Supplementary Methods and Results: Comparing chimpanzees' preparatory responses to known and unknown future outcomes

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General Methods

All subjects were born in captivity and housed in two separate social groups (three individuals per group) at the Furuvik Zoo, Sweden. The subjects had previously participated in other cognitive studies including affective forecasting (see (*1*) for methods), string pulling, and memory. Linda and Maggan previously participated in a planning study (*2*) and Manda and Maggan were part of a future-oriented bartering study (*3*). Subjects were fed a diet of mixed vegetables, animal proteins (meat, egg and dairy products) and fruit twice daily and had *ad libitum* access to water throughout testing. For both groups, all testing took place in a compartment attached to the group's main enclosure. The doors to the testing compartments were kept open so that subjects could move in and out of the compartment freely.

Prior to testing, all individuals first learned to catch a grape as it fell from the bottom of a single tube (length: 50cm; diameter: 5cm) placed against the bars. Subjects moved on to testing after successfully covering the bottom of the tube to catch the grape three consecutive times.

Specific methods

As specified in the main text, half of the subjects were tested first in the uncertain outcome condition followed by the certain outcome condition, whereas the other half were immediately tested in the certain outcome condition. As we initially predicted that subjects would develop a bias for using both hands in the certain condition, these subjects were not subsequently tested in the uncertain condition (conversely, if they failed the task there was little reason to test them

on a more difficult version). Instead, any subjects that used both hands on five or more trials in the certain condition were then given mixed trials in order to get a clearer picture of what rules they might have been applying to solve the task. Trials were videotaped, and after each trial in all conditions the experimenter paused and noted down which tube the subject covered, therefore there was always a roughly 5-10 second interval between trials.

Uncertain outcome: Prior to testing, the experimenter demonstrated the tubes by holding up a grape before covering it with both hands, during which time the grape was transferred to either the left or right hand (unseen by the subject). The experimenter then placed one fist over each tube, so that the grape would fall from the tube corresponding with the hand it was hidden in. Subjects received 6 demonstration trials (order from experimenter's side: R, L, L, R, L, R) before beginning testing. For test trials, the side in which the grape fell out was pseudorandomized. Testing took place over two consecutive days in May 2017. We set a maximum of 48 trials, with each subject receiving no more than 24 trials per day.

Certain outcome: At the start of each test trial, the experimenter held one grape over each tube opening for three seconds before dropping both grapes into the tubes, so that if subjects covered both tube exits they could retrieve both items. Subjects tested in the uncertain trials received demonstrations to show that the grape would be dropped randomly in one of the two tubes, however in the certain outcome condition the grapes were visibly held above each tube for several seconds; as the possibilities were visible and this was similar to the training phase in which subjects learned to catch a single grape held over a tube we expected that demonstrations were not necessary. Testing took place over four days: one day in November 2017 and three consecutive days in February 2018. These testing dates reflect two different visits to the research site, which requires extensive travel to reach. Only one subject, Linda received her

first 20 trials in November, and as her performance on the next 20 trials was nearly identical (she showed a strong bias for the right tube), this gap was unlikely to have had a major impact on her performance. To give subjects an even greater chance to potentially learn to use both hands in this condition we set a maximum of 60 trials, with each subject receiving no more than 40 trials per day.

Mixed trials: If any subject used both hands on at least five trials with the parallel tubes (known condition), they were given mixed trials to determine whether they could then use both hands when faced with an uncertain outcome, or whether they would continue to use both hands across all trials even when it was not necessary to do so (i.e. they were shown which tube a single grape would be dropped in). Mixed trials consisted of three different trial types (known, unknown and visible; described in the main text) in a pseudorandom order, with a single trial type repeated on no more than two trials in a row. Testing took place opportunistically over three consecutive days in February 2018, and stopped when subjects were no longer motivated to participate. Two subjects – Maggan and Manda – stopped participating in tests and so have fewer trials (21 and 40 trials, respectively).

Supplementary results

Uncertain outcome: Tjobbe, Maggan and Santino were first tested in the uncertain outcome condition, each receiving a total of 48 trials. All subjects covered the tube on the right (from the experimenter's perspective) on the majority of trials, and consequently were rewarded on roughly 50% of trials (Table S1).

Table S1. *Chimpanzees' performance across 48 trials in the uncertain outcome condition.*

ID	Left	Right	Both	Total correct
Maggan	10	38	0	26
Santino	1	41	6	25
Tjobbe*	1	45	0	24
Grand total	*12*	*124*	*6*	*75*

*Did not cover either tube on the first two trials.

Certain outcome: All six subjects were tested in the certain outcome condition and demonstrated clear individual preferences for covering one particular tube throughout testing (shown in Table S2).

Table S2. *Tubes covered by the apes in the certain outcome condition.*

ID	Left	Right	Both	Total
Linda	2	58		60
Maggan	5	14	2	21
Manda	40	-	-	40
Santino	49	1	10	60
Selma	-	32	28	60
Tjobbe	5	21	34	60

Mixed trials: The three subjects that covered both tubes at least five times in the certain outcome condition were then given mixed trials. Although Selma appeared to cover both tubes more often on unknown trials compared to known and visible trials, she only did so on half of the unknown trials.

Table S3. Mixed trial performance: proportion of different trial types in which subjects covered both tubes.

ID	Known	Unknown	Visible	Total
Santino	25% (1/8)	17% (2/12)	0% (0/8)	10% (3/31)
Selma	18% (4/22)	50% (12/24)	9% (2/22)	26% (18/68)
Tjobbe	70% (7/10)	58% (7/12)	60% (6/10)	63% (20/32)
Grand total	*28% (12/43)*	*44% (21/48)*	*20% (8/40)*	

References:

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3. M. Osvath, T. Persson, (2013). *Frontiers in Psychology* **4**, 698.