

Person distinctions are generalized across Number: Evidence from language learning

Pronominal systems tend to maintain the same person distinctions across number categories^[1,2]. For example, if a pronominal system distinguishes between first (speaker), second (addressee), and third person (other) in the singular, it is also likely to do so in the plural. Feature-based theories of person account for this fact by modeling pronominal systems as a combination of independent person and number features^[1,3], which predicts that the specified person features will be uniform across number distinctions within a given language. At the same time, person and number features interact asymmetrically. The distinct behavior of 1st person plural (associative) versus 3rd person plural (additive) suggests that personal pronouns are not straightforwardly compositional (i.e., not simply the sum of person and number features, but rather categories on their own)^[2]. The main source of evidence for these theories is typological data; we aim here to complement this evidence with behavioral data. We use an artificial language learning approach to investigate whether learners have a preference for person systems that maintain uniform person distinctions across number categories. Specifically, participants learn to distinguish between a speaker and someone who is not speaker (speaker bipartition), or between someone who is a participant of a conversation and someone who is not (participant bipartition). Then, we test whether learners tend to infer the same contrast when they need to refer to groups.

Experiment 1 We use an extrapolation paradigm in artificial language learning^[4]. Participants are first taught a singular pronominal paradigm, and then asked to extrapolate the pronominal paradigm in the plural. The experiment has two conditions: the speaker bipartition condition (Condition 1) and the participant bipartition condition (Condition 2). The two conditions differ only on the singular paradigm that participants are taught: in Condition 1, participants learn a speaker bipartition (i.e., one form for singular speaker (1sg), and another form for singular addressee (2sg) and singular other (3sg)); in Condition 2, participants learn a participant bipartition (i.e., one form for singular other (3sg), and another form for singular speaker (1sg) and singular addressee (2sg)). In both conditions, after learning the singular forms, participants are taught two plural forms: a form for groups that include speaker (1pl) and a form for groups that include neither speaker nor addressee (3pl). At the critical test, participants are asked to use one of the two forms they've learned for 1pl and 3pl to refer to groups that include addressee (2pl) (held-out meaning) (Fig. 1). Participant's response at the test indicates whether they have a preference for a system with the same person distinction between the singular and plural. Our hypothesis is that learners prefer systems that make the same person distinctions across number categories. Given that person systems in which speaker role is kept distinct are preferred by learners^[5,6], we compare the proportion of responses that match a participant bipartition in the plural across conditions. We predict that participants in Condition 2 are more likely to infer a participant bipartition for plural pronouns than those in Condition 1.

The language consisted of 2 pairs of singular and plural forms in which the plurals are derived from the singulars by adding the suffix *-fu* (i.e., *bo* and *bofu*, and *ga* and *gafu*). The mapping between forms and meanings was randomized across participants. Visual stimuli

	SG training	PL training	Extrapolation
Condition 1	1sg = form 1 2sg, 3sg = form 2	1pl = form 3 3pl = form 4	2pl = form 3 or form 4?
Condition 2	1sg, 2sg = form 1 3sg = form 2		

Figure 1: Design conditions in Experiment 1

were pictures of a family consisting of three sisters and their parents. The two older sisters were always speaker or addressee. The parents and the third little sister were others, without participating in the conversation. The speaker and addressee roles switched multiple times in the experiment. The addressee asked a question like 'Who will be fat?' and the speaker answered with a pronoun. The reference of the form was expressed by highlighting family members (see Fig. 2). The exper-



Figure 2: Example of visual stimuli in Exp 1. (A): example question; (B): 1sg; (C): 1pl; (D): held-out 2pl.

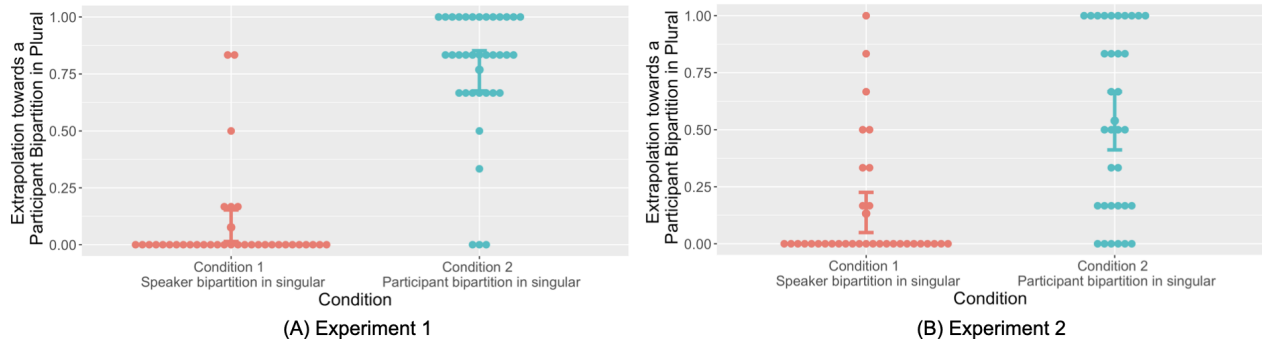


Figure 3: Proportion of responses choosing 1pl form for 2pl meaning (i.e., a participant bipartition) in Exps. 1 and 2. Error bars indicate bootstrap 95% CIs on the mean across participants; dots indicate individual participants' means.

iment was conducted on Prolific (N = 143 native English speakers). 71 participants who met the accuracy criteria (i.e., no lower than 60% for each singular meaning and no lower than 57% for 1pl and 3pl) were included in the analysis (Condition 1: 35; Condition 2: 36).

Results Fig. 3A shows the proportion of trials that participant chose the 1PL form for the held-out 2PL meaning (i.e., the participant bipartition). We ran a logistic mixed-effects regression model predicting the responses in held-out trials. The dependent variable was whether participant's response matched the participant bipartition or not. The independent variable was Condition (sum-coded). By-participant random intercepts were included. The model revealed that participants in Condition 2 were more likely to choose the form that matched the participant bipartition than those in Condition 1 ($\beta = 3.27, p < 0.001$).

Experiment 2 We test whether the difference between conditions we observed in Experiment 1 is maintained in the absence of a transparent compositional relation between the singular and plural forms. The design, materials, and procedure of Exp. 2 are the same as Exp. 1, except two changes: i) two plural forms: *tevo* (pairs with *ga*) and *zuki* (pairs with *bo*); ii) the father in the visual stimuli was changed into an aunt to discourage participants to think about irrelevant information about gender. 154 native English speakers participated in Exp. 2 and 68 of them who met the accuracy criteria were included in the analysis (34 in each condition).

Results The proportion of trials in which participant chose the 1pl form for the held-out 2pl in Exp. 2 is shown in Fig. 3B. We did the same analysis as in Experiment 1. The model revealed that participants in Condition 2 were more likely to choose the form that matched the participant bipartition paradigm compared to those in Condition 1 ($\beta = 2.56, p < 0.001$).

Discussion Our findings suggest that learners extrapolate person distinctions across number paradigms, regardless of the morphological transparency of number marking. As predicted by feature-based theories, pronominal systems are most effectively learned as the combination of distinct person and number features, rather than as unified categories. The next step will test how learners infer a bipartition paradigm in the plural when they are exposed to a tripartition in the singular (as the baseline) and compare that with the results from these two experiments.

References [1] Harley & Ritter (2002). *Language*. [2] Cysouw (2009). *The paradigmatic structure of person marking*. [3] Harbour (2016). *Impossible persons*. [4] Culbertson (2023). In *Oxford handbook of experimental syntax*. [5] Maldonado & Culbertson (2022). *Linguistic Inquiry*. [6] Maldonado et al. (2023). In *Cogsci*.