unable to explain how to succeed on a task they are able to perform correctly (Bullock & Gelman, 1979; Diamond, Towle & Boyer, 1994). For example, Diamond and colleagues (1994) found that although 3-year-old children successfully performed a delayed nonmatch-to-sample task, which requires the deduction of a rule, they were unable to articulate the rule guiding their choices. Younger children (12–18 months), on the other hand, were unable to perform the task successfully even when explicitly told the rule. These results may be explained by models of development suggesting that implicit processes develop earlier, and may have a stronger effect on behavior than more explicit influences, whether internally or externally generated.

The current results must be considered in light of a number of limitations. First, the current study involved only one type of priming manipulation. The particular type of priming examined here represents, perhaps, a behavioral contagion effect (Chartrand & Bargh, 1999). That is, children's behavior was influenced by the intended actions of the character in the story. This priming manipulation may have been especially effective for young children, for whom the actions of peers are particularly salient. Children may have been more influenced by indirect suggestions from a child protagonist than by explicit instructions delivered by an adult. Future research should explore whether other types of priming (e.g. subliminal priming, mindset priming) would be similarly effective at influencing children's behavior.

One possible alternative explanation for the current results is that children may not have attended to the explicit instructions. An explicit instruction with additional emphasis or explanation may have proven as effective as the implicit instructions. Although the explicit directions were relatively straightforward, future research should examine the extent to which further instruction or scaffolding would lead to comparable effects of implicit and explicit instructions in children.

Although these limitations should be considered, it is also important to consider the possibility that indirect approaches may prove effective at changing children's behavior in a wide range of situations. For example, stories and television programs aimed at children often have an underlying moral message that is never explicitly stated. There is some question as to whether children understand these moral messages. For example, Mares and Acosta (2008) found that children had difficulty articulating the underlying moral message of a television program that involved fictional animal characters. Children may not be able to articulate the moral of the story, but the moral may influence their behavior nonetheless. Further work might usefully assess how the relative effectiveness of these kinds of approach changes as children develop, including at what point children are able to override indirect suggestions in order to accomplish an explicit goal.

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