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Brief Report

Five-year-olds do not show ambiguity aversion in a risk and ambiguity task with physical objects



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ABSTRACT

Ambiguity aversion arises when a decision maker prefers risky gambles with known probabilities over equivalent ambiguous gambles with unknown probabilities. This phenomenon has been consistently observed in adults across a large body of empirical work. Evaluating ambiguity aversion in young children, however, has posed methodological challenges because probabilistic representations appropriate for adults might not be understood by young children. Here, we established a novel method for representing risk and ambiguity with physical objects that overcomes previous methodological limitations and allows us to measure ambiguity aversion in young children. We found that individual 5-year-olds exhibited consistent choice preferences and, as a group, exhibited no ambiguity aversion in a task that evokes ambiguity aversion in adults. Across individuals, 5-year-olds exhibited greater variance in ambiguity preferences compared with adults tested under similar conditions. This suggests that ambiguity aversion is absent during early childhood and emerges over the course of development.

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Introduction

In the field of decision science, economists and psychologists formally distinguish between two types of uncertainty: risk, in which outcomes are uncertain but their probabilities are known (e.g., a 50% chance of winning \$10, otherwise \$0), and ambiguity, in which outcomes are uncertain and their probabilities are unknown (e.g., some unknown chance of winning \$10, otherwise \$0). Adult decision makers exhibit ambiguity aversion, or the preference for risky gambles over ambiguous gambles with equivalent potential outcomes. This was first demonstrated in the classic Ellsberg urn paradigm (Ellsberg, 1961), in which participants preferred to draw from a physical urn containing 50% winning and 50% losing balls over drawing from an urn containing some unknown ratio of winning to losing balls. Throughout the decades since Ellsberg's seminal work, ambiguity aversion has been consistently found in adult decision makers in a variety of different tasks (Becker & Brownson, 1964; Einhorn & Hogarth, 1986; Fox & Tversky, 1995; Hsu, Bhatt, Adolphs, Tranel, & Camerer, 2005; Yates & Zuckowski, 1976; for reviews, see Camerer & Weber, 1992; Trautmann & van de Kuilen, 2015).

Many everyday decisions are formally ambiguous—even if they are colloquially described as “risky.” For example, a child may know that it is “risky” to climb to the top of the jungle gym, but she does not know the exact probabilities of falling and hurting herself. Consequently, for people's everyday decisions, ambiguity preferences may be better predictors than risk preferences (i.e., preferences for certain outcomes over economically equivalent risky outcomes). In fact, two studies have found that ambiguity aversion, but not risk aversion, correlates negatively with self-reported everyday reckless behavior in older children, adolescents, and adults (Blankenstein, Crone, van den Bos, & van Duijvenvoorde, 2016; Tymula et al., 2012). Such correlations, when linked to the finding that adolescents are less ambiguity averse compared with adults (Tymula et al., 2012), have led to the conjecture that the developmental peak in reckless everyday decision making found in adolescents is driven by their tolerance for ambiguity (Shulman et al., 2016). This, in turn, suggests that public health interventions should be tailored to adolescents' ambiguity attitudes (Tymula et al., 2012).

More recent studies with younger populations, however, have found that ambiguity tolerance is not unique to adolescents. Developmental work has found that 8-year-olds are also less ambiguity averse compared with adults (Li, Brannon, & Huettel, 2015), and a cross-sectional study of participants between the ages of 10 and 25 years found ambiguity aversion to linearly increase with age, with no evidence of a quadratic trend or peak during adolescence (Blankenstein et al., 2016). Characterizing ambiguity preferences during young childhood, thus, could provide insight into its developmental time course, allowing better appreciation of later changes during adolescence and suggesting developmentally earlier opportunities for intervention to reduce maladaptive decision making. For example, the assumption that the adolescent peak in everyday reckless behavior is mirrored by laboratory risk-taking findings has been challenged by studies showing that young children take more risks compared with adolescents (Eshel, Nelson, Blair, Pine, & Ernst, 2007; Paulsen, Carter, Platt, Huettel, & Brannon, 2012; Paulsen, Platt, Huettel, & Brannon, 2011; Weller, Levin, & Denburg, 2011; for reviews, see Defoe, Dubas, Figner, & van Aken, 2015; Paulsen, Platt, Huettel, & Brannon, 2012) and highlights the need to investigate broader developmental trajectories in developmental decision-making research.

The few aforementioned currently published developmental studies of ambiguity aversion (Blankenstein et al., 2016; Li et al., 2015; Tymula, Rosenberg Belmaker, Ruderman, Glimcher, & Levy, 2013; Tymula et al., 2012) used abstract computerized stimuli to represent risk and ambiguity. Risky stimuli represented by segmented pies or bars depicting probabilities, however, may be challenging for young children to grasp before they receive formal education in probability or proportions. Furthermore, computerized ambiguous stimuli rely on visually occluded pies or bars to represent hidden probabilities (e.g., a red, blue, and gray pie with red and blue representing known probabilities and gray representing unknown probabilities). Occluded information that already represents an abstract concept of probability and that further cannot be seen requires complex verbal explanations that are likely even more difficult for young children to comprehend. Similarly, because the classic Ellsberg urn paradigm relies on verbal explanations of each urn's contents, it would likely tax the limits of young children's attention spans and working memory. Due to such methodological challenges, no studies to date have evaluated the ambiguity preferences of children younger than 8 years.

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