Individual differences (or the lack of them) in comprehension of singular *they*

Jennifer E. Arnold, Heather Mayo, & Lisa Dong

University of North Carolina at Chapel Hill

Address all correspondence to:

Jennifer Arnold

University of North Carolina at Chapel Hill

Dept. of Psychology and Neuroscience, Davie 337B

Chapel Hill, NC 27599-3170

Abstract

The pronoun "they" can refer to an individual who identifies as nonbinary, but it also is commonly used as a plural pronoun. How do listeners identify whether "they" is being used in a singular or plural sense? Arnold, Mayo, & Dong (in press) report three experiments in that test the role of explicitly introducing gender identity via pronouns, e.g. "This is Alex, and they use they/them pronouns." Participants read short stories like "Alex went running with Liz and they fell down." Answers to "Who fell down" indicated whether participants interpreted *they* as Alex or Alex-and-Liz. Singular interpretations of *they* were more likely when participants hear an explicit statement that Alex uses they/them pronouns, and in supporting discourse contexts. This paper is a companion to the main article, and reports analyses of individual difference measures. Participants self-reported familiarity with individuals who identify as nonbinary, which was expected to increase singular interpretations, but mostly it did not. In experiment 2 we also measured print exposure, but we found that it did not affect interpretation of singular *they*. In short, we saw virtually no effects of individual difference predictors.

Keywords: Pronouns, gender identity, nonbinary, discourse

1. Introduction

The English pronouns *they/them/theirs* are typically considered plural pronouns, but in fact they is frequently used with a singular interpretation, and have been for centuries. The most common singular uses are for quantified referents like *Everyone cuts their hair*, or for referents where the gender is unknown or de-emphasized, like *Someone called and they left a message*. But *they/them/theirs* are also often used as the personal pronoun of choice for individuals who identify as nonbinary, that is, those who identify outside the gender categories male and female. This means that the word *they* is ambiguous, requiring comprehenders to identify the intended referent among multiple possibilities. For example, consider a story about Alex and Aron, who both identify as nonbinary: *Alex saw Aron when they went to the market*. Here *they* could potentially refer to either Alex, Aron, or the two of them together. This ambiguity offers a window onto a change in progress (Konnelly & Cowper, 2020), where the frequency and range of interpretations of singular *they* is increasing overall, but is still stronger for some individuals than others (Ackerman, 2019; Camilliere, Izes, Leventhal, & Grodner, 2019; Bjorkman, 2019; Konnelly & Cowper, 2020).

Arnold, Mayo, and Dong (in press) asked whether the process of interpreting *they* is influenced by explicit commentary about pronouns. A recent trend is for people to introduce their pronouns as a way of signaling gender identity, e.g. "My pronouns are she/her/hers", or "My pronouns are they/them theirs." Arnold et al. tested pronoun comprehension in short stories about three characters: Liz (she/her/hers), Alex (they/them/theirs), and Will (he/him/his); see Figure 1. In three experiments, they manipulated whether the survey introduced these characters along with their pronouns, or just by name. In both versions of the survey, participants saw several "training" stories that referred to Alex with *they*, so they had ample opportunity to learn

this fact. In addition, the analysis was restricted to only participants who responded that *they* referred to Alex on 100% of the training trials, so the authors knew that participants were fully aware that Alex used they/them pronouns.

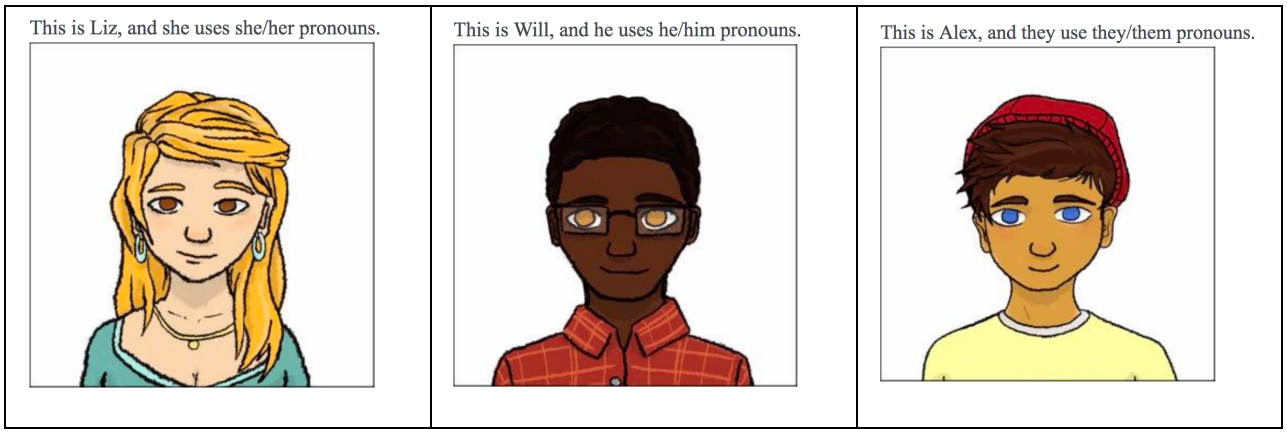


Figure 1. Example character introductions from Arnold et al. (in press) for the Explicit lists. Each picture and introductory sentence appeared alone on a separate screen. The Implicit lists were identical except they did not mention pronouns.

In all three experiments, the primary analysis concerned how people interpreted the eight critical stories about Alex. People read short stories like "Alex went running with Liz. They fell down," and then answered a question like "Who fell down?", where the choices were either Alex, or Alex-and-Liz together. Thus, their responses indicated whether they assigned *they* to a singular or plural referent. All three experiments manipulated whether the introduction of the characters' pronouns was explicit or implicit. In addition, each experiment manipulated the discourse context (see Table 1). Based on research with he/she pronouns (e.g., Arnold et al., 2000), we expected that Alex would be more available as the referent when they were the only character in the story (single-character context) than when there were two characters. We also expected that mentioning Alex first would increase assignment of *they* to Alex. Experiment 1 compared the single-character with the two-character/first-mention contexts; Experiments 2 and

3 compared the first-mention and second-mention contexts. Both of these discourse patterns were observed (see Figure 2).

Table 1. Example discourse contexts from Arnold et al. (in press).

1. Single-character: Alex went running. They fell down.
2. Two-character, first mention: Alex went running with Liz. They fell down.
3. Two-character, second mention: Liz went running with Alex. They fell down.

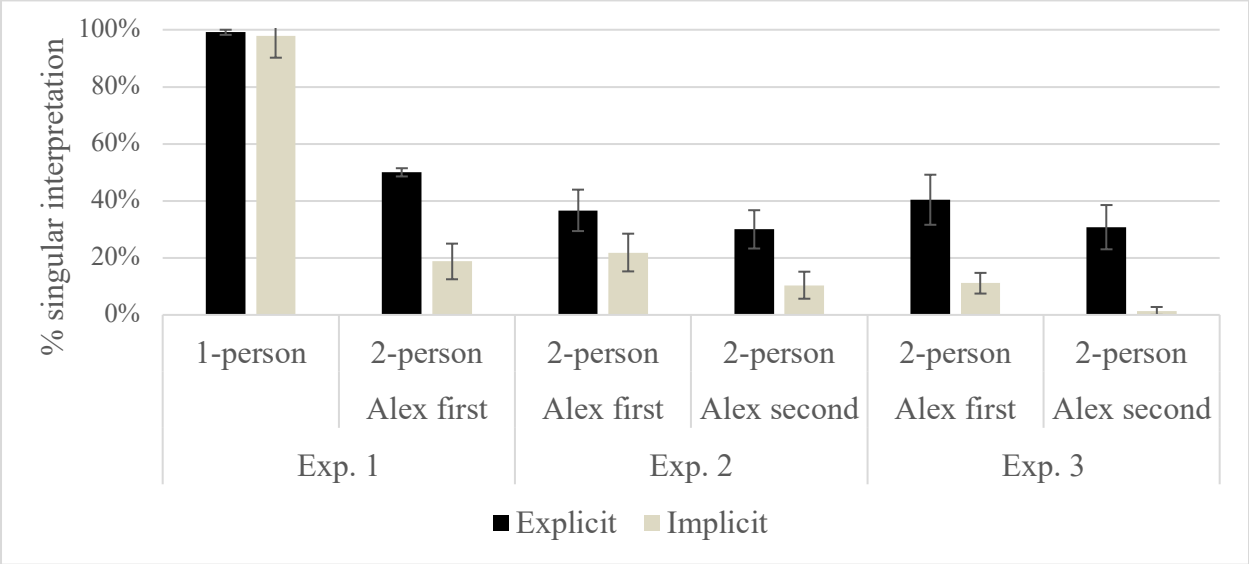


Figure 2. Results reported in Arnold, Mayo, & Dong (in press). Average percentage of singular interpretations for nonbinary "they" as a function of the pronoun-introduction condition. (explicit vs. implicit) and discourse context (1-person; 2-person Alex first, 2-personAlex second).

Here we report data on individual differences in these three studies as a companion to the main study, because readers will likely wonder about variation amongst the particiapnts. However, our analyses show that there are no reliable patterns of our measures.

We focus on two questions. First, it is likely that people are more likely to accept a nonbinary usage of singular *they* if they participate in communities where this form is used frequently, and indeed several scholars report this trend (e.g., Bjorkman, 2018; Konnelly & Cowper, 2020). We measured this with two self-report questions: 1) how many individuals who identify as non-binary do you know?, and 2) how familiar are you with individuals who identify as nonbinary?

Second, there is evidence that some people are more sensitive to constraints from the discourse context when interpreting pronouns, but this evidence comes from the interpretation of *he/she* pronouns. In sentences like *Ana is cleaning with Liz. She needs the broom,* there is a general preference to assign *she* to the first character (or grammatical subject), Ana (Arnold et al., 2000; Gernsbacher & Hargreaves, 1988). However, this bias is stronger for people who have been exposed to more print materials (Arnold, Strangmann, Hwang, Zerkle, & Nappa, 2018; Arnold, Castro-Schilo, Zerkle, & Rao, 2019; Langlois & Arnold, 2020). We hypothesized that if participants prefer to assign a singular interpretation to *they* when a nonbinary character was in subject position of the previous sentence (as they did for exp. 2 and 3), this pattern might be stronger for people with high print exposure. We therefore tested this question in experiment 2 with the Author Recognition Task (Acheson et al., 2008; Moore & Gordon, 2015; Stanovich & West, 1989), but this measure had no effect so we did not include it in experiment 3.

2. Methods

The participants and methods are described in Arnold et al. (in press). In this paper, we describe analyses with three independent difference measures. In the first part of the survey, participants answered a number of demographic and background questions, which were used to characterize the samples across experiments; these data are in Table 2. Two additional questions

probed familiarity with nonbinary individuals; these are shown in Table 1. All stimuli are available at https://arnoldlab.web.unc.edu/publications/supporting-materials/arnold-mayo-dong-2020/).

Table 2. Demographic Data for all three experiments

	Exp. 1	Exp. 2	Exp. 3
Age: mean (range)	36.3 (22-61)	37 (23-63)	36.4 (21-66)
Sex	F: 25, M: 27	F: 26, M: 28	F: 25, M: 19
Ethnicity: Hispanic or Latinx	6	3	3
Ethnicity: Not Hispanic or Latinx	44	50	38
Ethnicity: Do not wish to report	2	1	3
Race: Asian	4	4	1
Race: Black or African American	5	3	8
White	39	46	33
More than one race	2	1	1
Do not wish to report	2	0	1
Education: High school or less	5	7	4
Education: Some college, 2 year degree, or technical school	25	24	18
Education: 4-year college degree	44	41	34
Education: Masters, professional, Ph.D., M.D., or other graduate degree	26	30	26

Table 3. Background questions regarding familiarity with people who identify as gender nonbinary.

1. How many people do you know personally who have a gender identity other than male or female (yourself included)? (None; 1; 2-5; 6 or more)
2. How familiar are you with people who do not identify as either male or female? (0-10 sliding scale)

In addition, in Experiment 2 they completed the Author Recognition Task (Acheson et al., 2008; Stanovich & West, 1989; Moore & Gordon, 2015), which is a variant of a version designed by Peter Gordon's lab (p.c.). The Author Recognition Task (ART) asks participants to read a list of author names, 62 real and 64 fake. They select the names they are familiar with. The final score is the number of real minus fake names selected (to control for guessing).

The primary task was to read two-sentence stories and answer two questions. Participants first read 12-16 training questions, which illustrated the pronouns used by each of our three characters (Alex – they; Liz – she; Will p he). They then read 8 critical questions intermixed with 15 fillers. Here we present an analysis of the 8 critical questions, which appeared in one of two discourse conditions, as shown in Table 4. For the examples in Table 4, the question was "Who drank expired milk?", and the choices were pictures of either 1) Alex or 2) Alex and Liz together.

Table 4. Examples of conditions and stimuli for critical questions in each experiment.

Exp.	Condition	Example
1	Single-character	Alex drank some expired milk. They needed to go to the hospital.
1/2/3	Two-char/1st-mention	Alex drank some expired milk with Will. They needed to go to the hospital.
2/3	Two-char/2nd-mention	Will drank some expired milk with Alex. They needed to go to the hospital.

Thus, each experiment included two discourse conditions. The 8 critical items were rotated across the conditions in two lists. In addition, our key manipulation was whether the instructions gave explicit information about pronouns. In the explicit condition, participants were tested to ensure they remembered the names and pronouns of each character. In the implicit condition, they were just tested on the names. Thus, there were four lists per experiment, crossing the explicit/implicit manipulation and the two discourse-condition lists.

Following Arnold et al. (in press), our analysis is restricted to participants who answered "singular" on all the training questions about Alex, which signals that they fully recognized that Alex uses they/them pronouns. This is the strongest test of our hypothesis that explicit instructions affect comprehension, because it ensures that any differences between conditions were not simply due to the implicit participants not realizing what Alex's pronouns were. This analysis includes 52 participants in Experiment 1, 54 in Experiment 2, and 44 in Experiment 3. For full details for procedure and inclusion criteria, see Arnold et al. (in press).

3. Results.

Our dependent measure was whether the participant answered with the singular or plural interpretation for the critical sentence. Our main predictors were 1) whether the participant saw explicit or implicit pronoun instructions, and 2) discourse condition. We analyzed responses in a mixed effects logistic regression, using SAS proc glimmix, with a binary distribution and a logit link, and centered predictors. Models included maximal random effects (Barr, Levy, Scheepers, & Tily, 2013), including random intercepts for participants and items, and random slopes as appropriate. were grand-mean centered. For each individual difference variable, we added the predictor to the main model.

Table 5. Average selection of "singular" in the critical stories about Alex. Standard error is reported in parentheses. (Copy of Table 2 from Arnold et al., in press).

		Exp. 1	**Exp. 2**	**Exp. 3**
Explicit	1-person context	99% (1%)		
	2-person/Alex first	50% (1%)	37% (7%)	40% (9%)
	2-person/Alex second		30% (7%)	31% (8%)
Implicit	1-person context	98% (8%)		
	2-person/Alex first	19% (6%)	22% (7%)	11% (4%)
	2-person/Alex second		10% (5%)	1% (1%)

Table 6. Inferential statistics for main model (Copy of Table 3 from Arnold et al., in press)

	Estimate (SE)	**t**	**p**
Experiment 1			
Explicit vs. Implicit introduction of pronouns	1.77 (0.39)	1.71	0.091
Discourse context (1 vs. 2 person)	1.34 (0.78)	7.61	<.0001
Explicitness x Discourse context	5.47 (0.72)	-0.63	0.533
Experiment 2			
Explicit vs. Implicit introduction of pronouns	1.41 (0.66)	2.15	0.037
Discourse context (Alex first vs. Alex second)	0.85 (0.33)	2.58	0.034
Explicitness x Discourse context	-0.79 (0.63)	-1.25	0.211
Experiment 3			
Explicit vs. Implicit introduction of pronouns	3.12 (1.08)	2.9	0.004
Discourse context (Alex first vs. Alex second)	1.45 (0.63)	2.3	0.029
Explicitness x Discourse context	-1.41 (1.15)	-1.23	0.22

3.1. Descriptive statistics for individual difference measures

As shown in Table 6, the average ratings for the Know variable (how many individuals who identify as nonbinary do you know) tend to be low. The possible responses to this question were None, 1, 2-5, or 6+. The 2-5 response was re-coded as 3.5 (the middle value); the 6+ category was recoded as 6. Most people responded None (exp. 1: 29/52; exp. 2: 31/54; exp. 3:

21/44). The average ratings for the Familiar variable showed more variation, with an average around 4. Nevertheless, these two ratings were correlated significantly in each experiment.

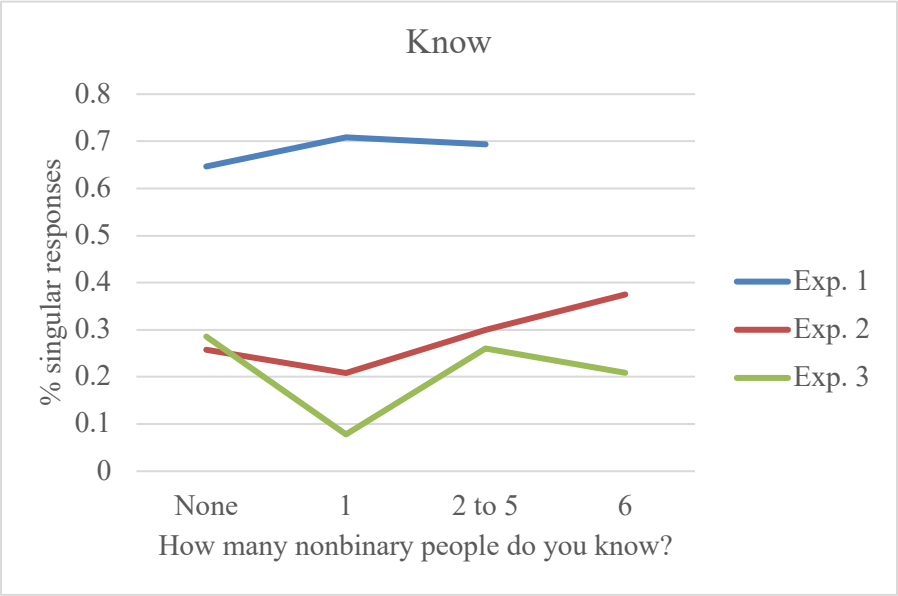
In experiment 2, the Author Recognition Task (ART) yielded scores ranging from 1 to 51, with an average of 16. The ART scores were not correlated with either the Know or Familiar variables.

Table 7. Average values and standard deviation, and correlations amongst the three individual difference measures: Know; Familiar (how familiar are you with individuals who identify as nonbinary) and ART (Author Recognition Task).

	exp. 1 (N=52)	**exp. 2 (N = 54)**	**exp. 3 (n = 44)**
Know	mean= 0.97, S.D. = 1.38	mean= 0.98, S.D. = 1.5	mean= 1.55, S.D.= 1.92
Familiar	mean= 4.31, S.D. = 3.02	mean= 4.07, S.D. = 3.49	mean= 4.25, S.D.= 3.2
ART		mean= 16.11, S.D. = 11.41	
correlation know vs. familiar	r=0.41, p=0.002	r=0.27, p=0.05	r=0.41, p=0.006
correlation know vs. ART		r=-0.06, p=0.646	
correlation familiar vs. ART		r=0.01, p=0.923	

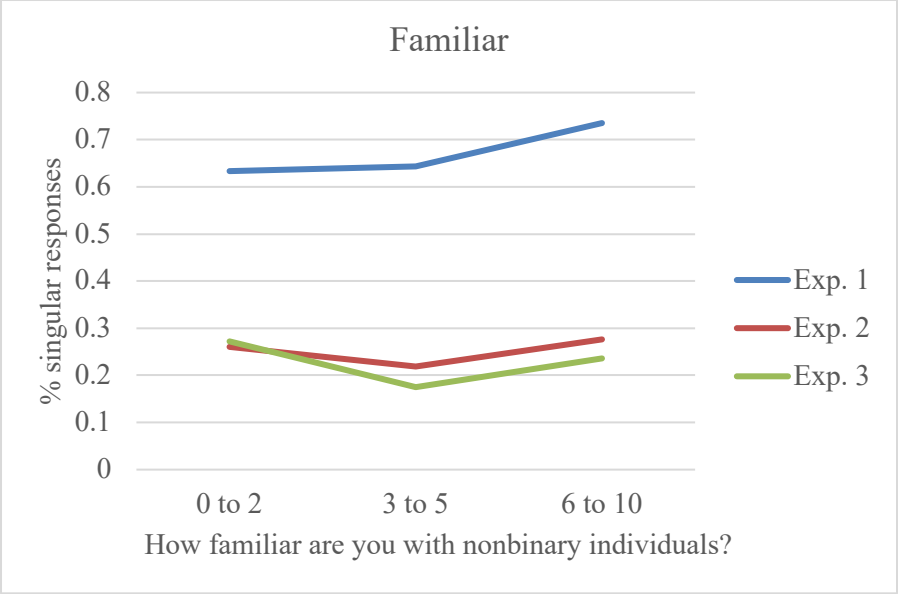
3.2. Do individual difference measures affect singular responses?

Figure 3 illustrates the average rate of singular responses for each experiment, divided by the Know variable. Figure 4 does the same for the Familiar variable. These graphs reveal no consistent relationship between either variable and responses. Experiment 1 has a higher rate of singular responses, on average, because it included the one-person condition, while Experiments 2 and 3 had only the two-person conditions that yielded lower singular responses.



Know	exp1	exp2	exp4
0	29	31	21
1	12	12	8
3.5	11	10	12
6	0	1	3

Figure 3. Top panel: Average singular responses for each experiment, divided by ratings of how many nonbinary people the participant knows. Bottom panel: Total N in each category.



	exp1	exp2	exp4
0 to 2	15	23	17
3 to 5	20	12	10
6 to 10	17	19	17
Grand Total	52	54	44

Figure 4. Top. Panel: Average singular responses for each experiment, divided by ratings of familiarity with nonbinary individuals. Bottom panel: total N in each category.

To test whether the Know and Familiar predictors had significant effects on the results, we started with the model that had been developed to test the manipulated variables in each experiment. We then simplified it by removing the nonsignificant interaction between the discourse manipulation and the explicit/implicit manipulation. We then added each individual difference measure, one at a time, along with the interactions between the new variable and each of the manipulation variables. All predictors were centered.

As shown in Tables 6 and 7, there were virtually no significant effects of either the Know or Familiar predictors. The only exception to this pattern was in experiment 1, where we saw a significant effect of the Familiar predictor: people who reported more familiarity with nonbinary

individuals also tended to adopt singular interpretations more often. This effect did not interact with either the explicitness manipulation or the discourse manipulation. There were no effects of print exposure in experiment 2.

A substantial concern with the analyses for each experiment is that the sample size is fairly small, and thus it is difficult to obtain a robust picture of individual difference measures. We therefore combined all the experiments together and tested the Know and Familiar variables (Table 7 and 8). The Discourse manipulation was operationalized as two manipulations: Single vs. Two-person, where experiments 2 and 3 included all 2-person conditions, and Alex first vs. Alex second, where the single-character condition counted as an instance of Alex first. In these analyses, there were no effects of either the Know or Familiar predictors, nor any interactions with them.[1]

Table 8. Effects of the Know predictor in each experiment. The discourse manipulation is single-character vs. two-character in Experiment 1, and Alex first vs. Alex second in Experiments 2 and 3.

	EXPERIMENT 1			**EXPERIMENT 2**			**EXPERIMENT 3**		
Effect	Est (S.E.)	t	p	Est (S.E.)	t	p	Est (S.E.)	t	p
Explicit vs. Implicit	1.69 (0.6)	2.84	0.007	1.47 (0.69)	2.15	0.039	2.46 (0.84)	2.94	0.005
Discourse Manip.	5.64 (0.74)	7.66	<.0001	0.78 (0.36)	2.17	0.071	1.03 (0.55)	1.86	0.089
Know	0.1 (0.21)	0.47	0.64	0.05 (0.4)	0.12	0.904	-0.05 (0.24)	-0.2	0.842
Explicit * Know	0.25 (0.43)	0.58	0.568	-0.74 (0.73)	-1.01	0.319	-0.44 (0.42)	-1.03	0.31
Discourse * Know				0.34 (0.46)	0.74	0.497	0.14 (0.23)	0.61	0.546

- TABLE NOTE: In experiment 1, the model would not converge with the Discourse * Know predictor, so it was remoted.

[1] One might object that our method of excluding resisters meant that we excluded the participants who likely had the least familiarity with nonbinary individuals. Nevertheless, even if we include the entire dataset, the same patterns obtain.

Table 9. Effects of the Familiar predictor in each experiment. The discourse manipulation is single-character vs. two-character in Experiment 1, and Alex first vs. Alex second in Experiments 2 and 3.

	EXPERIMENT 1			EXPERIMENT 2			EXPERIMENT 3		
Effect	Est (S.E.)	t	p	Est (S.E.)	t	p	Est (S.E.)	t	p
Explicit vs. Implicit	1.93 (0.63)	3.06	0.004	1.38 (0.67)	2.06	0.048	2.48 (0.85)	2.92	0.005
Discourse Manip.	8.92 (2.51)	3.56	<.001	0.76 (0.32)	2.35	0.057	0.99 (0.51)	1.94	0.08
Familiar	0.79 (0.38)	2.07	0.039	0.08 (0.1)	0.77	0.446	0.03 (0.14)	0.22	0.831
Explicit * Familiar	0.03 (0.21)	0.13	0.9	0.06 (0.19)	0.33	0.742	-0.2 (0.28)	-0.71	0.48
Discourse * Familiar	1.29 (0.73)	1.76	0.079	-0.1 (0.11)	-0.95	0.387	0.1 (0.13)	0.75	0.458

Table 10. Effects of the ART predictor in Experiment 2. The discourse manipulation is whether Alex is first or second.

Effect	Est (S.E.)	t	p
Explicit vs. Implicit	1.51 (0.68)	2.22	0.033
Discourse Manipulation	0.11 (0.57)	0.19	0.85
ART	0.03 (0.03)	1.13	0.268
Explicit * ART	-0.03 (0.06)	-0.54	0.592
Discourse * ART	0.04 (0.03)	1.36	0.22

Table 11. Effects of the Know predictor in all three experiments together.

	Est (S.E.)	t	p
Explicit vs. Implicit	1.71 (0.38)	4.55	<.0001
First mention	0.82 (0.39)	2.08	0.039
Single	6.04 (0.71)	8.56	<.0001
Know	0.07 (0.13)	0.57	0.569
Explicit * Know	-0.16 (0.24)	-0.69	0.49

Table 12. Effects of the Familiar predictor in all three experiments together.

	Est (S.E.)	t	p
Explicit vs. Implicit	1.76 (0.38)	4.64	<.0001
First mention	0.79 (0.39)	2	0.052
Single	6.05 (0.71)	8.51	<.0001
Familiar	0.08 (0.06)	1.34	0.183
Explicit * Familiar	-0.04 (0.12)	-0.31	0.76

General Discussion

Contrary to expectations, there were almost no effects of individual difference predictors in this experiment. In Experiment 1 we did find that people who reported higher familiarity with nonbinary individuals also tended to provide more singular responses. However, this effect must be considered with caution, because it was not observed in either experiment 2 or 3, nor in the analysis with all experiments together.

These findings are surprising, because other studies have reported that some individuals are more likely to use singular they, more likely to adopt a singular interpretation of *they*, or more likely to permit a wider range of contexts where *they* is appropriate (e Ackerman, 2019; Camilliere, Izes, Leventhal, & Grodner, 2019; Bjorkman, 2019; Konnelly & Cowper, 2020). It is therefore likely our failure to find individual difference effects is due to our measure and/or our sample. Our measures of individual exposure to nonbinary individuals are rough. Participants may have adopted different interpretations about what it means to be familiar with a nonbinary individual. In addition, there was very little variation overall in our sample, where over half of our participants reported that they did not know any nonbinary people.

Our findings may also signal that for all participants, even those who are somewhat familiar with nonbinary *they*, the singular interpretation is unnatural in a two-person context. The singular interpretation was relatively infrequent in the two-person contexts, such that the plural interpretation was chosen more than half the time. The presence of a natural plural interpretation of the pronoun provides a compelling competitor for the singular interpretation. Thus, even for innovators who use singular *they* frequently, this interpretation may suffer when the more common plural interpretation is also available.

We also found that print exposure had no effect on performance in experiment 2. In several studies our lab has found that people with higher print exposure are more likely to follow a first-mention bias for interpreting binary pronouns like *he* and *she* (Arnold et al., 2018; Arnold et al., 2019; Langlois & Arnold, 2020). We also saw that people assigned *they* to Alex when Alex was in first position more than in second position. If print exposure was related to this too, we would expect an interaction between the first-mention manipulation and print exposure. It may be that we did not detect this effect because the overall rate of singular interpretation was

very low in Experiment 2, and the first-mention effect was relatively small. Alternatively, print exposure may be unrelated to variation in the interpretation of *they.*

In sum, other research shows that some individuals are more adept at using and interpreting nonbinary *they,* so we do not take our results as evidence for homogeneity in the English-speaking population. However, the communities with extensive experience may be small and unlikely to participate in Amazon Mechanical Turk studies, such that our sample includes relatively little individual variability.

Acknowledgements

We are grateful to Darith Klibanow for drawing the pictures of the characters in our survey. This project was partially funded by a Stephenson-Lindquist grant from the Dept. of Psychology at UNC Chapel Hill, and partially funded by NSF grants 1651000 and 1917840 to J. Arnold.

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