Two Replication Attempts (May, 2013) of:


**Background:** In 2007, our laboratory conducted a series of experiments examining whether pronouns embedded in short sentences (e.g., *I am/You are/He is peeling the cucumber.*) modulate reaction times when participants are tasked to verify whether a picture depicts a described action. Critically, the picture depicted an actor performing the action (e.g., peeling a cucumber) from either the actor’s internal perspective, or the perspective of an external observer. Our results demonstrated that description pronouns do indeed interact with picture perspectives; response times showed faster verifications when the implied perspectives of the pronouns and pictures matched rather than mismatched. As expected the grammatical persons *I am* and *You are* promoted faster response times when verifying internal rather than external perspective pictures; in contrast, *He is* promoted faster response times when verifying external rather than internal perspective pictures. We interpreted these findings as indicating that readers use pronouns to differentiate perspectives, and are more likely to internalize the action when they are directly addressed as the protagonist (*You are*) or the sentence uses the first-person perspective (*I am*). These findings were published in *Psychological Science* in 2009.

**Citations and Conceptual Replications:** Our original paper has been cited 52 times as of May, 2013 (according to Google Scholar). Though many of these citations have simply referenced the paper to support theoretical positions 1-5, the work has also inspired others to manipulate linguistic pronouns to investigate issues related to mental simulation and embodied cognition. In general, many of these experimental (some behavioral, some using event-related potentials) papers provide support for the notion that pronouns can be used to modulate visual and/or motoric mental simulations 6-12.

In January 2013, Professor Rolf Zwaan (Erasmus University, Rotterdam) presented us with results from two attempts to replicate our experimental paradigm using Mechanical Turk, an online service that allows for remote data collection using a varied participant sample (called workers; N = 120 per experiment). Overall, his two attempts were unsuccessful, with null picture perspective effects across all three pronouns; in other words, pronouns failed to modulate reaction times to internal versus external pictures. Professor Zwaan provided us with compiled data, which we analyzed, and we confirmed his findings. Given the ambiguity of these data, we conducted two follow-up laboratory-based attempts at replicating our original paradigm; these are described below.

**Replication Attempt 1**

**Participants & Setting:** 48 native speakers of English participated (*M_{age} = 20.9*, 20 male, 28 female) for $10 USD monetary compensation (data collected May 6-17th, 2013). The procedures precisely matched those reported by Brunyé and colleagues (2009). Data were collected on four 21” iMac computers running SuperLab 4.5, each at individual workstations. Experimenter included faculty, a full-time research assistant, and an advanced graduate student, with only one present during each experimental session.

**Data Analysis:** Data were independently analyzed by 4 individuals (3 faculty members, 1 advanced graduate student). Analysis methods and results were at consensus. Both raw and Log10 transformed reaction times were analyzed. As in the original paper, only response times from correctly answered active and matching (i.e., actor portrayed as *performing the described action*) trials were analyzed using SPSS (v17 herein). Raw data (.txt) files are

**Results:**

**Accuracy.** Supporting the original findings, overall accuracy (including all trial types) was high (\(M = .95, SE = .01\)), and did not vary as a function of description pronoun (I, You, He; \(F < 1\)) or picture perspective (internal, external; \(F < 1\)); the two variables also did not interact (\(F < 1\)), and there were no interactive effects of gender (all \(F\)'s < 1). However, unlike the original study, males showed marginally lower accuracy (\(M = .93\)) than females (\(M = .97\)), \(F(1, 46) = 3.87, p = .055, \eta^2 = .08\).

**Response Times.** As in the original paper, we use Log\(_{10}\) transformed response times to correct for a positive skew (Fisher’s skewness pre = 1.52; post = .38); we note, however, that non-transformed response times showed similar patterns.

Unlike the original findings, response time analysis demonstrated main effects of description pronoun, \(F(2, 94) = 3.31, p < .05, \eta^2 = .01\), and picture perspective, \(F(1, 47) = 7.05, p = .01, \eta^2 = .02\). These effects were qualified by an interaction, \(F(2, 94) = 9.17, p < .01, \eta^2 = .10\), with the same effect size magnitude (“medium,” Cohen, 1988) as the original. Note that we re-ran these analyses with Gender as a between-participants factor and found no main (\(F = 2.56, p = .12\)) or interactive (\(F_{\text{max}} = 1.22, p_{\text{min}} = .30\)) effects of Gender.

![Figure 1. Mean response times (and standard error) as a function of Description Pronoun and Picture Perspective.](image)

Supporting our original findings (see Figure 1), planned comparisons revealed faster verification of internal relative to external perspective pictures following the use of the second-person (You) pronoun, \(t(47) = 2.91, p < .01, d = .57\), and first-person pronoun (I), \(t(47) = 2.99, p < .01, d = .49\). With the third person pronoun (He), we found faster verification of external relative to internal perspective pictures, \(t(47) = 2.93, p < .01, d = .45\). With the You and I pronouns, effect sizes were higher than the original findings; the effect size in the You condition now reached

“medium” magnitude (Cohen, 1988), and the effect size in the I condition remained in the “small” magnitude category. The effect size in the He condition was similar to the original finding, “small” in magnitude.

Conclusion: Overall, our first replication attempt found similar results to those reported by Brunyé and colleagues (2009), with minimal exceptions (see below, Discrepant Findings).

Converging Findings: Response time analyses showed a significant Description Pronoun × Image Perspective interaction. After reading a sentence containing the pronouns I or You, participants showed faster response times when verifying internal- versus external-perspective pictures. In contrast, after reading a sentence containing the pronoun He, participants showed faster response times when verifying external- versus internal-perspective pictures. Effect sizes were categorically similar (small or medium) to the original findings, with one exception that showed a stronger effect in this replication attempt (following the You pronoun) relative to the original findings.

Discrepant Findings: Response time analyses showed main effects of Description Pronoun, with fastest response times following sentences using the pronoun You (M = 1012.5 ms), and relatively slow times following sentences using the pronoun I (M = 1085.6 ms) or He (M = 1069.6 ms). Similarly, there was a main effect of Image Perspective, with faster verification of internal (M = 1015.9 ms) versus external (M = 1095.8 ms) perspective images. In the original findings, these main effects did not reach significance. We also found that Gender modulated accuracy, with marginally lower accuracy among males versus females; in the original findings, there was no reliable effect of Gender. Finally, we found a categorically larger effect size following the You description pronoun than found in our original study.

Follow-up Analyses: Follow-up analyses were aimed at evaluating the consistency of our effects at the level of individual participants; these are summarized in Table 1. We parsed individuals by whether they showed the expected or an opposite response time pattern (internal relative to external) in all 3 pronoun conditions (Table 1, columns 2-3). We also checked results from each individual pronoun (Table 1, columns 4-9).

<table>
<thead>
<tr>
<th></th>
<th>All 3 Pronouns</th>
<th>I Pronoun</th>
<th>You Pronoun</th>
<th>He Pronoun</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Expected</td>
<td>Opposite</td>
<td>Expected</td>
<td>Opposite</td>
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<td>Number of participants</td>
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<td>4 (8.33%)</td>
<td>29 (60.4%)</td>
<td>19 (39.6%)</td>
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<td>172.7</td>
<td>460.7</td>
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</table>

Table 1. Number of participants showing expected versus opposite numerical patterns in all 3 pronoun conditions. And, number of participants showing expected versus opposite numerical patterns (internal versus external response times) within the I, You, and He pronoun conditions.

Overall, we found that only 19 of the 48 participants (39.6% of sample) showed numerical evidence for the entire pattern depicted in Figure 1; in contrast, 4 of the 48 participants (8.33% of sample) showed the entirely opposite numerical pattern. As would be expected, the magnitude of response time differences was most pronounced in the expected (532.1 ms), rather than opposite (172.7 ms), cases.

Furthermore, 16 of the 48 participants (33.33% of sample) showed the expected internal versus external differences in only a single pronoun condition (I: 5, You: 5, He: 6). The remaining 9 participants (18.75% of sample) showed the expected pattern in only two of the three pronoun conditions. Thus, we find evidence that only a minority of participants reliably (i.e., in all 3 cases; n = 19) use pronouns to modulate perspective-taking during sentence comprehension. Indeed the majority of participants (n = 25) showed pronoun use with only a single pronoun type (n = 16) or with only two pronoun types (n = 9).
Replication Attempt 2

Participants & Setting: 48 native speakers of English participated ($M_{age} = 21.3$, 17 male, 31 female) for $10$ USD monetary compensation (data collected May 17-28th, 2013). All other details matched Replication Attempt 1.

Data Analysis: Analyses matched Replication Attempt 1. Raw data (.txt) files are available for download in compressed (.zip) format at our laboratory website: http://ase.tufts.edu/psychology/spacelab

Results:

Accuracy. Supporting the original findings, overall accuracy (including all trial types) was high ($M = .96$, $SE = .01$). Accuracy marginally varied as a function of description pronoun (I, You, He; $p = .08$), with highest accuracy in the You pronoun condition ($M_I = .95$, $SE_I = .02$; $M_{you} = .97$, $SE_{you} = .01$; $M_{he} = .96$, $SE_{he} = .01$). There was no effect of picture perspective (internal, external; $F < 1$), description pronoun and picture perspective did not interact ($F < 1$), and there were no main or interactive effects of gender (all $p$’s > .14).

Response Times. As in the original paper, we use Log$_{10}$ transformed response times to correct for a positive skew (Fisher’s skewness pre = 1.51; post = .45); we note, however, that non-transformed response times showed similar patterns.

Unlike the original findings, response time analysis demonstrated a main effect of description pronoun, $F(2, 94) = 4.07$, $p < .05$, $\eta^2 = .02$. This effect was qualified by an interaction between description pronoun and picture perspective, $F(2, 94) = 11.53$, $p < .01$, $\eta^2 = .13$, with the same effect size magnitude (“medium,” Cohen, 1988) as the original. Note that we re-ran these analyses with Gender as a between-participants factor and found no main ($F = .46$, $p = .5$) or interactive ($F_{max} = 1.85$, $p_{min} = .18$) effects of Gender.

![Figure 2. Mean response times (and standard error) as a function of Description Pronoun and Picture Perspective.](image-url)
Supporting our original findings (see Figure 2), planned comparisons revealed faster verification of internal relative to external perspective pictures following the use of the second-person (You) pronoun, $t(47) = 3.83, p < .01, d = .64$. With the third person pronoun (He), we found faster verification of external relative to internal perspective pictures, $t(47) = 3.16, p < .01, d = .6$. Unlike in our original findings, the first-person (I) pronoun did not show a difference between external and internal perspective pictures, $t(47) = 1.29, p = .21, d = .21$. With the You and He pronouns, the effect sizes were higher than the original findings; the effect size in the You and He conditions now reached “medium” (versus “small”) magnitude (Cohen, 1988).

**Conclusion:** Overall, our second replication attempt found somewhat dissimilar results to those reported by Brunyé and colleagues (2009; see below, Discrepant Findings).

**Converging Findings:** Response time analyses showed a significant Description Pronoun × Image Perspective interaction. After reading a sentence containing the pronoun You, participants showed faster response times when verifying internal- versus external-perspective pictures. In contrast, after reading a sentence containing the pronoun He, participants showed faster response times when verifying external- versus internal-perspective pictures. With both the You and He pronouns, effect sizes were categorically larger than in the original findings.

**Discrepant Findings:** Response time analyses showed a main effect of Description Pronoun, with fastest response times following sentences using the pronoun I ($M = 1009.8$ ms), and relatively slow times following sentences using the pronoun You ($M = 1070.5$ ms) or He ($M = 1110.9$ ms). In the original findings, this main effect did not reach significance. We also found no evidence that the first-person (I am) pronoun modulated perspective-taking, with highly similar internal and external picture response time in this condition. Finally, we found a categorically larger effect sizes following the You and He description pronouns than found in our original study.

**Follow-up Analyses:** Follow-up analyses were aimed at evaluating the consistency of our effects at the level of individual participants; these are summarized in Table 2. We parsed individuals by whether they showed the expected or an opposite response time pattern (internal relative to external) in all 3 pronoun conditions (Table 2, columns 2-3). We also checked results from each individual pronoun (Table 2, columns 4-9).

<table>
<thead>
<tr>
<th></th>
<th>All 3 Pronouns</th>
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<th>You Pronoun</th>
<th>He Pronoun</th>
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<td>Difference</td>
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</table>

*Table 2.* Number of participants showing expected versus opposite numerical patterns in all 3 pronoun conditions. And, number of participants showing expected versus opposite numerical patterns (internal versus external response times) within the I, You, and He pronoun conditions.

Overall, we found that only 16 of the 48 participants (33.33% of sample) showed numerical evidence for the entire pattern depicted in Figure 2; in contrast, 6 of the 48 participants (12.5% of sample) showed the entirely opposite numerical pattern. As would be expected, the magnitude of response time differences was most pronounced in the expected (580.9 ms), rather than opposite (278.8 ms), cases.

Furthermore, 10 of the 48 participants (33.33% of sample) showed the expected internal versus external differences in only a single pronoun condition (I: 2, You: 4, He: 4). The remaining 16 participants (33.33% of sample) showed the expected pattern in only two of the three pronoun conditions. Thus, we find evidence that only a minority of participants reliably (i.e., in all 3 cases; n = 16) use pronouns to modulate perspective-taking...
Cite this document as: Brunyé, T. T., Taylor, H. A., Gardony, A. G., Ditman, T., & Giles, G. E. (2013). Pronouns and visual perspective-taking: Two replication attempts. Retrieved from: http://ase.tufts.edu/psychology/spacelab during sentence comprehension. Indeed the majority of participants \( n = 26 \) showed pronoun use with only a single pronoun type \( n = 10 \) or with only two pronoun types \( n = 16 \).

**Overall Conclusions**

We were partially successful in replicating our original effects, though the presently reported studies revealed varied effect sizes and, in one instance, a failure to replicate results with the first-person perspective (I am...). Follow-up analyses revealed some intricacies in participant-level patterns that are worth discussing. First, both replication attempts demonstrated that only a small minority of participants showed evidence for modulating visual perspectives in response to all three pronouns, and some participants showed the exact opposite pattern. In fact, participants varied widely in whether they modulated visual perspectives in response to one or more pronouns. In other words, though our aggregate data patterns (see Figures 1 & 2) suggest some universality to perspective adoption in response to pronouns embedded in action sentences, the pattern is neither universal nor necessary for language comprehension. Current studies in our laboratory are aimed at: 1) delineating the participant-level factors (e.g., gender, reading skills, levels of immersion/engagement) that may predict differential visual perspective adoption in response to pronouns, and 2) ascertaining levels of comprehension on behalf of readers who show no evidence for differential perspective adoption.

**References**


