# Effect of referent lifetime in the processing of verbal morphology: a self-paced reading study

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**Background** Theories of sentence processing, as well as studies, suggest multiple linguistic and non-linguistic sources of information are integrated during comprehension (e.g., Altmann & Kamide, 2007; Nieuwland & Martin, 2012). Information about a referent's lifetime (dead or alive), for example, has been shown to be integrated with temporal morphology in a phenomenon known as *the Lifetime Effect*, eliciting processing costs and lower ratings when the Present Simple or Present Perfect are used to refer to dead referents (Chen & Husband, 2018; Palleschi et al., 2020). Building on these finding, the current study contrasts the English Present Perfect with the Past Simple in the context of the Lifetime Effect. The former links completed past events to the present through 'current relevance' or 'future possibility' (Klein, 1992; ex.1a), whereas the Past Simple requires a link to a completed past time frame, and has been described as anaphoric (e.g., Partee, 1973; ex. 1b). When no explicit mention of a time frame is mentioned, the temporal context may be inferred to be the lifetime of a referent, invoking *The Lifetime Effect* (dead = past, living = present; Musan, 1997; ex. 2). Thus, when the Past Simple is used with a living individual in the absence of a completed past time frame, the utterance is left 'hanging in the air' due to the missing past temporal antecedent. Meanwhile, the use of the Present Perfect to describe a dead referent violates the 'current relevance' requirement (Klein, 1992). The current study thus involves the integration of lifetime knowledge with temporal morphology, further refining the types of information considered immediately available in theories of language processing, and provides a first glimpse into the processing of the Present Perfect Lifetime Effect contrasted with the Past Simple.

**Present Study** In a cumulative self-paced reading experiment, the Present Perfect and Past Simple were presented in sentences describing accomplishments of dead and living cultural figures, with no temporal references given. The lifetime of the cultural referents therefore provided the frame of temporal reference, with the dead and living being congruent with the Present Perfect and Past Simple, respectively. Verbs (*n*=10) were counterbalanced across conditions. Differences between the dead and living conditions within each verb tense would be evidence of the integration of lifetime context in the processing of temporal morphology.

**Procedure** In an online cumulative self-paced reading experiment, native British English speakers (n = 160, 111 female, aged 18-31) read sentences (20 critical and 30 filler items) describing the occupation and life status of a cultural figure (ex. 3a/b), followed by a critical sentence containing either the present perfect (PP; ex.4a) or past simple (PS; ex.4b). A post-trial binary naturalness judgement task followed. Lower proportions of '*yes*' responses and longer reading times from the verb region onward were expected for the *dead-PP* and *living-PS* conditions compared to their congruent lifetime counterparts, respectively. Stronger effects were expected for violations containing the PP, following Roberts & Liszka (2013). Linear mixed-effects regression models were fitted to the log reading times from the verb region onward. A generalised linear mixed model was run on the binary response data.

**Results** Conditions were contrast coded using sliding contrasts. Of interest, the *dead-PP* elicited significantly longer reading times than the *living-PP* in the 'adjective' region and the two penultimate sentence regions, while the *living-PS* elicited longer reading times in the 'object-NP' and sentence-final region (Fig. 1). The effect (*Cohen's d*) was larger for the PP violations. In addition, the *dead-PP* and *living-PS* both elicited higher rejection rates (Fig. 2).

**Conclusion** The effect found in the present perfect conditions indicate that violations of the Present Perfect Lifetime Effect elicit processing costs, indicating difficulties integrating the Present Perfect in the context of a completed lifetime. Meanwhile, the past simple effect provides initial support for processing delays elicited by sentences left 'hanging in the air' by a lack of a completed past temporal antecedent in the living condition. For violations of both the Present Perfect Lifetime Effect and the Past Simple anaphora, the ratings indicated explicit awareness of the violations. The reading results indicate that lifetime contexts of well-known cultural figures are integrated with temporal morphology, further informing processing theories regarding the types of information available during comprehension. To what extent long-term knowledge of the cultural figures contributed to these effects will be explored in future studies.

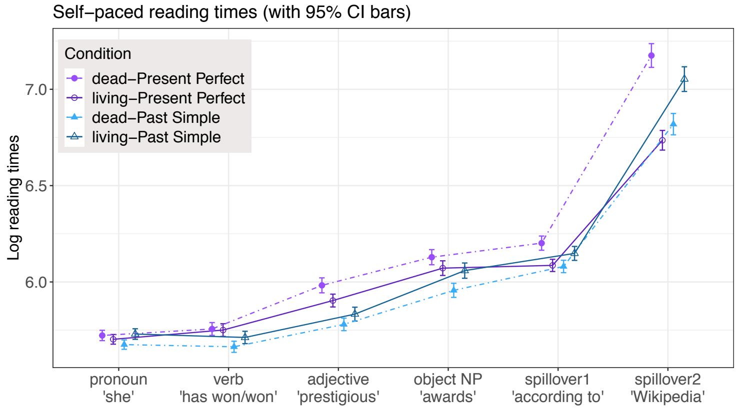
## Example sentences

| | | |
|---|---|---|
| 1a. | John *has seen* his sister twice since last year/*last year. | *Present Perfect* |
| 1b. | John *saw* his sister twice last year/*since last year. | *Past Simple* |
| 2a. | Angela Merkel *has accomplished* / ??*accomplished* a lot. | *Living* |
| 2b. | Abraham Lincoln *accomplished* / ??*has accomplished* a lot. | *Dead* |
| 3a. | Beyoncé is an American performer. She lives in California. | *Living* |
| 3b. | Whitney Houston was an American performer. She died in California. | *Dead* |
| 4a. | She *has performed* in many arenas, according to Wikipedia. | *Present Perfect* |
| 4b. | She *performed* in many arenas, according to Wikipedia. | *Past Simple* |

## Results

| | Tense | | | Lifetime | | | Interaction | | | Dead-livingPP | | | living-deadPS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $t_{138}$ = | *p* < | *d* = | $t_{138}$ = | *p* < | *d* = | $t_{138}$ = | *p* < | *d* = | $t_{138}$ = | *p* < | *d* = | $t_{138}$ = | *p* < | *d* = |
| verb | 5.95 | .001 | .08 | | | | | | | | | | | | |
| adj | 7.3 | .001 | .11 | | | | 7.3 | .01 | .05 | 3.7 | .01 | .15 | | | |
| Obj-NP | 4.2 | .001 | .07 | | | | 3.7 | .01 | .06 | | | | 3.5 | .01 | .15 |
| Spill1 | | | | | | | 4.7 | .001 | .08 | 4.6 | .001 | .22 | | | |
| Spill2 | | | | | | | 2.5 | .001 | .15 | 7.5 | .001 | .44 | 3.1 | .05 | .18 |
| Rating | | | | | | | -22 | .001 | N/A | -6.8 | .001 | N/A | -6.7 | .001 | N/A |

***Table 1**: t-values, p-values, and Cohen's d for reading times per region and ratings. Reading time p-values are Bonferroni corrected for multiple comparisons (multiplied by five; once for each region analysed). Insignificant effects are omitted for visual simplicity. Ratings: z-scores are reported (rather than t-values) and Cohen's* d *was not calculated as it is not suitable for binomial data*



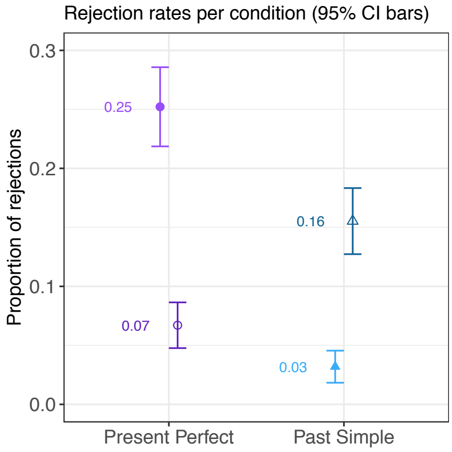




***Figure 1** (left): log reading times across sentence regions*
***Figure 2** (right): proportion of rejections in binary naturalness ratings; Figure 1 legend applies*

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