Examining the mechanisms of structural priming: considering the effects of disfluent sentences on the implicit learning account

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Structural priming, the tendency to produce and anticipate a sentence structure after brief experience with it, has been proposed to have lasting impacts on both adults' parsing preferences and children's language development (Qi et al., 2011). This effect is stronger with unexpected primes (prime surprisal) (Bernolet & Hartsuiker, 2010). Yet, prior work does not consider disfluent speech. Disfluencies not only occur in a large proportion of speech (Bortfeld et al., 2001) but are also more likely to precede low probability words and structures. Moreover, parsers use disfluencies but not everyday noises as a signal to shift parsing preferences towards otherwise unlikely structures (Arnold et al., 2007). Following disfluencies, parsers also integrate low probability words more easily and recall the word preceding disfluencies at higher rates (Corley et al., 2007). As a result, unlikely syntactic structures following disfluencies may be less surprising for listeners, resulting in lower prime surprisal and a reduced likelihood to be structurally primed. Another possibility is that disfluencies will increase the salience of the primes. Both possibilities pose a problem for implicit learning, a prominent mechanism proposed to underlie structural priming and models of syntactic development. In this account, the strength of the prime and consequently implicit learning is a product of the level of mismatch (error) between parsers' predictions and the actual input.

Method To investigate these possibility, adults' susceptibility to prime sentences with **high surprisal levels** and either disfluencies or an everyday noise (e.g. Table 1. 1(a) and 1(b)) were probed in an ongoing study on Qualtrics using a validated and open-source online mouse tracking software (Mathur & Reichling, 2019). In the study, participants on saw four critical trials and four distractor trials. In each trial, participants were introduced to two images before hearing three sentences. Labels corresponding to the images were presented on the top corners of the screen (e.g. nurse and money) and were associated with one of the three sentences—the target sentence in critical trials and a random sentence in the distractor trials.

In each critical trials, participants were primed by double object (DO) or prepositional datives (PD) (Figure 1). Participants heard two priming sentences (e.g. 1(a) and 2(a)) before hearing a target sentence with a dative verb (e.g. 3(a) or 3(b)). In our preliminary data, 46 participants heard prime sentences with an everyday noise (construction noises), and 44 heard prime sentences with disfluencies (e.g. 1(a) vs. 1(b)). During the target sentence, a visual cue appeared after the verb and during a construction noise, indicating that participants should choose one of the labels (e.g. nurse vs. money) as a possible sentence continuation. In distractor trials, participants heard unrelated sentence structures and perform the same task on a random sentence.

Analysis In the critical trials, if participants are primed, they will prefer the label that matches the primes' structure. Preference is measured through the trajectory of mouse movements (area between the ideal trajectory towards the label participants choose and the actual trajectory). For example, if participants are strongly primed with DO frames, they should prefer the label corresponding to a DO frame (e.g. nurse) and have a more direct trajectory towards the label. If they choose the label for the PP frame but are still primed, they will be more attracted to the label for the DO frame and have a less direct trajectory towards the label.

Using this measure, we compared 90 adults' susceptibility to the different prime sentences with a semiparametric generalized estimating equations (GEE) model with a working exchangeable correlation structure and robust inference. The model indicated that there was a trend for disfluent primes having an increased likelihood to prime participants ($p = 0.078$). Our poster will discuss the results of this ongoing study and its implications for the implicit learning account.

References

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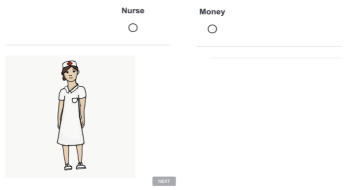
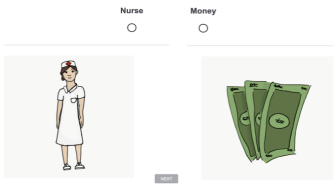
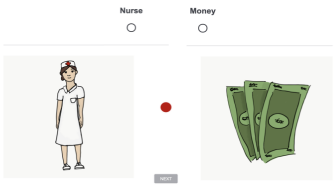
Table 1: Example sentences

1(a) The teacher saved *[thee uh]* the student the cookie.
1(b) The teacher saved *[construction noise]* the student the cookie.
2(a) The grandma wrapped *[thee uh]* boy the present
2(b) The grandma wrapped *[construction noise]* boy the present.
3(a) The doctor paid *[construction noise]* nurse the money.
3(b) The doctor paid *[construction noise]* money to the nurse.

Figure 1: Schematic of a critical item trial

Stimuli	**Introduction to Items**	**Prime Sentences (preceded by two filler sentences)**	**Test Trials**
Visual Stimuli			
Auditory Stimuli	This is a nurse. This is money.	Construction Noise Condition: The teacher saved *[the Construction Noise]* student the cookie. The grandma wrapped *[the Construction Noise]* boy the present. Disfluency Condition: The teacher saved *[thee uh]* student the cookie.The grandma wrapped *[thee uh]* boy the present	The doctor paid [the + *CONSTRUCTION NOISE*] nurse the money