

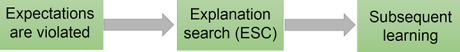
# Explaining the impossible: How explanation-seeking may change the processing of impossible events

Mallory Pennington, Dare Baldwin

University of Oregon, Acquiring Minds Lab, Department of Psychology

## Introduction

- **How do humans decide to seek an explanation for something they don't understand?**
- **Violation of expectation effects**
  - Paradigm to assess object permanence<sup>1</sup>, but also boosts attention and learning<sup>2,3</sup>
- **Explanation-seeking curiosity** as a mediator
  - Traditional models of ESC<sup>4,5</sup>
  - Explanation search explains VOE effects<sup>6</sup>



- **Impossible vs. improbable stimuli**
  - Is there a difference in attention? Previous evidence suggests it<sup>7</sup>

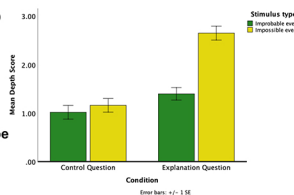
## Hypotheses

1. Although both *impossible* and *improbable* events are surprising, **impossible** events will elicit longer and more complex explanations than improbable events.
2. The effect(s) of **impossible** events on explanation-seeking will be specific to the impossibility itself (and thus not emerge for explanations regarding other facets of the event at issue).

## Results

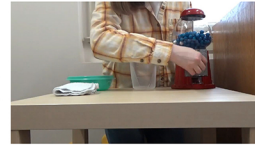
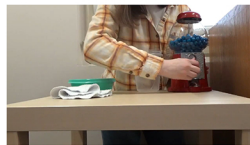
- **WAVE 1**
  - 119 participants, 58% female
- **DV 1: Depth** (coded 0 – 3, where 3 is most complex)
- **DV 2: Word count** (length of explanation)
- Initial analyses show interaction between order of stimuli and condition, suggesting carryover effects
  - *Final analyses include only first stimuli type seen*
- Multivariate ANOVA conducted with two DVs
  - As predicted, significant main effect of **Condition**
  - As predicted, significant main effect of **Stimuli Type**
  - As predicted, significant interaction between **Condition & Stimuli Type**
- **WAVE 2 ongoing**

Depth by Condition & Stimuli Type



## Methods

- Virtual study mounted via SONA (University of Oregon Human Subjects Pool) and Prolific
- Dwell-time self-paced slideshow paradigm used to assess attention as time lingering on each slide<sup>8,9</sup>
  - **Wave 1:** participants see both events (in randomized order) and asked to explain outcome or control
  - **Wave 2:** participants see either impossible or improbable event and asked to explain outcome or control



**LEFT:** The impossible event; only blue gumballs in the machine, white gumball produced.

**RIGHT:** The improbable event; a few white gumballs in the machine, white gumball produced.



**LEFT:** The explanation condition question: "...the color of the gumball produced by the machine..."

**RIGHT:** The control condition question: "...why the person in the previous video wiped off the gumball machine..."

## Discussion

- **As predicted, the impossible event triggered longer and more complex explanations from viewers, but only in the explanation condition**
- *Dwell-time data remain to be analyzed; further data remain to be collected*
- Preliminary results support the idea that impossible stimuli in VOE paradigms may uniquely trigger explanation-seeking curiosity<sup>7,6</sup>
- Preliminary results disagree with some past models of ESC
  - Past evidence showing "moderately" surprising stimuli as most important, but impossible is not "moderate"<sup>10</sup>
- Present study is limited in its ability to assess graded effect of probability
- Important implications for how to **enhance the presentation of to-be-learned stimuli**, such as in educational settings

## References

1. Baillargeon, R., Spelke, E. S., & Wasserman, S. (1985). Object permanence in five-month-old infants. *Cognition*, 20(3), 191-208. doi: 10.1016/0010-0277(85)90008-3. 2. Stahl, A. E., & Feigenson, L. (2015). Observing the unexpected enhances infants' learning and exploration. *Science*, 348(6230), 91-94. doi: 10.1126/science.1237999. 3. Stahl, A. E., & Feigenson, L. (2017). Expectancy violations promote learning in young children. *Cognition*, 163, 1-14. doi: 10.1016/j.cognition.2017.02.008. 4. Aquino, E. G., & Lombrozo, T. (2020a). A functional approach to explanation-seeking curiosity. *Cognitive Psychology*, 119, 101278. doi: 10.1016/j.cogpsych.2020.101278. 5. Lovenstein, G. (1984). The psychology of curiosity: A review and interpretation. *Psychological Bulletin*, 116(1), 75-98. doi: 10.1037/0033-2909.116.1.75. 6. Perez, J., & Feigenson, L. (2020). Violations of expectation trigger infants to search for explanations. *PsychXiv*. doi: 10.31234/osf.io/zhj7. 7. Stahl, A. E., Mandajou, S., & Feigenson, L. (2017). *Impossibly Special: Impossible but not Improbable Events Boost Children's Learning* [Poster presentation]. Cognitive Development Society Bi-Annual Conference, Portland, OR. 8. Hard, B., Recchia, G., & Tversky, B. (2011). The shape of action. *Journal of Experimental Psychology General*, 140, 586-604. doi: 10.1037/a0024310. 9. Garofalo, N., Scott, E., Tanaka, Y., Wallner, S., DeWald, D., Pennington, M., & Baldwin, D. (2022). On-line dwell-time: Open-source code and documentation for measuring attentional patterns as events unfold in time. *Open Science Framework*. 10. Baranes, A., Oudeyer, P., & Gottlieb, J. (2015). Eye movements reveal epistemic curiosity in human observers. *Vision Research*, 117, 81-90. doi: 10.1016/j.visres.2015.10.009.