

Supplementary material

Table S1. Name, age, sex, location and previous experience of subjects involved in the study.

Species	Sub	Sex	Age (years)	Location	Prior experience in cognitive experiments
Brown capuchin	Rav	M	7	GFPA, Rieti, Italy	Yes
Brown capuchin	Sam	M	6	GFPA, Rieti, Italy	Yes
Brown capuchin	Pao	F	8	GFPA, Rieti, Italy	Yes
Brown capuchin	Pet	F	8	GFPA, Rieti, Italy	Yes
Brown capuchin	Ros	F	7	GFPA, Rieti, Italy	Yes
Brown capuchin	Vel	M	2	GFPA, Rieti, Italy	No
Tonkean macaque	Rai	M	7	GFPA, Rieti, Italy	Yes
Tonkean macaque	She	M	6	GFPA, Rieti, Italy	Yes
Tonkean macaque	Sim	M	6	GFPA, Rieti, Italy	Yes
Tonkean macaque	Syb	F	6	GFPA, Rieti, Italy	Yes
Tonkean macaque	Tan	F	5	GFPA, Rieti, Italy	No
Orangutan	Pin	F	23	WKRPC, Leipzig Zoo, Germany	Yes
Orangutan	Pad	F	14	WKRPC, Leipzig Zoo, Germany	Yes
Orangutan	Dok	F	22	WKRPC, Leipzig Zoo, Germany	Yes
Orangutan	Kil	F	11	WKRPC, Leipzig Zoo, Germany	Yes
Orangutan	Raj	F	8	WKRPC, Leipzig Zoo, Germany	No
Orangutan	Bim	M	31	WKRPC, Leipzig Zoo, Germany	Yes
Gorilla	Kib	F	7	WKRPC, Leipzig Zoo, Germany	Yes
Gorilla	Gor	M	30	WKRPC, Leipzig Zoo, Germany	No
Gorilla	Vir	F	16	WKRPC, Leipzig Zoo, Germany	Yes
Gorilla	Lou	F	5	WKRPC, Leipzig Zoo, Germany	No
Gorilla	Col	M	29	CIRMF, Franceville, Gabon	No
Gorilla	Tani	F	15	CIRMF, Franceville, Gabon	No
Gorilla	Djo	M	30	CIRMF, Franceville, Gabon	No
Chimpanzee	Fre	M	18	Edinburgh Zoo, UK	No
Chimpanzee	Pau	M	18	Edinburgh Zoo, UK	No
Chimpanzee	Ren	M	18	Edinburgh Zoo, UK	No
Chimpanzee	Cla	M	31	CIRMF, Franceville, Gabon	No
Chimpanzee	Moa	M	31	CIRMF, Franceville, Gabon	No
Chimpanzee	Chi	F	32	CIRMF, Franceville, Gabon	No
Chimpanzee	Mak	F	32	CIRMF, Franceville, Gabon	No
Chimpanzee	Bak	M	28	CIRMF, Franceville, Gabon	No
Chimpanzee	Dom	F	30	CIRMF, Franceville, Gabon	No

Chimpanzee	Vai	M	33	CIRMF, Franceville, Gabon	No
Chimpanzee	Nur	F	26	CIRMF, Franceville, Gabon	No
Chimpanzee	Bou*	M	10	CIRMF, Franceville, Gabon	No
Bonobo	Kun	M	15	WKRPC, Leipzig Zoo, Germany	Yes
Bonobo	Joe	M	29	WKRPC, Leipzig Zoo, Germany	Yes
Bonobo	Uli	F	18	WKRPC, Leipzig Zoo, Germany	Yes
Bonobo	Lui	F	6	WKRPC, Leipzig Zoo, Germany	No
Bonobo	Yas	F	17	WKRPC, Leipzig Zoo, Germany	Yes
Bonobo	Jas	M	21	WKRPC, Leipzig Zoo, Germany	No

* Only 13 sessions completed

Training procedure

The Tonkean macaques, capuchin monkeys and three out of six orangutans (Dok, Pad, Pin) had already been trained to exchange food items of different qualities and quantities with a human experimenter in previous studies (Drapier et al. 2005; Ramseyer et al. 2006; Pelé et al. 2010b, 2011). Three orangutans (Bim, Raj, Kil), three gorillas (Kib, Gor, Vir) and four bonobos (Kun, Joe, Uli, Yas) have been trained to discriminate and exchange tokens with a human experimenter in previous studies (Pelé et al. 2009; Dufour et al. 2009), but they had no experience in exchanging food items. All chimpanzees, two bonobos (Jas, Lui), four gorillas (Col, Djo Tan, Lou) were naïve individuals. The naïve individuals have been trained to exchange tokens to obtain food item. Then, they have been trained to exchange food of different qualities (e.g. celery for cracker). This phase was run until they reached a criterion of 90% of success. Then, all individuals of the six species were trained as follows: subjects were given a small piece of cracker (1 x 2 x 0.5 cm) that they had to exchange for a larger one (4 x 4 x 0.5 cm). Then, they have to exchange a small one for a medium one (2 x 2 x 0.5 cm) and finally a medium one for a larger one. This phase was run until subjects reached a criterion of 100% of success during one session. A last training phase aimed at familiarizing the subjects to the apparatus, which consisted of a tray of six aligned plastic cups. The experimenter presented a piece of cracker of 2 x 2 x 0.5 cm to the subject in one hand and in the other hand a tray of six aligned plastic cups. The experimenter gave the small piece of cracker to the subject, and then slowly turned his/her hand upward to present it palm open to the subjects, asking her/him to give the initial

item back. If the subject did so, the experimenter rewarded her/him by giving her/him the content of one of the six aligned cups – randomly chosen. During a training session, cups contain only large sized rewards (4 trials), then only medium sized rewards (4 trials), and then only small sized rewards (4 trials). As before, one training session consisted of 12 trials. To reach the criterion, subjects had to exchange the initial reward for larger rewards and keep it for smaller rewards trials with 90% of success during two consecutive sessions. Then, the subject started the testing phase. Note that this last training phase had two aims: 1) insuring that the exchange behaviour was not automatic and that attention was paid to the content of the cup, and 2) exposing subject to the notion that they had no mean to predict which cup from number one to six they were going to receive if they gambled.

We noted that 2 chimpanzees that succeeded in the training phase stopped to participate in mid-testing course. These two subjects exhibited a lot of signs of frustration after losses. In all other cases, frustrated or not, individuals always quickly resume their position, coming close from the experimenter and getting prepared to look at the cups and have a go at the next trial. In these next trials, individuals did not show behavior that would be particularly experimenter-oriented and if the experimenter was perceived as nasty by the subjects, this was not obvious to us.