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### **Psychological proximity guides multimodal communication**

A behavioural and eye-tracking study

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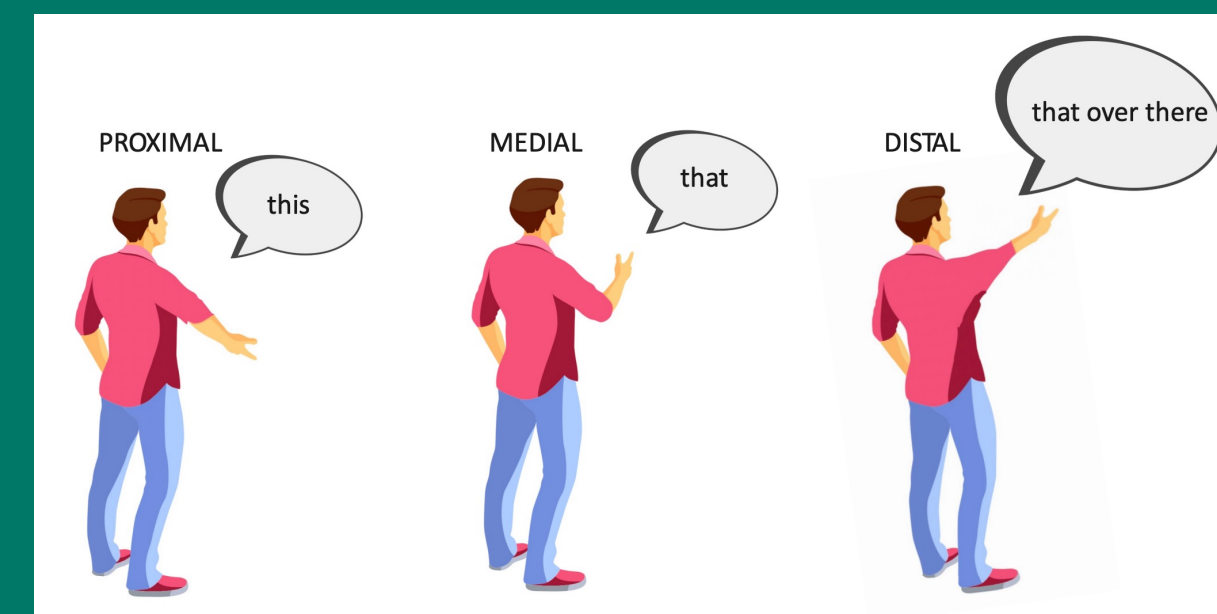
# Psychological proximity guides multimodal communication

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## BACKGROUND AND HYPOTHESIS

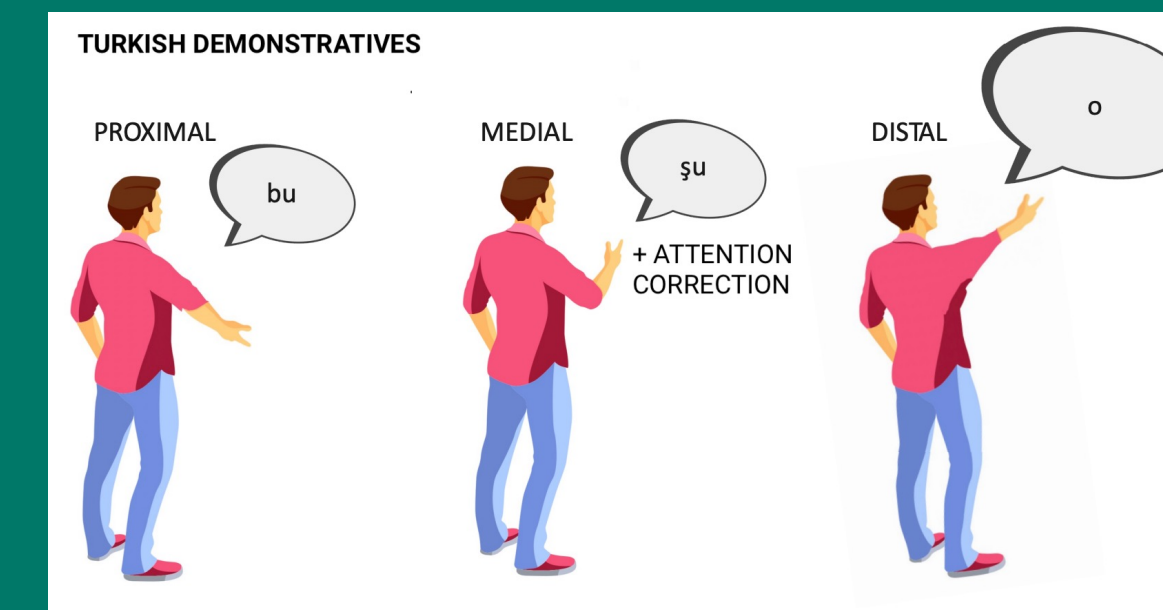
**1** Pointing gestures and demonstratives are two early acquired means of establishing joint attention. While they are frequently used in combination, the exact nature of their relationship has yet to be determined.



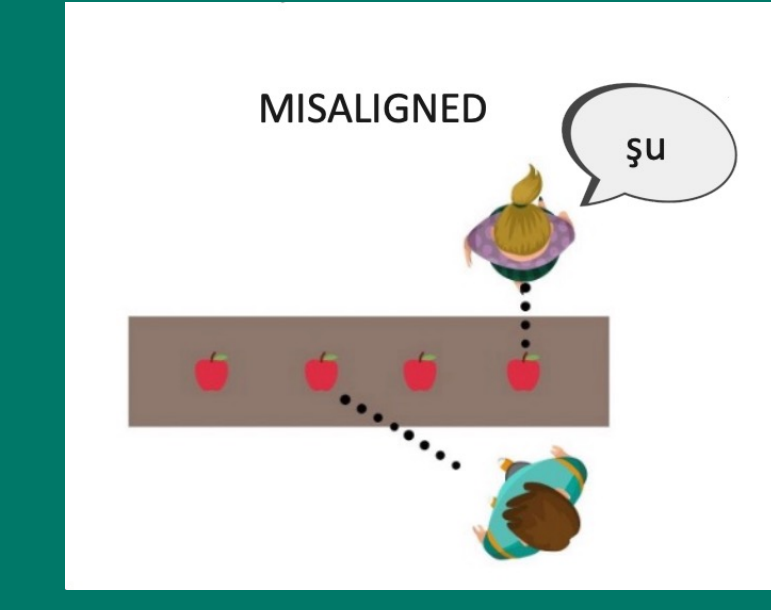
**2** Traditional accounts of demonstrative use have focused on the role of spatial factors (i.e., distance) in guiding referential choice [1], while recent accounts argue psychological factors (e.g., correcting a listener's attention) also play a role [2].



**3** This raises an important question regarding multimodal communication: how are pointing and demonstratives co-ordinated in languages that encode both distance and attention correction (like Turkish)?



**4** Recent work suggests that "şu" is used more often when a speaker and listener's perspectives are misaligned [3]. Following prior naturalistic data [4], we thus predict that a pointing gesture (vs no gesture) will more often accompany "şu" to guide the listener to the correct object.



## EXPERIMENT 1

### Videos eliciting demonstrative choice

Replicating and extending prior work [3, 4], here we used more naturalistic materials (i.e., controlled videos).

#### SET-UP

- In the videos (N=48) a speaker and listener appeared on opposite sides of a table with 4 identical objects.
- Participants were asked to play the role of the speaker and request a target object (which appeared inside a red circle) from the listener.
- To do so, participants completed the phrase in the speech bubble ("Now I need...") with "bu", "şu" or "o"

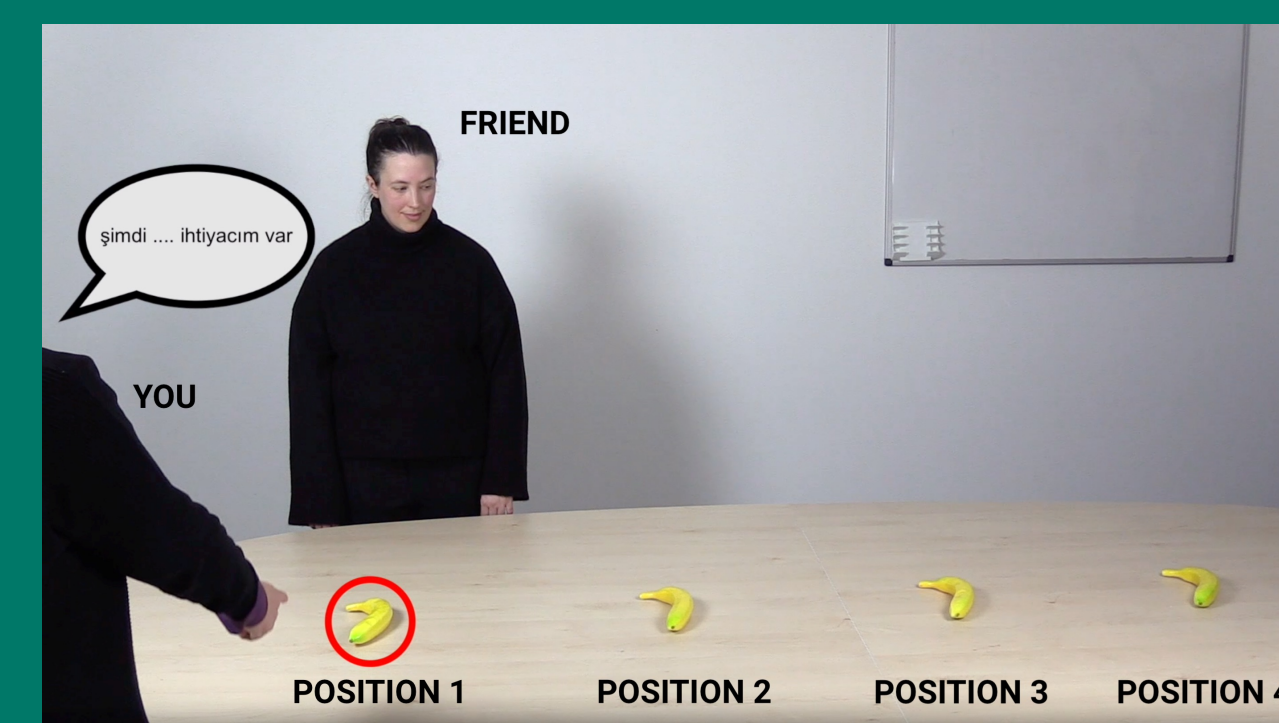


Figure 1: Trial with misaligned visual perspectives and pointing. Link to example video: <https://osf.io/s7dq3>

#### CONDITIONS

- Pointing**
  - Pointing vs No pointing
- Position (1-4)**
  - Speaker remained in P1; listener moved positions for each trial
- Perspective**
  - Aligned: both looking at the same object
  - Misaligned: looking at different objects

## Results

LMER model of Şu Choice (Şu=1, Bu/O=0) with Pointing, Position, and Perspective as FE, maximal RE structure.

- Main effect of Pointing** ( $p < .001$ ): şu selected more often with pointing
- Main effect of Perspective** ( $p < .001$ ): şu selected more often in misaligned trials
- Main effect of Position** ( $p < .001$ ): şu selected more often in the middle positions (2-3)

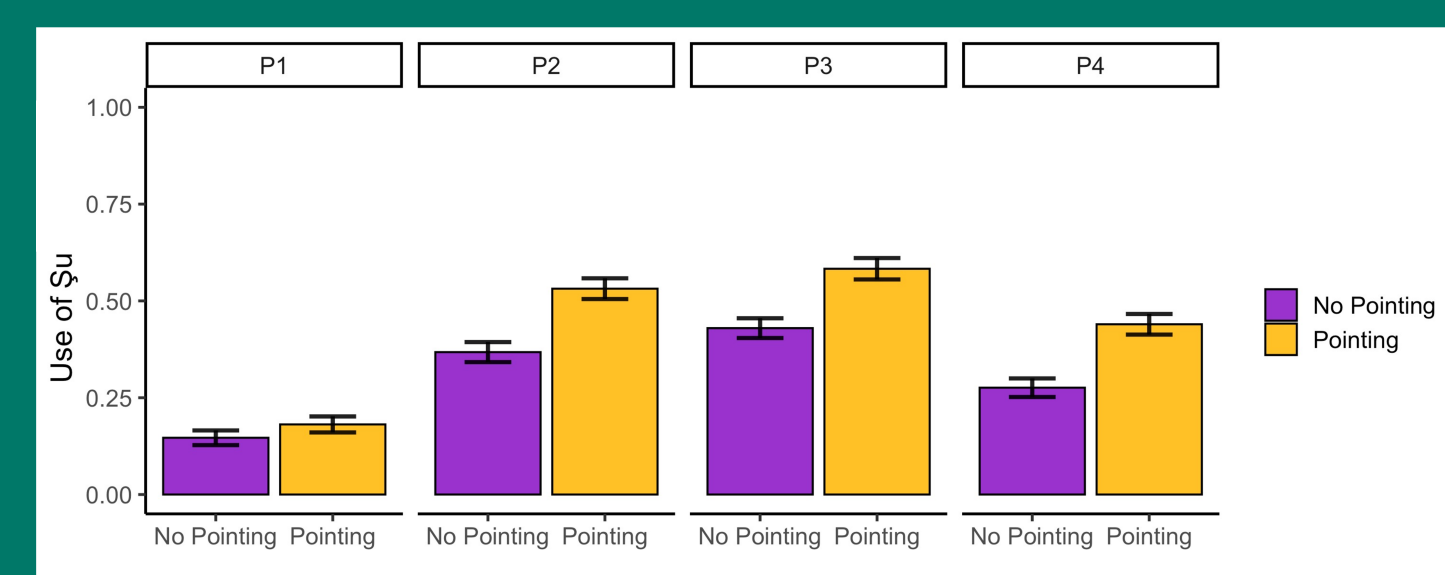


Figure 2: Position x Pointing interaction ( $p = .027$ )

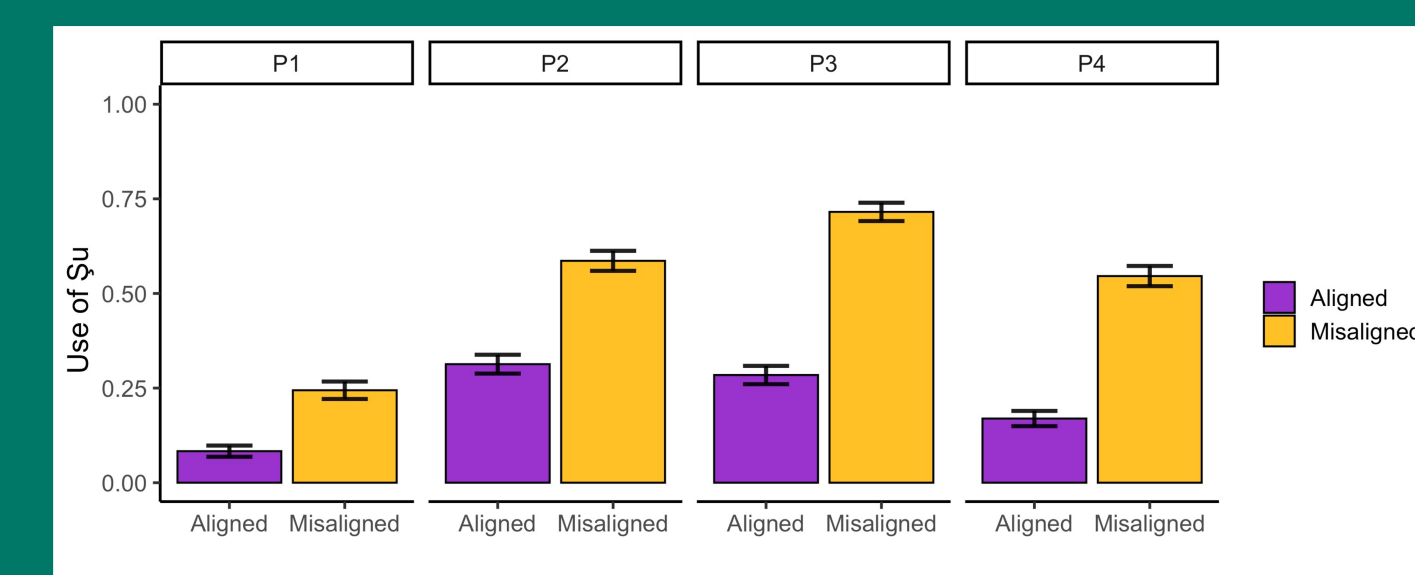


Figure 3: Position x Perspective interaction ( $p = .001$ )

- Note that LMER models for Bu and O did not reveal greater choice in misaligned trials, supporting the notion that Şu is used for attention correction. In addition, pointing gestures more frequently accompanied Şu (vs no pointing gestures). The same pattern held for Bu, whereas for O an absence of pointing gestures was more common. Bu was used more in P1 and O in P4.

## EXPERIMENT 2

### Demonstrative choice in interaction (an eye-tracking study)

To increase ecological validity, and further explore multimodal behavior when perspectives are misaligned, we used an interactive task where the participant wore eye-tracking glasses and a confederate acted as the listener.

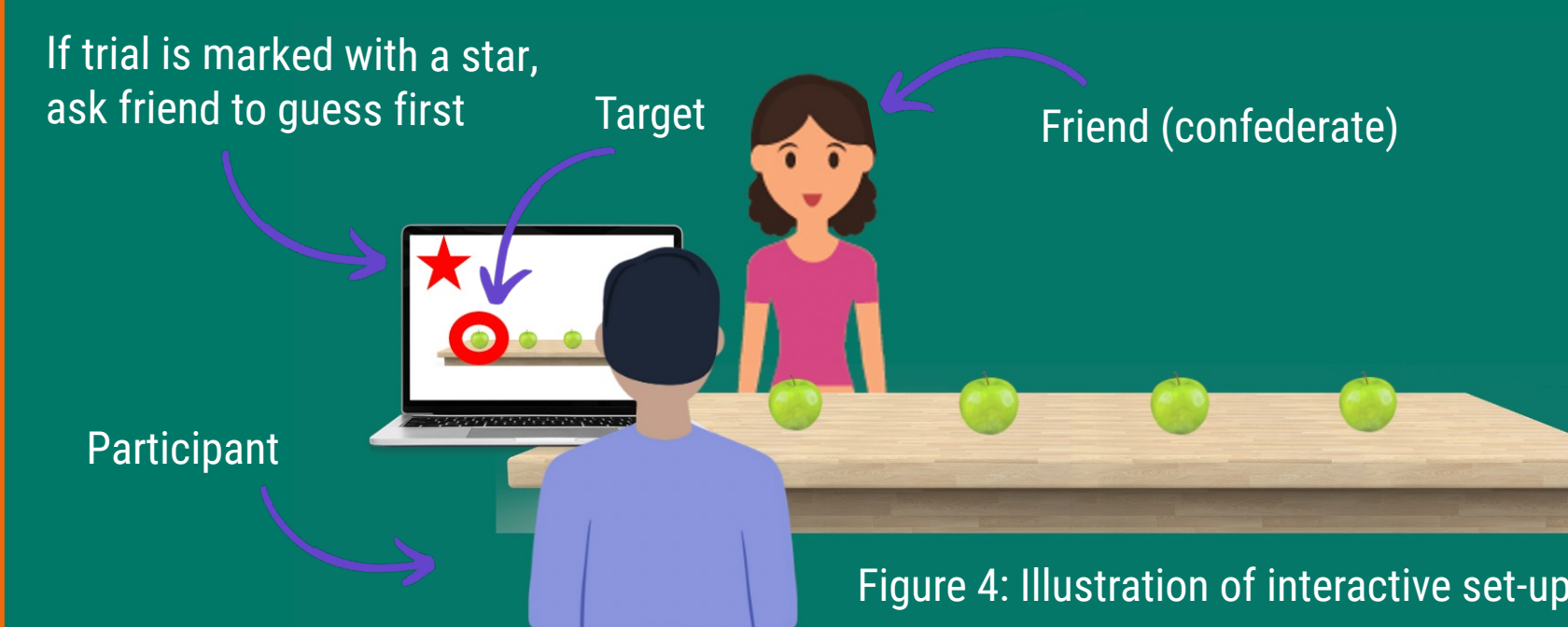


Figure 4: Illustration of interactive set-up.

#### CONDITIONS

- Attention direction**
  - Speaker directs the listener's attention to the target
- Attention correction**
  - Confederate guesses the wrong target, leading the speaker to correct them



Figure 5: Still image from synched cameras during the task (top: video cameras, bottom: eye-tracking glasses).

## Results

As this is a pilot study (N=5) with data collection ongoing, we report the initial patterns:

- Replicating Exp 1, şu was used more in attention correction trials (Fig. 6) with pointing at ceiling.
- Şu was also associated with the greatest variety of pointing types (Fig. 7), with the middle finger used exclusively with şu for attention correction. This gesture may have served a dual-purpose of signalling the target location (i.e., Position 2 or 3), while also operating as an iconic gesture, indicating that the target was in between similar objects.

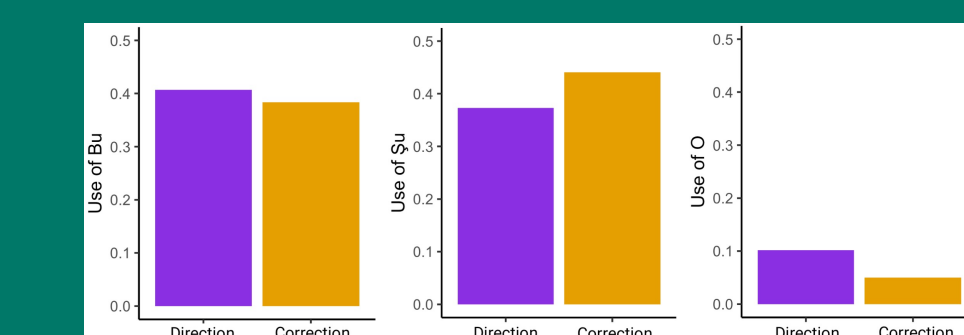


Figure 6: Demonstrative use across trial types.

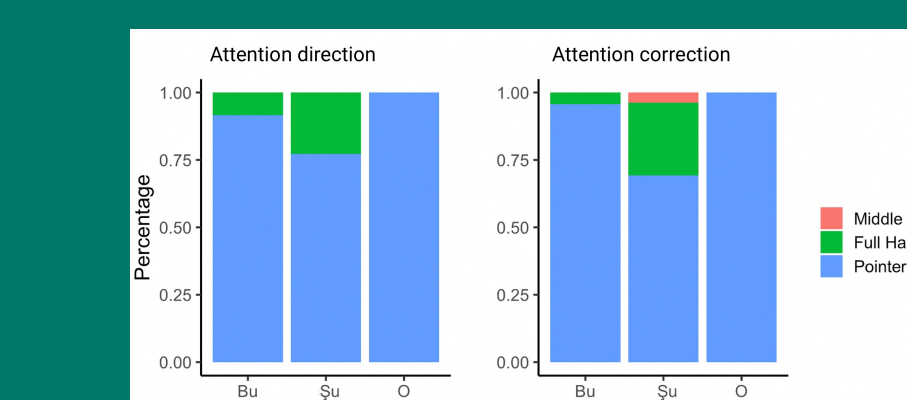


Figure 7: Pointing type by condition and demonstrative form.

## Conclusions

Our results support prior naturalistic [3] and empirical work [4] demonstrating that the Turkish middle demonstrative is used for attention correction. Turkish speakers thus dynamically integrate demonstrative use and pointing as a function of both spatial distance and psychological factors. Building on recent cross-linguistic work [4], this lends support to the notion that different demonstrative systems pose different demands on social cognition, reflected both in one's choice of demonstrative form and type of pointing, which can convey additional pragmatic information.