Rational Belief Revision in Chimpanzees

Rationality has long served as a central standard for evaluating human thought and has traditionally been regarded as uniquely human. Reasoning is typically considered rational only insofar as beliefs are grounded in, and appropriately updated by, the evidence available to the thinker. One particularly informative way to study rationality is by examining selective belief revision—that is, whether and how agents revise their beliefs as a function of the strength and relevance of new evidence.

In this talk, I present four studies suggesting that the capacity for rational belief revision is shared with our closest evolutionary relatives, chimpanzees. Across these studies, we investigate whether chimpanzees revise their beliefs in ways that are sensitive to evidence strength, second-order evidence, and social sources of information.

In the first two experiments, we investigated chimpanzees' (N = 15; preregistered) responses to counter-evidence. A piece of food was hidden in one of two locations. Chimpanzees first received evidence favoring one location and made an initial choice. They were then presented with a second piece of evidence favoring the alternative location and made a second choice. Crucially, we varied whether the second evidence was weaker (strong-evidence-first condition) or stronger (weak-evidence-first condition). Across both experiments, chimpanzees were significantly more likely to revise their beliefs when the initial evidence was weak than when it was strong (Experiment 1: $\chi^2 = 14.03$, df = 1, $p < .001$; Experiment 2: $\chi^2 = 20.52$, df = 1, $p < .001$), indicating sensitivity to the relative strength of competing pieces of evidence.

In the third experiment (N = 22 chimpanzees; preregistered), we examined whether chimpanzees revise their beliefs in light of second-order evidence, specifically undermining defeaters—information that weakens the evidential basis of a belief without directly supporting an alternative. The experiment included defeater and non-defeater conditions and was conducted in both visual and auditory modalities. In the visual defeater condition, after chimpanzees had chosen a location supported by visual evidence (seeing food through blurry glass), the experimenter revealed a screen with a picture of an apple glued to it, thereby undermining the original evidence. In the corresponding non-defeater condition, the revealed screen was fully transparent, leaving the original evidence intact. In the auditory version, chimpanzees first chose based on a rattling sound; the evidence was undermined by revealing a stone (defeater) or left intact by revealing a leaf (non-defeater). As predicted, chimpanzees were significantly more likely to switch to the alternative location in defeater than in non-defeater conditions ($\chi^2 = 16.27$, df = 1, $p < .001$), with this effect holding across modalities and no interaction between condition and modality ($\chi^2 = 0.11$, df = 1, $p = .743$).

In the fourth experiment, we tested whether chimpanzees (N = 22 chimpanzees; preregistered) revise their beliefs rationally in social contexts, when their own belief conflicts with that of a partner. Subjects first made a choice based either on evidence or no evidence. A competitor then made the opposite choice, also either with or without evidence. Importantly, subjects could observe whether the competitor's choice was evidence-based, even if they could not see the evidence directly. The results showed that chimpanzees integrated social and epistemic information in a rational manner: they revised their believes more often when they themselves

lacked evidence and the competitor had strong evidence than when the reverse was true ($z = 2.02$, $p = .043$).

Taken together, these findings demonstrate that chimpanzees selectively revise their beliefs in ways that are sensitive to evidence strength, the integrity of evidential support, and social sources of information. Rather than revising beliefs indiscriminately, chimpanzees adjust their beliefs in a manner consistent with core principles of rational reasoning. These results challenge the view that rational belief revision is uniquely human and suggest deeper evolutionary roots of this capacity than previously assumed.