Piagetian Overconservation in African Grey Parrots (Psittacus erithacus)
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**Abstract**

Piagetian liquid conservation marks the transition between the pre-operational and concrete operational stages of child development (Piaget & Inhelder, 1941). Human children usually develop this ability at ~6 to 7 years. Four Grey parrots (Psittacus erithacus) who previously demonstrated conservation (Pepperberg et al., 2017), were given overconservation tasks to compare their abilities to those of apes (Suda & Call, 2004).

**Introduction**

In Piagetian liquid conservation, a child is shown two equal quantities of a liquid, in two identical containers. The child, asked about the quantities, routinely states that they are “same”. The liquids are then poured into differently-shaped containers (usually a thin, long one and a short, wide one) that make the quantities appear different. Human children do not fully understand that the quantities are still equal—“conservation”—until they are ~7 years old: before then, they state that the thin vessel, with the “taller” quantity, now has “more” (Piaget & Inhelder, 1941). One chimpanzee appeared to demonstrate conservation (Woodruff, Premack & Kennel, 1978), and so did four Grey parrots (Pepperberg et al., 2017). Chimpanzees, orangutans, and bonobos were sometimes successful at over-conservation, but relied heavily on perceptual cues to make their decisions, and could have been affected by cognitive conflict (Suda & Call, 2004).

**Approach**

**Experiment 1:** Two quantities of juice (1.5 mL, 3 mL), in identical clear cups, are shown to the parrots. The quantities are then poured, directly or in a crossed over fashion, into two identical cups, either clear or opaque. This demonstrates whether the parrots will indeed choose the larger quantity when they know which one it is, and that they are will work with opaque cups and crossovers.

**Experiment 2:** The quantities of juice (1.5 mL, 3 mL) are poured into same sized cups, one of which has a false bottom so that both quantities look equal. In half of the trials, initial cups are clear and the parrots can see the transfer; in the other half, initial cups are opaque and covered. Transfers are direct in half the trials, and crossed over in half. To show overconservation, parrots should pick the large amount in clear trials, but have a distinct side preference or be at chance in the opaque trials.

**Experiment 3:** Quantities are 2 mL and 4 mL. Initial cups are identical, clear in half the trials and opaque in the others, but destination cups are of different sizes. False bottoms cause both cups to always look full. Transfers are direct in half the trials, and crossed over in half. Parrots should pick the larger amount correctly in the clear trials, but be at chance or pick the larger cup in opaque trials.

**Impact**

All birds demonstrated overconservation abilities in Experiment 2; Griffin also succeeded fully in Experiment 3, a more stringent task, and Athena succeeded at the clear straight trials of Experiment 3 and, when she did not succeed in the crossed trials, she never resorted to a perceptual strategy but rather tended towards a side-preference. Given that this is the first research done regarding overconservation in non-primate animals, these results mark an important step on the road to understanding cognition across species on a broader scale. Further research on other non-human species in relation to overconservation may be valuable, as well as more research testing African Grey parrots on other Piagetian tasks.