

Introducing ToMcat: A videotaped, open-access violation-of-expectation study for measuring early false-belief understanding in infants and toddlers

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Introduction

Investigators have long sought to determine at what age children first show **false-belief understanding (FBU)**, which is widely perceived to be an important facet of representational ToM. Initial studies using explicit tasks suggested that children are not capable of FBU until about 4 years of age (Baron-Cohen et al., 1985; Gopnik & Astington, 1988; Perner et al., 1987; Wimmer & Perner, 1983). Subsequent investigations using implicit tasks suggested that some capacity for FBU is already present in infancy (for a review, Scott & Baillargeon, 2017).

However, non- or partial- replications of implicit FBU findings have led a number of researchers to question the reliability and validity of implicit measures of FBU (Kulke et al., 2018; Low & Edwards, 2018; Powell et al., 2018; Rakoczy, 2012).

Goals of ToMcat project:

1. Develop a videotaped violation-of expectation (VOE) task that measures implicit FBU in infants and toddlers
- Here we describe this new task and report the results of our first experiment.**
2. Assess the reliability and validity of our task by running a preregistered replication of our false-belief condition as well as a preregistered true-belief condition
 3. Conduct a multi-lab replication.

Method

False-Belief Change-of-Location VOE Task

Participants

- 24 children 18-28 months old ($M = 22.07$, $SD = 3.21$)
- Another 9 children were excluded due to being fussy (2) or distracted (2), failing to calibrate (2), or refusing to sit in parent's lap (1) or to wear eye-tracker sticker (2)

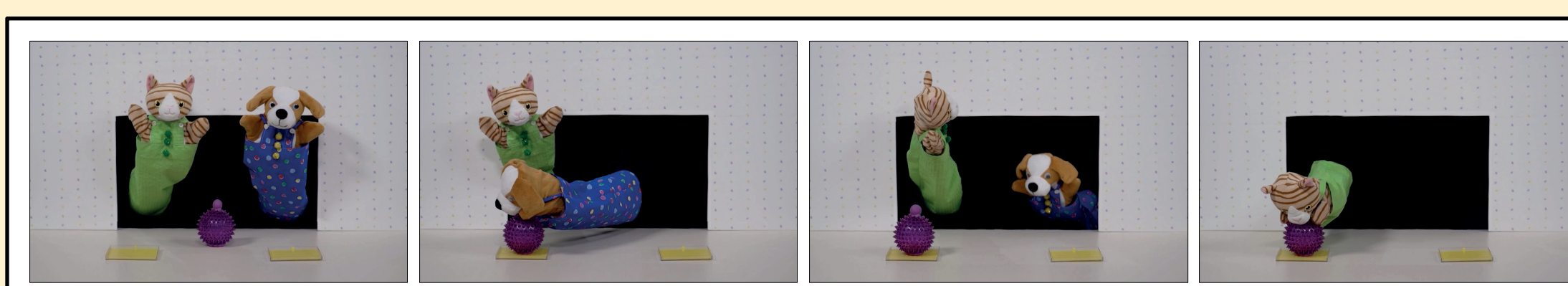
Design

- 4 Familiarization Trials & 2 Test Trials, all with 2 phases:
 - *Pre-trial*: videotaped event
 - *Main-trial*: final frame of each videotaped event
- Each main-trial ends when children (a) look away for 2 consecutive seconds after having looked for at least 2 cumulative seconds or (b) look for 30 seconds (as in Onishi & Baillargeon, 2005)
- Counterbalanced: side of cat, side of hiding location in familiarization and test trials, & test order

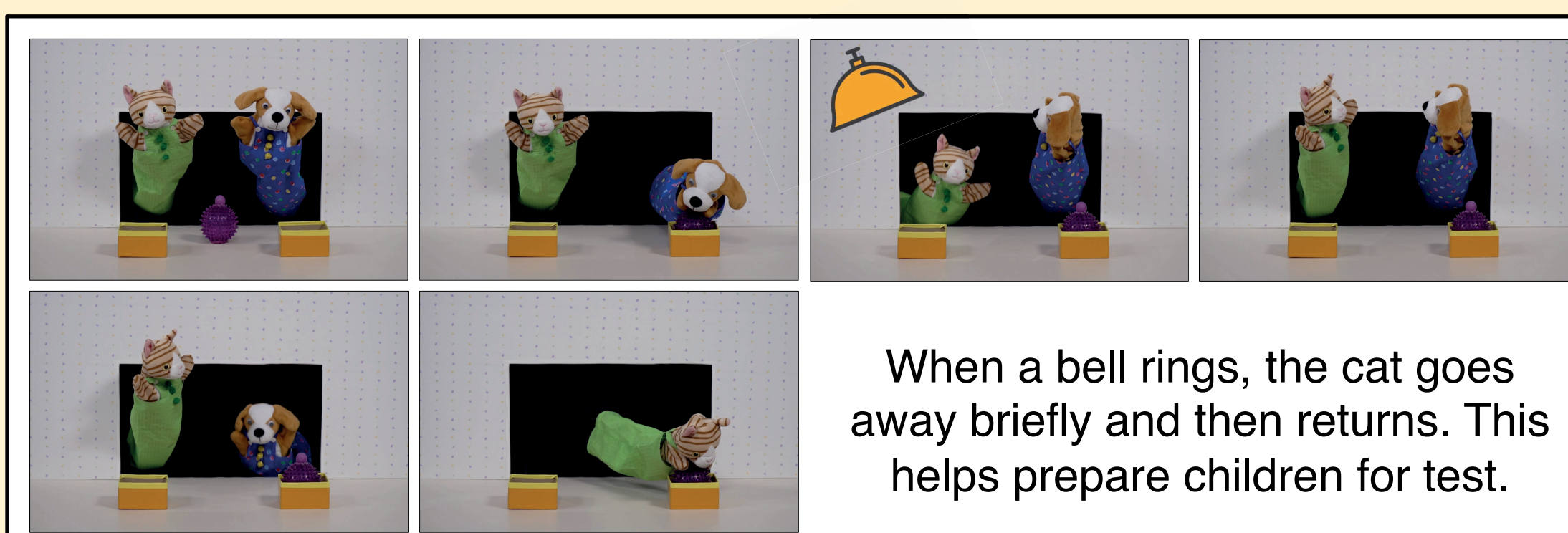
False-Belief Condition

Procedure

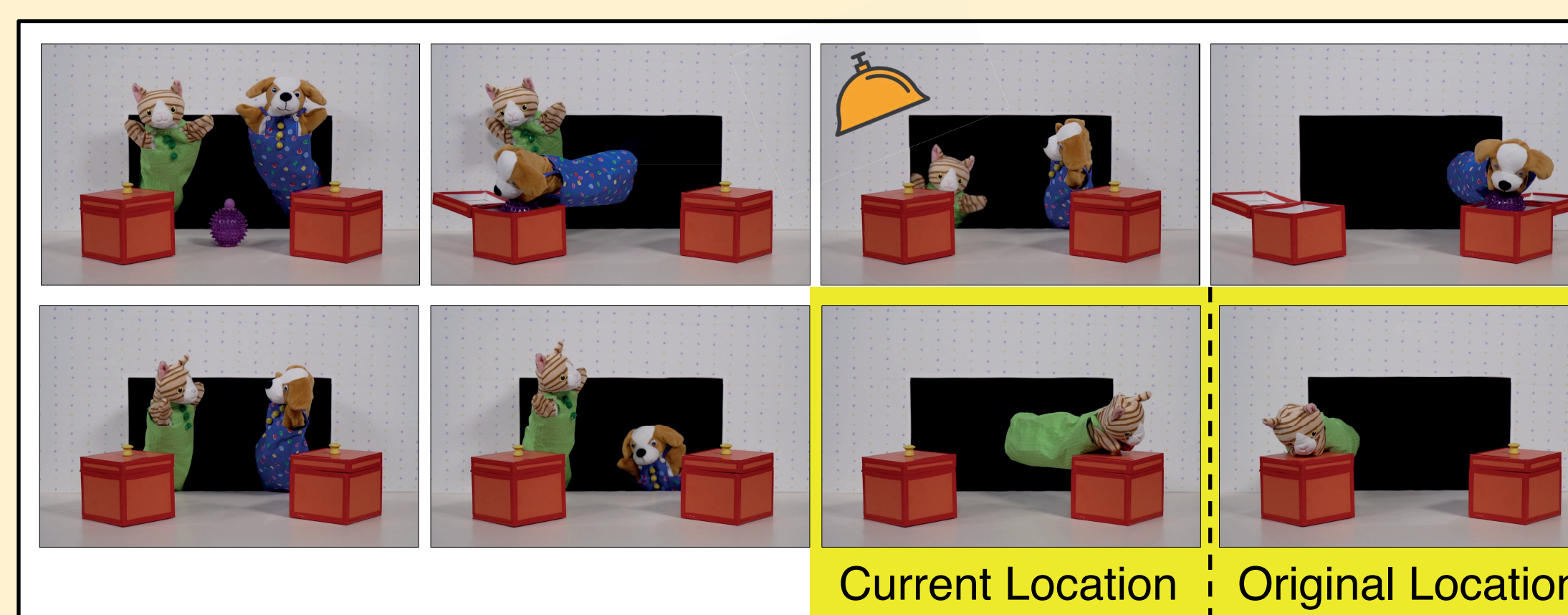
Familiarization Trials 1 & 2



Familiarization Trials 3 & 4



Test Trials



Eye-gaze recording

EyeLink 1000 Eye-tracker

- remote arm configuration
- 5-point calibration and validation procedure
- drift correction every 2 trials



Fig. 1. Picture of experiment set-up

Results

Both Test Trials

- Current Location ($M = 14.29$, $SD = 8.72$) > Original Location ($M = 8.01$, $SD = 4.97$), $t(23) = 3.11$, $p = .002$ (Fig. 2)
- 19 out of 24 children show this pattern, $p = .003$ (cumulative binomial probability; Fig. 3)

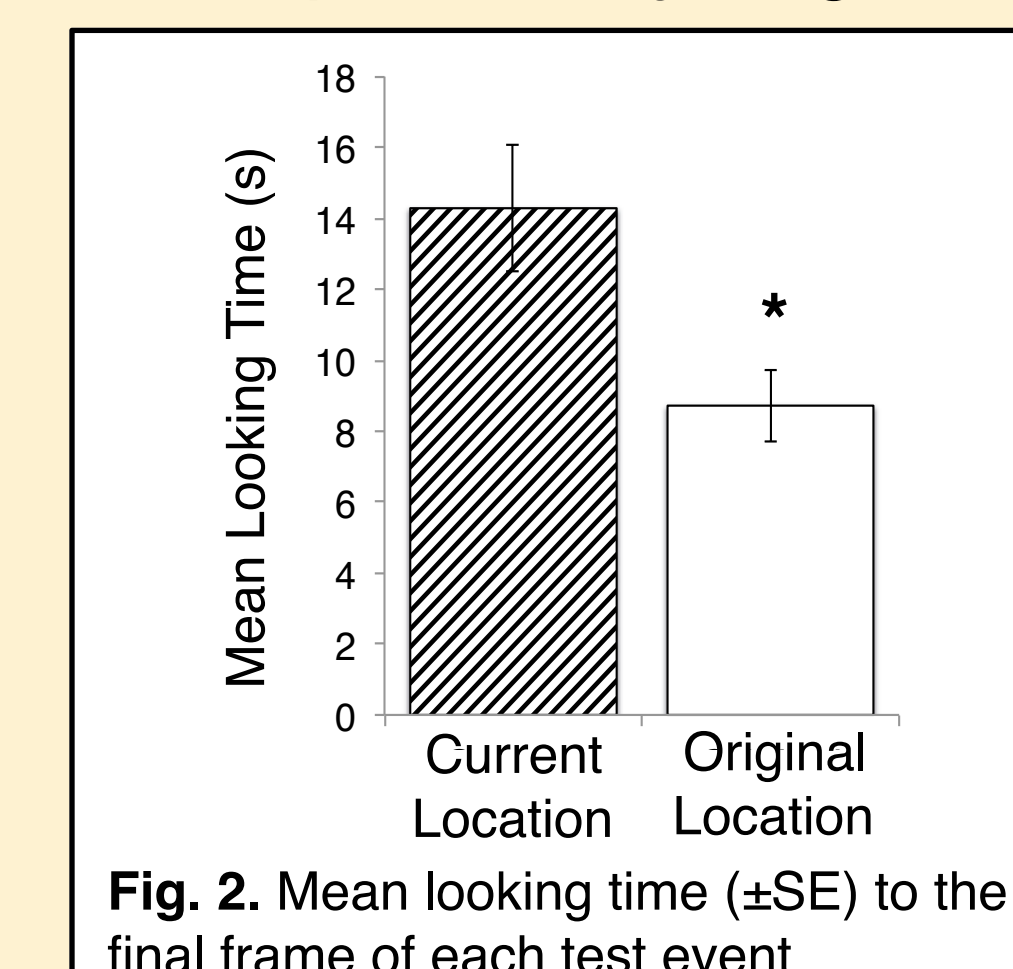


Fig. 2. Mean looking time (\pm SE) to the final frame of each test event

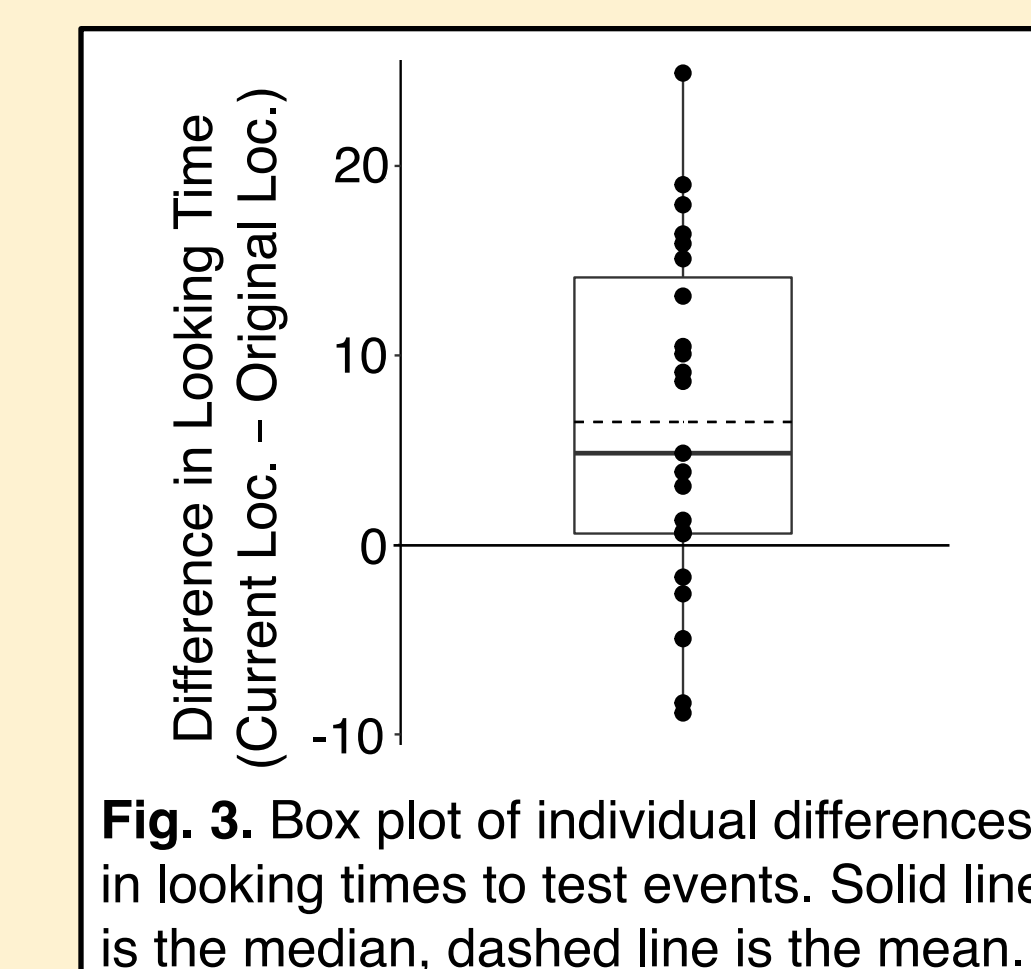


Fig. 3. Box plot of individual differences in looking times to test events. Solid line is the median, dashed line is the mean.

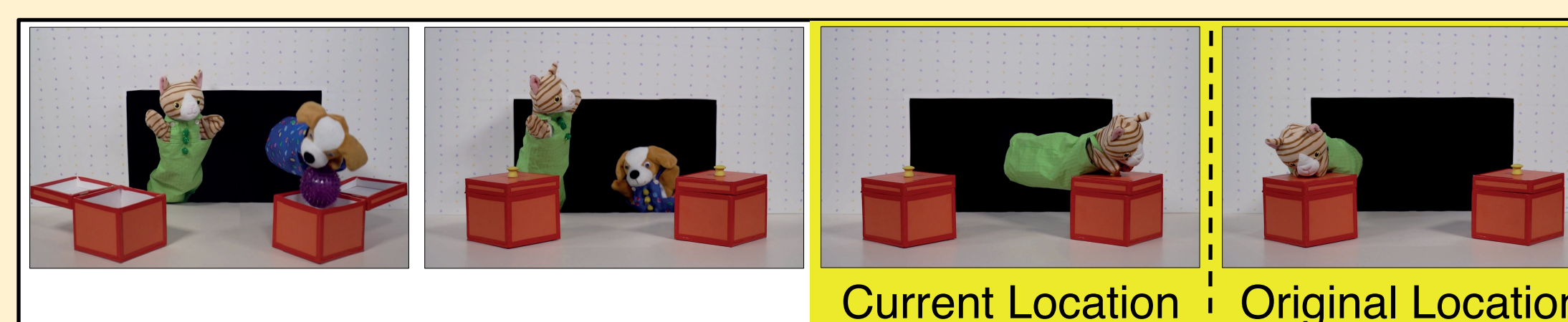
Test Trial 1 Only

- Current Location ($M = 17.45$, $SD = 8.58$) > Old Location ($M = 7.99$, $SD = 4.25$), $t(22) = 2.84$, $p = .005$

True-Belief Condition

Design

Test Trials



Our true-belief condition will be identical to the false-belief condition except in test the cat will return sooner and see the dog move the toy to the new location.

Evidence that children look longer at the original-location than at the current-location event in the false-belief condition, but show the reverse looking pattern in the true-belief condition, will support prior claims of early implicit FBU

Discussion

Children attributed a false-belief about the toy's location to the cat and found it unexpected when the cat failed to act in accordance with its belief.

Step 2 In progress (see Goals of ToMcat project)

We hope these efforts will be useful in the following ways:

1. By contributing evidence to the ongoing debate about implicit tests of FBU
2. By providing researchers with a reliable resource for assessing early FBU in their own labs

Acknowledgements

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