

# Children differ from adults in interpreting disjunctions: Evidence from an eye-tracking study

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## Introduction

The disjunctive connective *or* and the conjunctive connective *and* merge two semantically domain propositions like *A* and *B* into a conjunctive statement *A and B* and a disjunctive statement *A or B* respectively. The meaning of a conjunctive statement is straightforward. A disjunctive statement, however, often engenders two inferences: The speaker knows that the corresponding conjunctive statement *A and B* is false (**scalar implicature**); and the speaker doesn't know the truth values of the two domain propositions *A* and *B* (**ignorance inference**). Theories in literature (see Chemla & Singh, 2014, for a review) differ in:

- Whether the two inferences are semantic or pragmatic processes.
- Whether children differ from adults in processing these inferences.

To adjudicate between the different theories, we conducted an eye-tracking experiment using the **visual world paradigm** (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995) to compare the online processing of the two inferences deduced by children and adults.

## Our Experiment

Participants' behavioral responses and eye-movements were recorded when they were viewing the test images (Figure 1) and listening to the auditorily presented test sentences (Figure 2). On each trial, participants first saw images of two animals on the screen, along with the audio of the animals (Figure 3). Next, participants saw a test image consisting of four boxes (Figure 1) and heard a test sentence (Figure 2) via the two speakers. Participants' task was to locate *Xiaoming's* box according to the test sentence and to press the corresponding button as soon as possible.

In each test image, participants saw four boxes situated at the four quadrants and two different animals contained in the boxes. Participants were told that the four boxes could vary in two dimensions: its closeness and its size. Note that whether or not a box is closed influences our epistemic knowledge about that box: If a box is open, then the animal(s) contained in that box is known. If a box is closed, then the animal(s) contained in that box is unknown. The size of a box affects the number of animals contained in the box, but not our epistemic knowledge about that box. No matter whether the box is closed or not, a small box always contains one animal, and a big box always contains two different animals.

Given the experimental design, the correct responses to a conjunctive statement (Figure 2a) is the big open box (e.g., Box A in Figure 1). Participants' responses to the disjunctive statement (Figure 2b), however, depend on how the two inferences are processed. If participants compute neither the scalar implicature nor the ignorance inference, then all the four boxes will be eligible options. If participants compute the scalar implicature but not the ignorance inference, then the big boxes (e.g., Box A and Box C in Figure 1) will be ruled out, and the remaining two boxes B and D will be the eligible options. If participants compute the ignorance inference but not the scalar implicature, then all the open boxes (Box A and Box D in Figure 1) will be ruled out, and the remaining two boxes B and C will be the eligible options.

To summarize, the small closed box (e.g., Box B in Figure 1) will not be chosen as the final option of a disjunctive statement until both the scalar implicature and the ignorance inference are computed.

## Results and Discussion

Behavioral responses (Figure 4) reveal that both adults ( $n = 36$ ) and children ( $n = 28$ , mean age = 5) chose the big open box as the one corresponding to the conjunctive statements, confirming the validity of the responses under other conditions. Regarding their responses to the disjunctive statements, adults always chose the small closed box, suggesting that they computed both the scalar implicature and the ignorance inference. 5-year-old children, however, didn't give consistent behavioral responses, indicating that they failed to compute the two inferences.

The eye-movement data (Figure 5) confirmed the behavioral responses. More specifically, adults computed the two inferences engendered by the disjunction immediately upon encountering the disjunctive connective, i.e., prior to the offset of the disjunctive connective. By contrast, 5-year-olds never considered the closed boxes (i.e., the big closed and the small closed boxes) as the eligible options of the disjunctive statements.

## Selected References

Chemla, E., & Singh, R. (2014). Remarks on the experimental turn in the study of scalar implicature, part i/ii. *Language and Linguistics Compass*, 8/9, 373-399. doi: 10.1111/lnc3.12081  
Tanenhaus, M. K., Spivey-Knowlton, M. J., Eberhard, K. M., & Sedivy, J. C. (1995). Integration of visual and linguistic information in spoken language comprehension. *Science*, 268(5217), 1632-1634. doi: 10.1126/science.7777863

Figure 1. Test Image

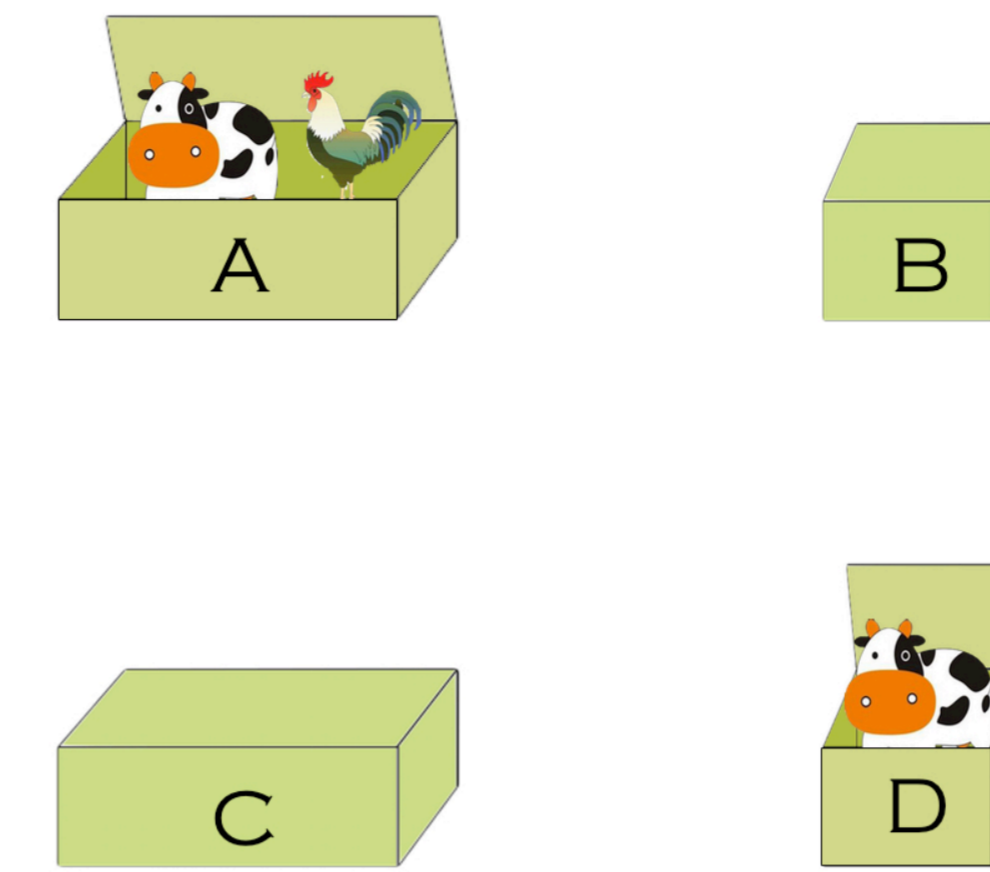


Figure 2. Test Sentences

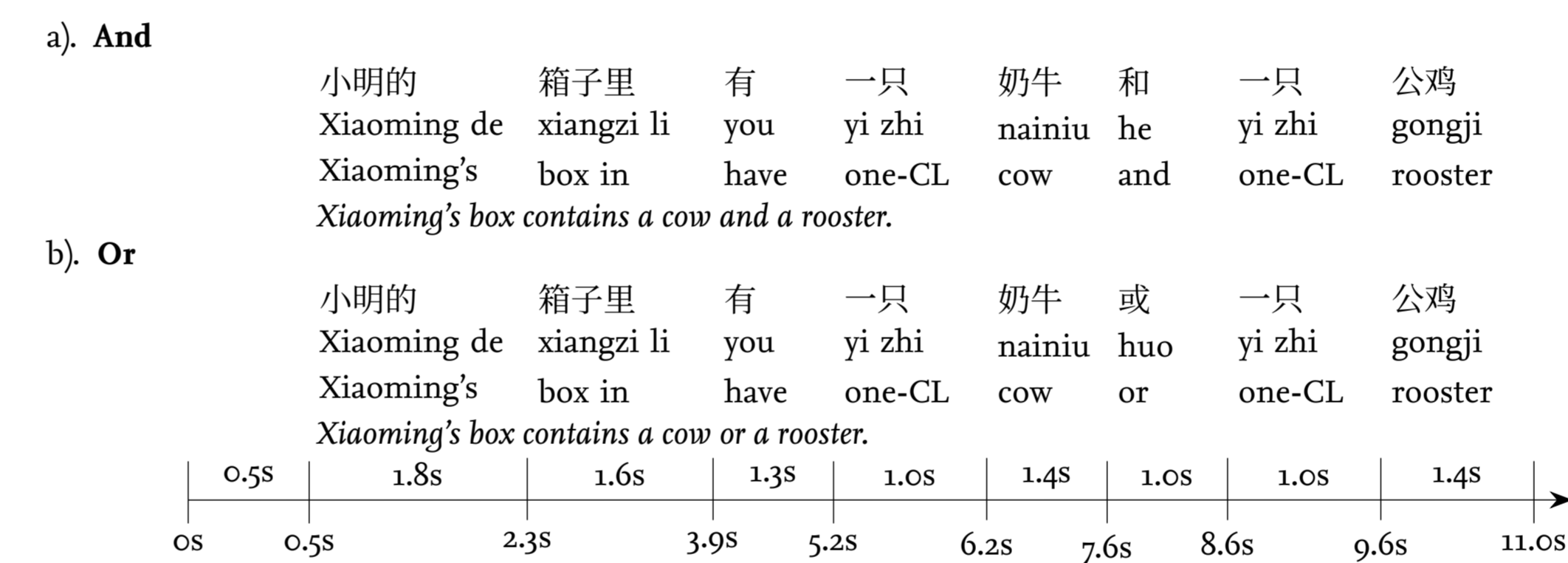


Figure 5. Eye-movements Results

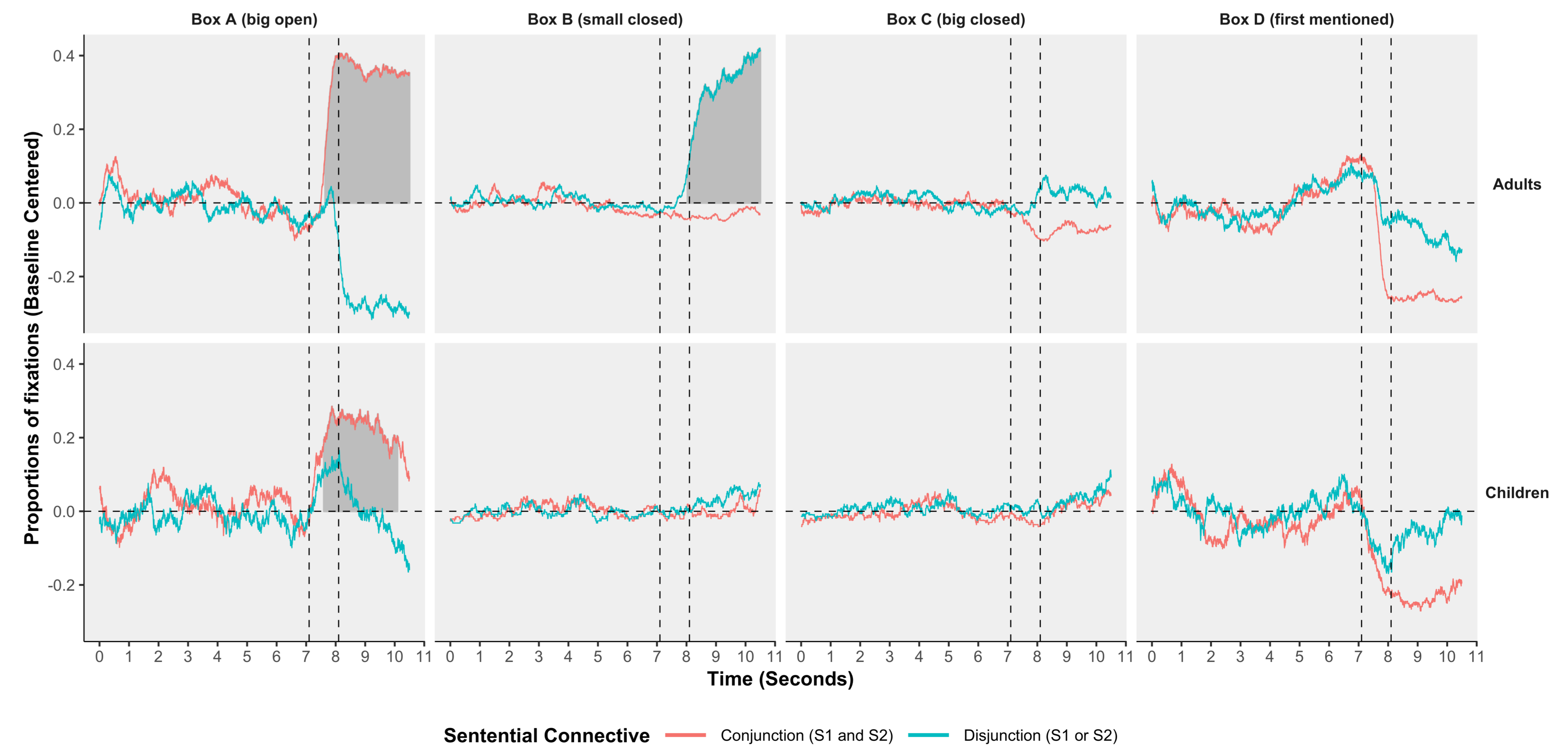


Figure 3. Experiment Structure

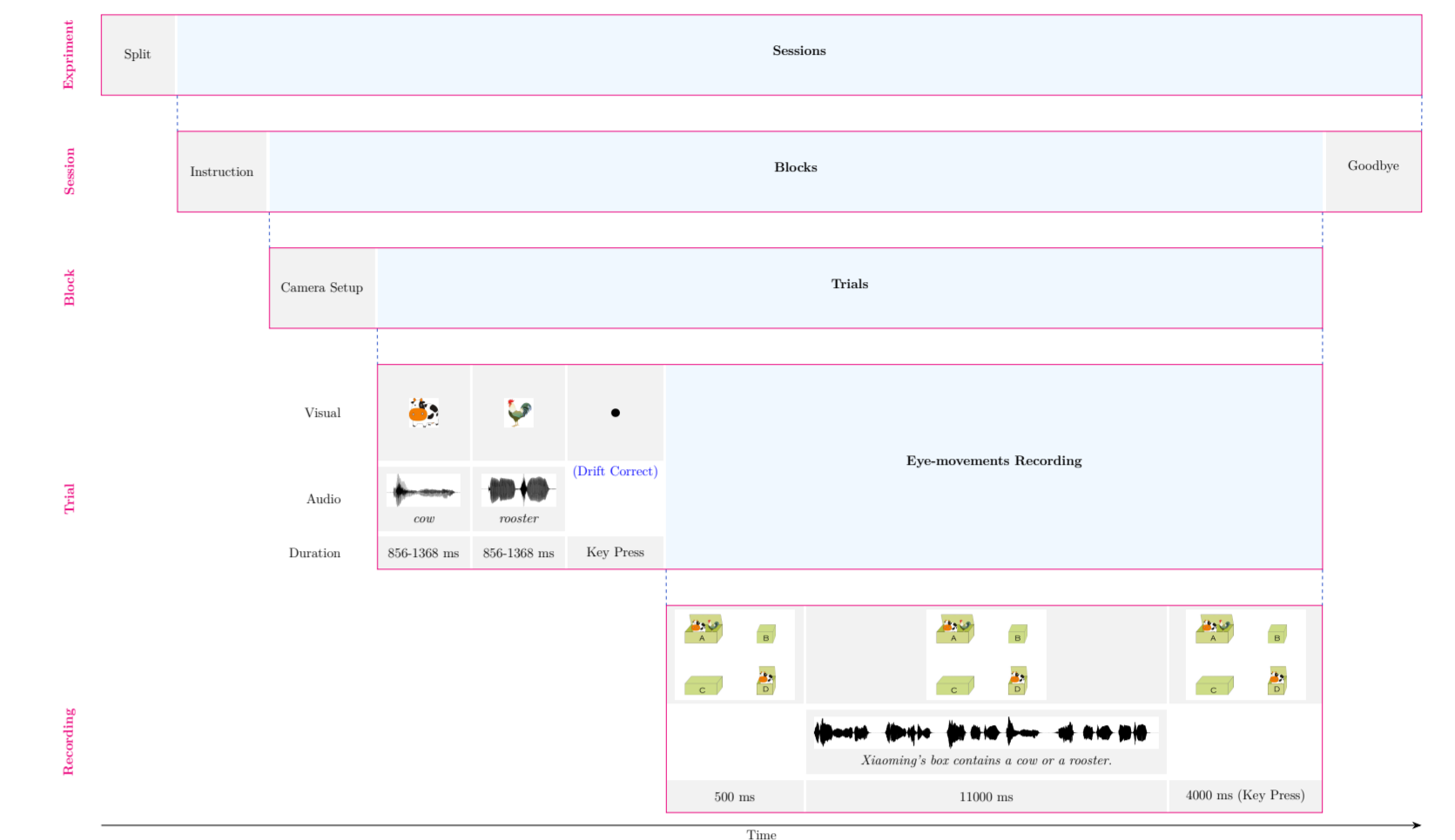


Figure 4. Behavioral Responses

