

# Risk and Ambiguity Preferences in Chimpanzees

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Risk preferences shape many of the decisions people make in life and is a crucial determinant of life outcomes such as health, wealth, and wellbeing. Yet, the biological underpinnings of this key building block of behavior remain unclear. Here, we investigated the extent to which chimpanzees, humans' closest living relatives, exhibit risk preferences that are in important respects isomorphic to human risk preferences. There are theoretical reasons to expect evolutionary continuities in risk preferences. Life-history theory predicts that differences in fitness expectations lead to systematic variations in risk taking behavior (Stearns, 1992). Reproductive competition is most intense for young males who compete for females and increased risk-taking has been observed in young human adult males (young male syndrome; Wilson & Daly, 1985).

In a multimethod approach, we studied 86 chimpanzees (47 females) aged from infancy to adulthood (age 2–40 years) in a cross-sectional design. We considered various domains that represent major classes of risks in the chimpanzee ecology and combined observer ratings with carefully controlled behavioral choice experiments. Specifically, we focus on four structural aspects of risk preference. First, does chimpanzee, like human risk preference, have the property of a psychological trait (Frey et al., 2017)? Second are chimpanzees ambiguity averse (Ellsberg, 1961)? Third, are males more inclined to take risks than females (Frey et al., 2021)? Fourth, do age differences in chimpanzee risk preference mirror those in humans, with risk taking peaking in early adulthood and being less pronounced in older age (Frey et al., 2021; Josef et al., 2016)?

Our results show, first, large positive correlations between risk domains and measurements, suggesting that risk preference in chimpanzees has the property of a psychological trait that manifests across domains in both behavior and observational assessments. Second, in the choice experiments, chimpanzees chose the risky urn in 55% but the ambiguous urn in only 25% of trials, see Fig. 1. This implies that chimpanzees are clearly ambiguity averse. Third, across domains and measurements, male chimpanzees were more risk prone than females, see Fig. 2. Fourth, the appetite for risk peaked in young adulthood (especially for males), indicating that chimpanzee risk preference follows an inverted U-shaped relation to age, see Fig. 3 and 4.

These findings suggest that the structural regularities of this building block of behavior are likely to reflect adaptations to similar dynamics in human and primate life histories. Modern humans' attitudes to risk are likely to be at least as old as humanity's last common ancestor with chimpanzees.



Figure 1. Ambiguous and risky choices in the behavioral experiments. (a) Set-up. (b) Ambiguous condition. (c) Risky condition. (d) Proportion of ambiguous and risky choices. Black dots represent means; error bars 95% credible intervals.

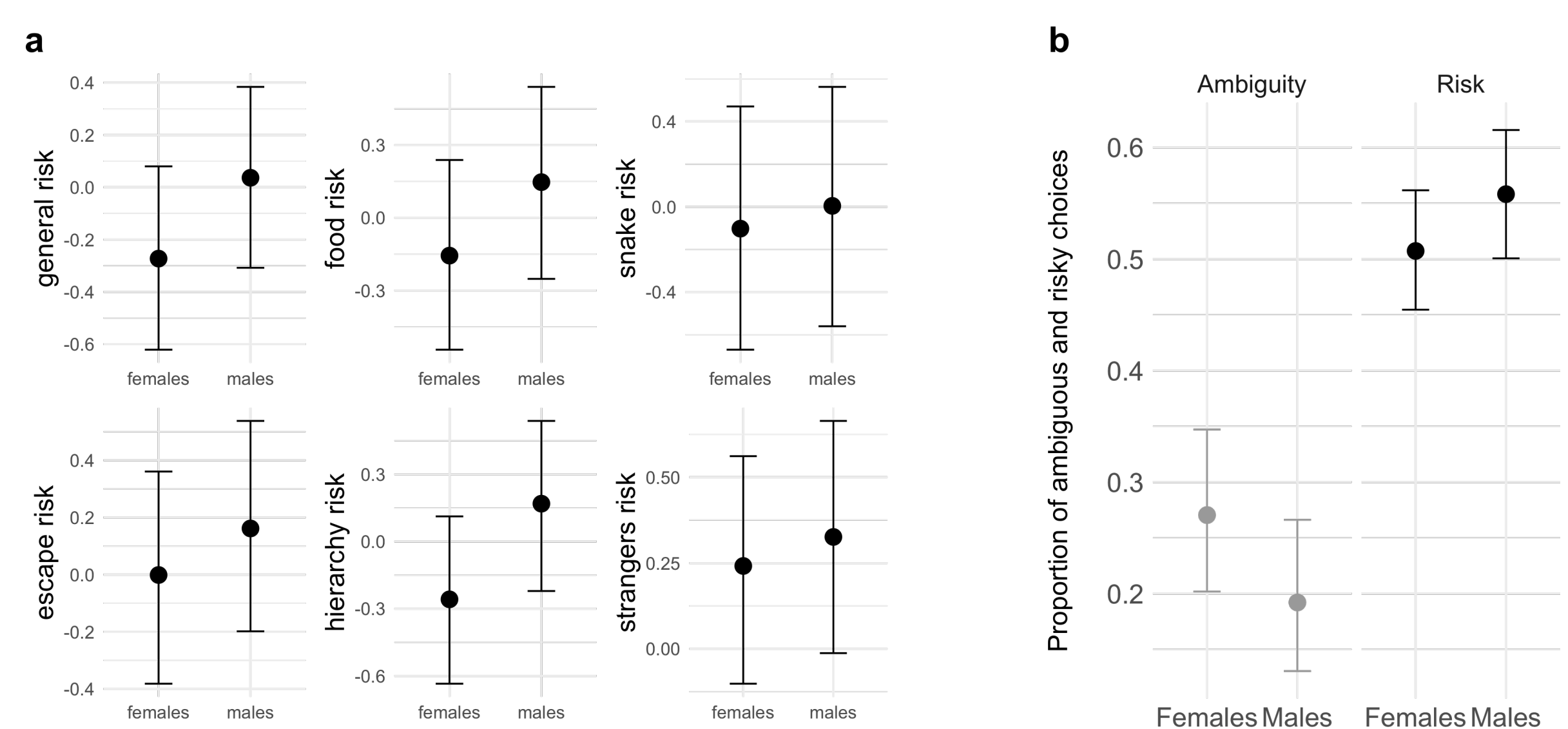


Figure 2. Sex differences in risk preference. Black dots represent means; error bars 95% credible intervals. (a) Sex differences in mean levels of general and domain-specific willingness to take risks. (b) Sex differences in proportion of ambiguous and risky choices.

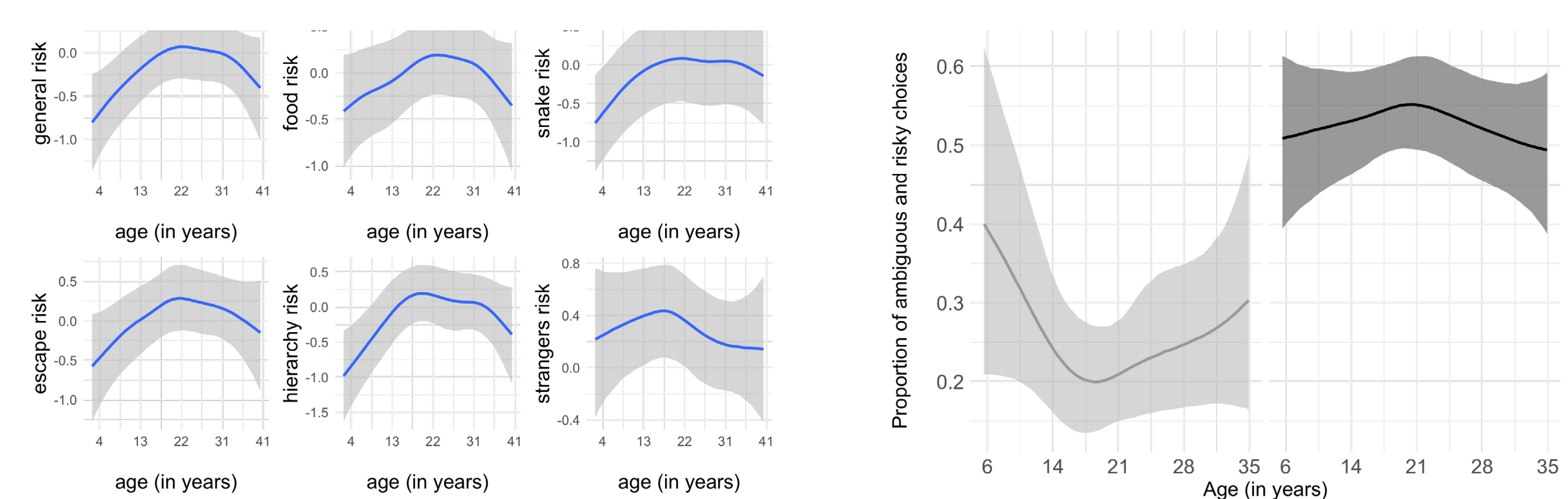


Figure 3. Age differences in risk preference. Regression splines with shaded 95% credible intervals. (a) Age differences in mean levels of general and domain-specific willingness to take risks. (b) Age differences in proportion of ambiguous and risky choices.

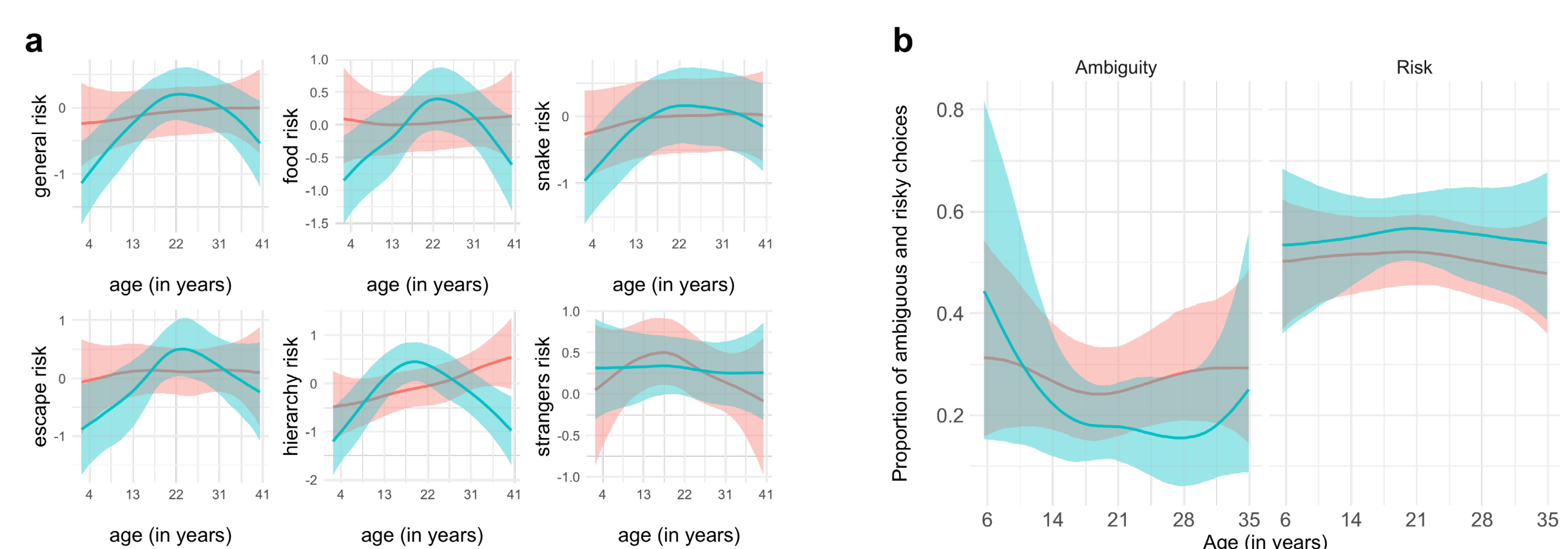


Figure 4. Age and sex differences in risk preference. Regression splines with shaded 95% credible intervals. Red lines indicate females; blue lines males. (a) Age and sex differences in mean levels of general and domain-specific willingness to take risks. (b) Age differences in proportion of ambiguous and risky choices.

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