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Improving children's affective decision making in the Children's Gambling Task

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ABSTRACT

Affective decision making was examined in 108 children (3-, 4-, and 5-year-olds) using the Children's Gambling Task (CGT). Children completed the CGT and then responded to awareness questions. Children in the binary_experience and binary_experience+awareness (not control) conditions first completed two simpler versions. Children in the binary_experience+awareness condition also responded to questions about relational components of the simpler versions. Experience with simpler versions facilitated decision making in 4- and 5-year-olds, but 3-year-olds' advantageous choices declined across trial blocks in the binary_experience and control conditions. Responding to questions about relational components further benefited the 4- and 5-year-olds. The 3-year-olds' advantageous choices on the final block were at chance level in the binary_experience+awareness condition but were below chance level in the other conditions. Awareness following the CGT was strongly correlated with advantageous choices and with age. Awareness was demonstrated by 5-year-olds (all conditions) and 4-year-olds (binary_experience and binary_experience+awareness) but not by 3-year-olds. The findings demonstrate the importance of complexity and conscious awareness in cognitive development.

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Introduction

The capacity to make prudent decisions is a cognitive achievement whose importance in daily living is difficult to overstate. Decision making appears to have a protracted course of development, and even adults frequently make errors or succumb to biases (Kahnemann, 2011). Effective decision making usually involves conscious consideration and integration of potential costs and benefits in order to identify the best course of action. The complexity of this integration process has been identified as a source of difficulty for young children (Andrews, Bunch, & Tolliday, 2008; Bunch, Andrews, & Halford, 2007; Kerr & Zelazo, 2004). Another issue is the role of conscious awareness (Garon, Longard, Craig, & Kent, 2015; Garon & Moore, 2004, 2007). In the current research, we examined the roles of cognitive complexity and awareness in 3-, 4-, and 5-year-olds' decision making on the Children's Gambling Task (CGT; Kerr & Zelazo, 2004). The aim was to determine whether performance on the standard CGT is improved when less complex versions of the CGT are presented before the standard version and whether questioning children about the relational components of the tasks confers a further benefit.

The CGT (Kerr & Zelazo, 2004) is a simplified version of the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994) that is widely used to assess affective decision making in adults. In the IGT, adult participants are given an initial stake of play money and are instructed to win as much money as possible by choosing cards from four decks. The four decks have different gain–loss profiles. The cards in the two disadvantageous decks yield high gains but higher losses. Selection of cards from these decks results in a net loss over trials. The cards in the two advantageous decks yield smaller gains but minimal losses. Selection of cards from these decks results in a net gain over trials. Neurologically intact adults learn over trials to select cards from the advantageous decks and to avoid the disadvantageous decks. In contrast, patients with lesions to the ventromedial region of the prefrontal cortex continue to select from the disadvantageous decks (Bechara et al., 1994, 2001).

The roles of conscious and nonconscious processes in advantageous responding on the IGT have been controversial (Bechara, Damasio, Tranel, & Damasio, 1997; Cui et al., 2015; Maia & McClelland, 2004). Proponents of the somatic marker hypothesis claim that conscious awareness emerges as the task progresses and that advantageous choices are made before conscious awareness of the advantageous decks is demonstrated. Others have questioned the latter point. Maia and McClelland's (2004) research employed more sensitive measures of conscious knowledge than Bechara and colleagues' research had done. Their findings suggest that advantageous choices were based on conscious knowledge.

The roles of conscious awareness and complexity have been addressed in cognitive developmental research using the CGT. In the CGT (Kerr & Zelazo, 2004), there are two decks of cards rather than four. This version has been used with children from 3 years of age (Bunch et al., 2007; Gao, Wei, Bai, Lin, & Li, 2009; Garon & Moore, 2007; Mata, Sallum, Miranda, Bechara, & Malloy-Diniz, 2013). The cards display happy and sad faces indicating the numbers of rewards (e.g., sweets, stickers) won and lost, respectively.

Kerr and Zelazo (2004) administered five 10-trial blocks. On later trial blocks, 4-year-olds made more choices from the advantageous deck than 3-year-olds, and 4-year-olds made significantly more advantageous choices than would be expected by chance on Blocks 3 and 5, whereas 3-year-olds made significantly fewer advantageous choices than would be expected by chance on Blocks 3 and 4. Kerr and Zelazo interpreted their findings in terms of cognitive complexity and control (CCC) theory (Zelazo & Frye, 1997; Zelazo, Müller, Frye, & Marcovitch, 2003), which proposes age-related increases in the maximum complexity of rules that children can use. From around 3 years of age, children can use a pair of arbitrary rules. At around 4 or 5 years of age, they can integrate two incompatible pairs of rules into a single rule system via a higher order rule (Zelazo, Jacques, Burack, & Frye, 2002). Older children are able to represent the higher order rule, and this allows them to appreciate net gains in the CGT. Representation of a higher order rule requires children to reflect on lower order rules. Without reflection, the full hierarchy in which lower order rules are embedded under higher order rules cannot be constructed (Zelazo, 2004). Thus, CCC theory specifies roles for cognitive complexity (lower order vs. higher order rules) and awareness (reflection on lower order rules) in the CGT and in cognitive development more generally.