Online Processing of, and Adaptation to, Nonbinary Pronouns

Recent years have seen a surge in usage of English nonbinary pronouns associated with increased salience of trans identities (Minkin 2021). These include definite specific singular *they* with referents of known gender, as well as neopronouns such as *xe, ze, fae,* and *thon*. Acceptability judgment studies have shown their grammaticality to be in transition (Rose et al 2023). For *they*, English speakers fall under one of three categories based on their acceptance of *they* (Camilliere et al. 2021): non-innovators, who only license indefinite antecedents (1); innovators, who also allow non-gendered specific antecedents (1-2); and super-innovators, who accept any animate antecedent (1-3).

(1) Someone$_i$ slept because they$_i$ were tired
(2) The student$_i$ slept because they$_i$ were tired
(3) Sarah$_i$ slept because they$_i$ were tired.

The present study used a web-based Maze task (Boyce et al. 2022) to investigate processing costs for *they*, *ze*, and *s/he* with definite singular referents, as well as whether difficulty changes throughout an experiment as participants are exposed to these usages. One possibility is that the novel *ze* will be more difficult than the more common *they* throughout the experiment. Alternatively, *ze* may be more difficult initially than *they* but may actually exhibit more rapid adaptation over the course of the study. Note that *they* is referentially and pragmatically more ambiguous than *ze*. *They* can be used to refer to many different types of antecedents (e.g., plurals, indefinites, generics, institutions). Nonbinary individuals are likely the least common antecedent for *they*. *Ze* is solely and explicitly a nonbinary pronoun. This may facilitate adaptation.

Experiment. 112 participants were trained on the use of either *they* or *ze*, then asked to read sentences about named individuals "who would be referred to with their pronouns." The names were highly associated with one binary gender or equibiased between binary genders, (established via a web-based survey on a separate group of participants). Sentences contained a critical pronoun (binary/nonbinary within participants, *they/ze* between participants) that matched its antecedent's gender features to varying degrees (intermediate/weak). 100 stimuli were developed and divided among four presentation lists using a Latin square design and pseudorandomly interspersed with 25 strongly matched controls.

Table 1. Example stimuli. Instructions: "This is a story about [name], who uses [pronouns] pronouns."

	Strong match	**Intermediate match**	**Weak match**
Binary pronoun	Amanda was studying for the bar because she wanted to be a lawyer.	Alex bought a new phone because he broke the old one.	Alice bought a new phone because he broke the old one.
Non-binary pronoun	-	Alex bought a new phone because they/ze broke the old one.	Alice bought a new phone because they/ze broke the old one.

At each point of a sentence, participants were presented with two words: the grammatically correct word, and a length- and frequency-matched foil word that was incompatible with the unfolding sentence. Participants had to select the correct word. RTs and error rates at the pronoun were recorded to assess processing difficulty. Participants also completed an acceptability survey of *they* with various antecedents in order to be classified as noninnovators, innovators, or superinnovators.

Results. Accuracy was at ceiling in all conditions (>98% in each condition) demonstrating that participants recognized all pronoun types as more grammatical than the foils. RTs were analyzed with maximal mixed effect models. We found a main effect of nonbinary pronoun type where *ze* elicited significantly greater difficulty than *they* ($\beta = -37.2$, $t = -2.76$, $p < 0.01$), likely due to its status as a neologism in a closed class (pronouns). There was also a main effect of presentation order ($\beta = -41.9$, $t = -8.40$, $p < .001$), and an interaction where reaction times

decreased over the course of the experiment at a greater rate for *ze* than *they* (β = -36.7, t = -2.69, p < 0.01). Non-innovators experienced greater difficulty with nonbinary pronouns than innovators and superinnovators (β = -95.7, t = -2.03, p < 0.05). For *ze*, non-innovators also showed more adaptation than innovators and superinnovators (β = 2.0, t = 3.75, p < 0.001), and innovators more than superinnovators (β = 1.4, t = 2.87, p < 0.01). No effect of match was found for nonbinary pronouns. Thus gender equibiased names did not significantly ameliorate difficulty with nonbinary pronouns.

Discussion. *Ze* was more difficult than *they*, but participants also adapted more quickly to *ze* than *they*. This supports the hypothesis that *ze* is easier to learn because it is less ambiguous than *they*. Another possibility is that learning is error based: The larger the error, the larger the adaptation. However such a mechanism should have led to fast adaptation in the binary weak match conditions, which was not observed. Superinnovators experienced less difficulty with nonbinary pronouns, but also less adaptation than the other clusters. They were previously shown to be younger, more familiar with, and more accepting of trans identities (Camilliere et al. 2021). Their processing fluency may have reached a ceiling early in the study due to prior exposure to, and acceptance of, nonbinary pronouns.

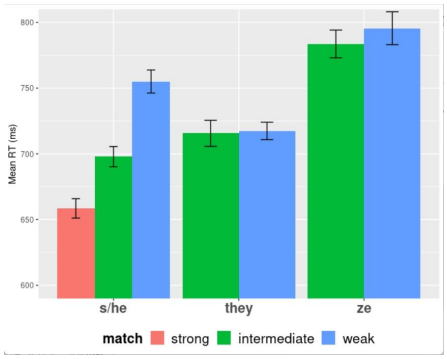

Figure 1: Mean RT by pronoun type and match.

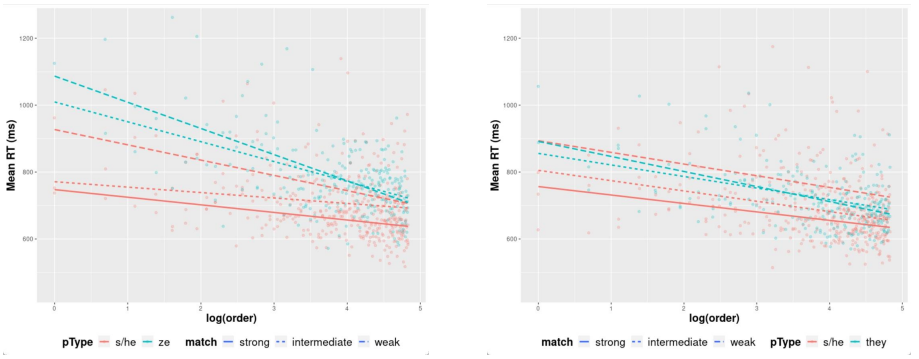

Figure 2: Mean RT by order for *ze* vs *s/he* (left) and *they* vs *s/he* (right).

References.

Boyce, V., Futrell, R., & Levy, R. P. (2019). Maze Made Easy: Better and Easier Measures of Incremental Processing Difficulty. https://doi.org/10.31234/osf.io/b7nqd

Camilliere, S., Izes, A., Leventhal, O., & Grodner, D. J. (2021). They is Changing: Pragmatic and Grammatical Factors that License Singular they. Proceedings of the Annual Meeting of the Cognitive Science Society.

Minkin, R. (2021, July 27). Rising shares of U.S. adults know someone who is transgender or goes by gender-neutral pronouns. Pew Research Center. https://www.pewresearch.org/short-reads/2021/07/27/rising-shares-of-u-s-adults-know-someone-who-is-transgender-or-goes-by-gender-neutral-pronouns/.

Rose, E., Winig, M., Nash, J., Roepke, K., & Conrod, K. (2023). Variation in acceptability of neologistic English pronouns. Proceedings of the Linguistic Society of America, 8(1), 5526. https://doi.org/10.3765/plsa.v8i1.5526