

# Processing Time for Events in Language Scales with their Real-World Duration

Longer events take a longer time to process, increasing at a roughly log-linear rate with their real duration.

## 1. Introduction

How do we represent the temporal duration of events as they unfold through language?

- Comprehending an event in language takes less time than experiencing it.
- Embodied accounts of cognition suggest we might take longer to process longer events, because part of the representation of the event is its simulation in our minds.
- Some studies have looked at the relationship between temporal structure<sup>1</sup> or relative event duration<sup>2,3</sup> and processing time.
- Others have looked at the effect of absolute duration on episodic shifts<sup>4,5,6</sup>, but not the time taken to process the events themselves.

Coll-Florit and Gennari (2011) found that RT on sensality judgments for punctual events was faster vs durative ones. They also found a correlation between Likert-scale estimates of event time and RT. However, a direct link between external and internal time (a rate of compression) has not been established.

**Question: Does the processing time for events in language scale with their real-world duration?**

## 2. Methods

### Subjects

80 online participants, 3 removed (< 75% accuracy)  
Right-handed, English monolingual

### Task

Does the sentence make sense? (YES/NO judgments, as quickly as possible)

### Stimuli

3-word sentences in the form “the [noun] [verb]-ed”, expressing bounded events

7 targets dropped for low sensality agreement (< 80%)

#### Targets (sensible)

“The mug shattered.”

“The mountain eroded.”

#### Foils (nonsensible)

“The coin shattered.”

“The mountain dissolved.”

### Duration estimates

#### Subjects

30 online participants

#### Task

Give duration estimates for all 90 targets by keying in a number then a unit, e.g. “1 hour”

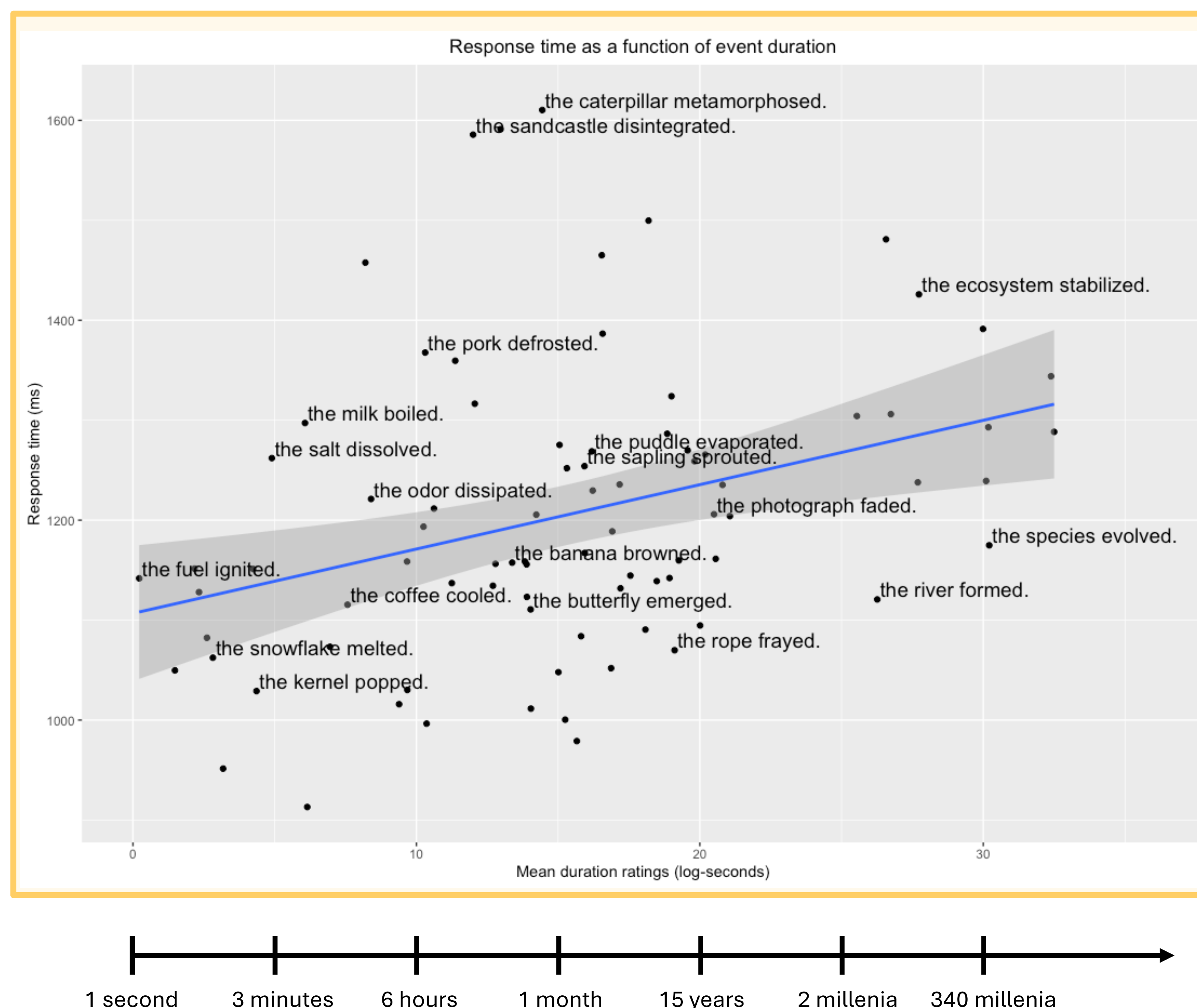
Mean duration estimates (in seconds) were calculated, then log<sub>e</sub>-transformed

## 3. Results

We used a generalized linear mixed-effects model (Gamma link) to estimate the effect of **event duration** (log-transformed means) on **reaction time**. Word length, age-of-acquisition, and surprisal (separate values for the noun and verb) were included in the model as **fixed covariates** and participant was included as a **random intercept**.

RT significantly increased with duration estimates ( $p < .001$ )\*. Age-of-acquisition values of the noun and verb were both also significant covariates ( $p < .001$ ).

\*Raw linear fit is plotted below



### Control analysis

- Reaction time was faster on items for which there was more agreement (sensible or not) on the sensality judgment task
- Slower RTs might therefore reflect confidence or certainty – as participants get less certain about a sensality judgment, they might make slower responses
- Including item accuracy as a fixed covariate in the model showed a significant effect ( $p < .001$ ); however, duration estimate was still a significant ( $p = .02$ ) predictor of RT.

## 4. Discussion

- Processing time for events in language scales at a log-linear rate with their real-world duration.
- Events are necessarily compressed in our minds. The question is whether they are simulated at a compressed rate, or if duration is simply encoded as encyclopedic knowledge. These results suggest the former.

### Connections to other studies

- Coll-Florit and Gennari (2011) found that RT on a sensality judgment task correlated positively with Likert-scale duration estimates. They attributed their effect to the diversity of semantic associations – our stimuli remain to be normed for this. However, whereas their stimuli described a wide variety of situations, ours involve single objects undergoing passive change, just at different timescales.
- Davis and Yee (2022)<sup>7</sup> found that the time taken to perceive individual concepts correlates with RT on a variety of tasks – these results extend that finding into the event domain.

### Future Work

- To fully isolate the contribution of an event’s duration to its processing time (as activated by its label), we will design an experiment where diversity of semantic associations is controlled for. This is the focus of ongoing work in the lab.

## References

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- <sup>7</sup>Davis, C. P., & Yee, E. (2022, October). Time as an embodied property of concepts. Poster presented at the 9th International Meeting on the Mental Lexicon, Niagara-on-the-Lake, ON, Canada.

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