

Sleep facilitates talker generalization of accent adaptation

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BACKGROUND

➤ Perceptual adaptation to nonstandard speech

- *Talker-specific learning*: Listeners rapidly overcome initial difficulty in processing non-standard speech signal via top-down guided adaptation [1].

- *Generalization across talkers*: The degree of acoustic-phonetic similarity between talkers modulates the degree of cross-talker generalization in tests immediately after exposure [2].

- *Long-term effects of adaptation*: Limited studies have reported maintenance of talker-specific adaptation (up to one week) [3]. No study has investigated whether listeners' ability to generalize across talkers changes over time.

➤ The role of *sleep-mediated consolidation* in speech and language processing

- Sleep promotes generalization from trained speech stimuli to novel tokens or contexts in language tasks such as word learning, non-native phonetic category learning, and adaptation to synthetic speech [4-6].

- Sleep may facilitate abstraction, or protect listeners from interference.

Our Question:

How do listeners, once adapted to a specific foreign-accented talker, retain this learning experience in memory and more importantly, how do they generalize perceptual performance to other talkers?

➤ Does sleep help listeners to retain talker-specific adaptation?

➤ Does sleep facilitate generalization across talkers?

METHODS

SPEAKERS

Trained Talker

- 1 male native-Mandarin speaker with medium intelligibility
- Listeners successfully adapted to this talker in a previous study [7].

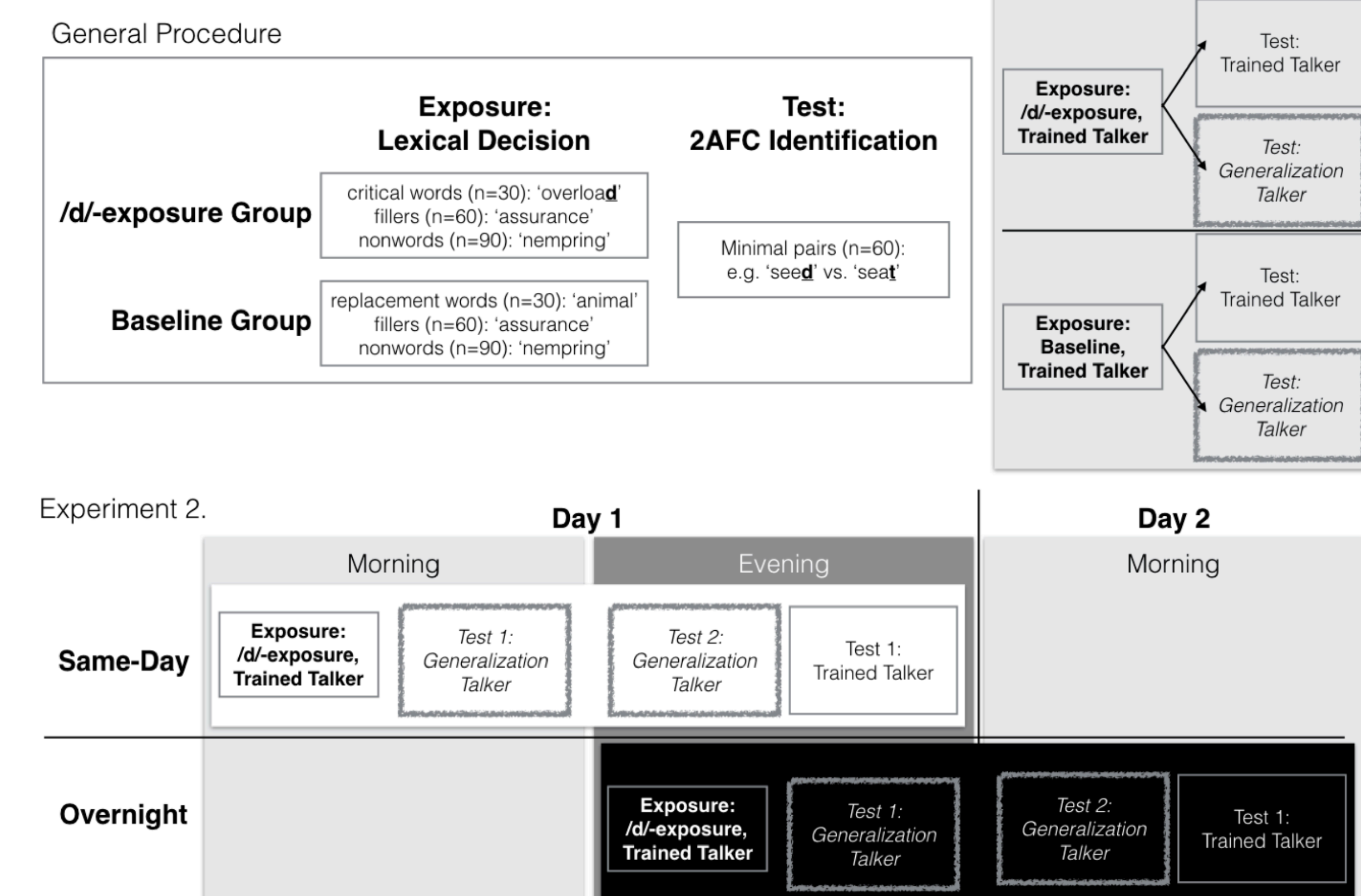
Test Talker

- 1 male native-Mandarin speaker with low intelligibility
- Listeners did not easily adapt to this talker's accent in our previous experiment.

Talker Similarity

- Different productions of word-final /d/ tokens: speech from the test talker was produced with shorter vowels and longer bursts than the trained talker, sounding more /t/-like to native-English listeners.

PROCEDURE and DESIGN



Exp1: Adaptation and Generalization in Immediate Test (N = 48)



➤ Trained Talker:

Trained Category: more /d/ responses for /d/-final words among the /d/-exposure group than the Baseline group ($\beta = .30$, $SE = .15$, $p < .05$).

Untrained Category: no group difference for /t/-final words ($\beta = .04$, $SE = .16$, $p = .78$).

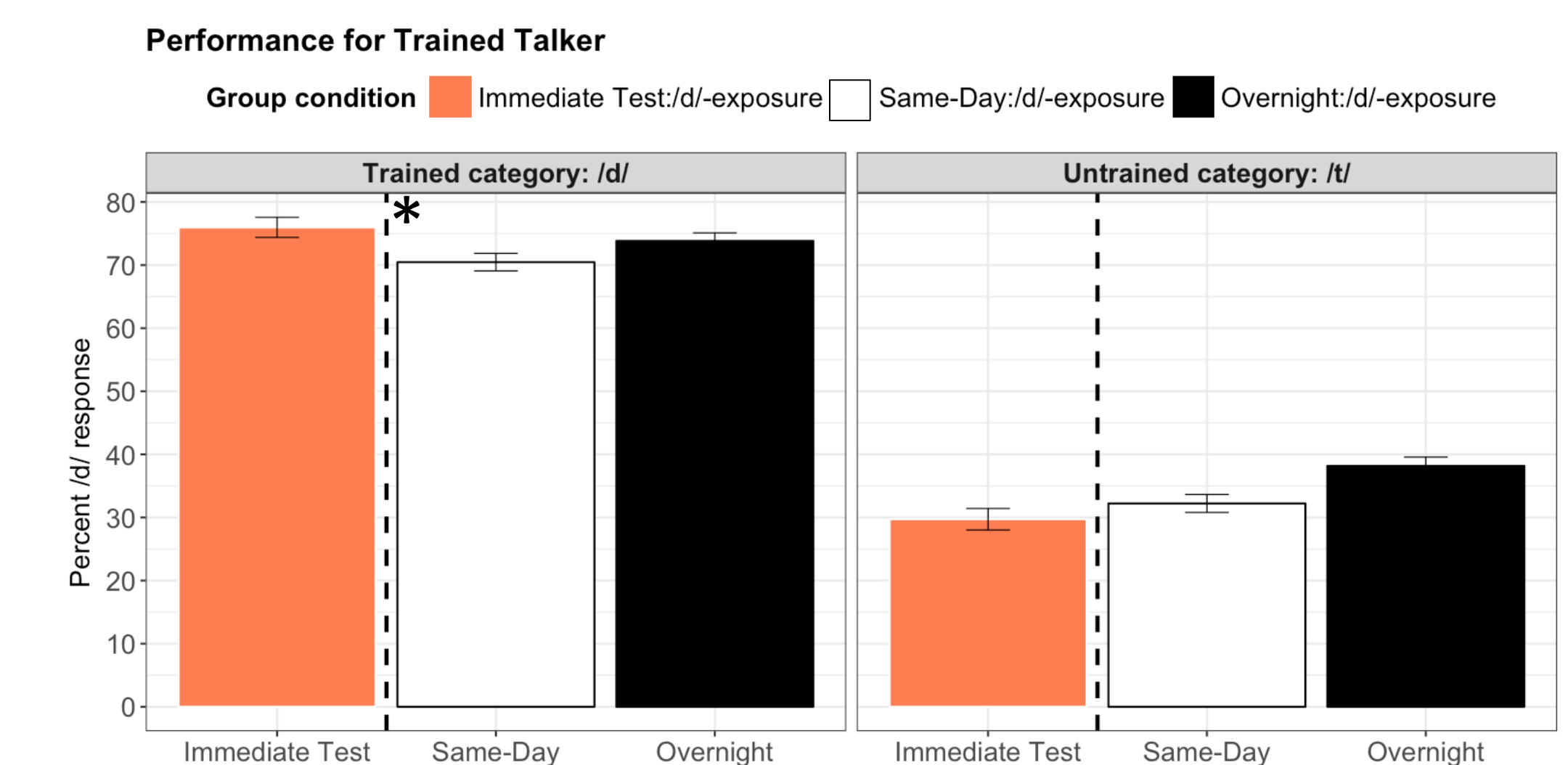
➤ Generalization Talker:

Trained Category: no group difference for /d/-final words ($\beta = .19$, $SE = .19$, $p = .32$).

Untrained Category: no group difference for /t/-final words ($\beta = .0003$, $SE = .18$, $p = .99$).

Replicated talker-specific adaptation, but no evidence of talker generalization.

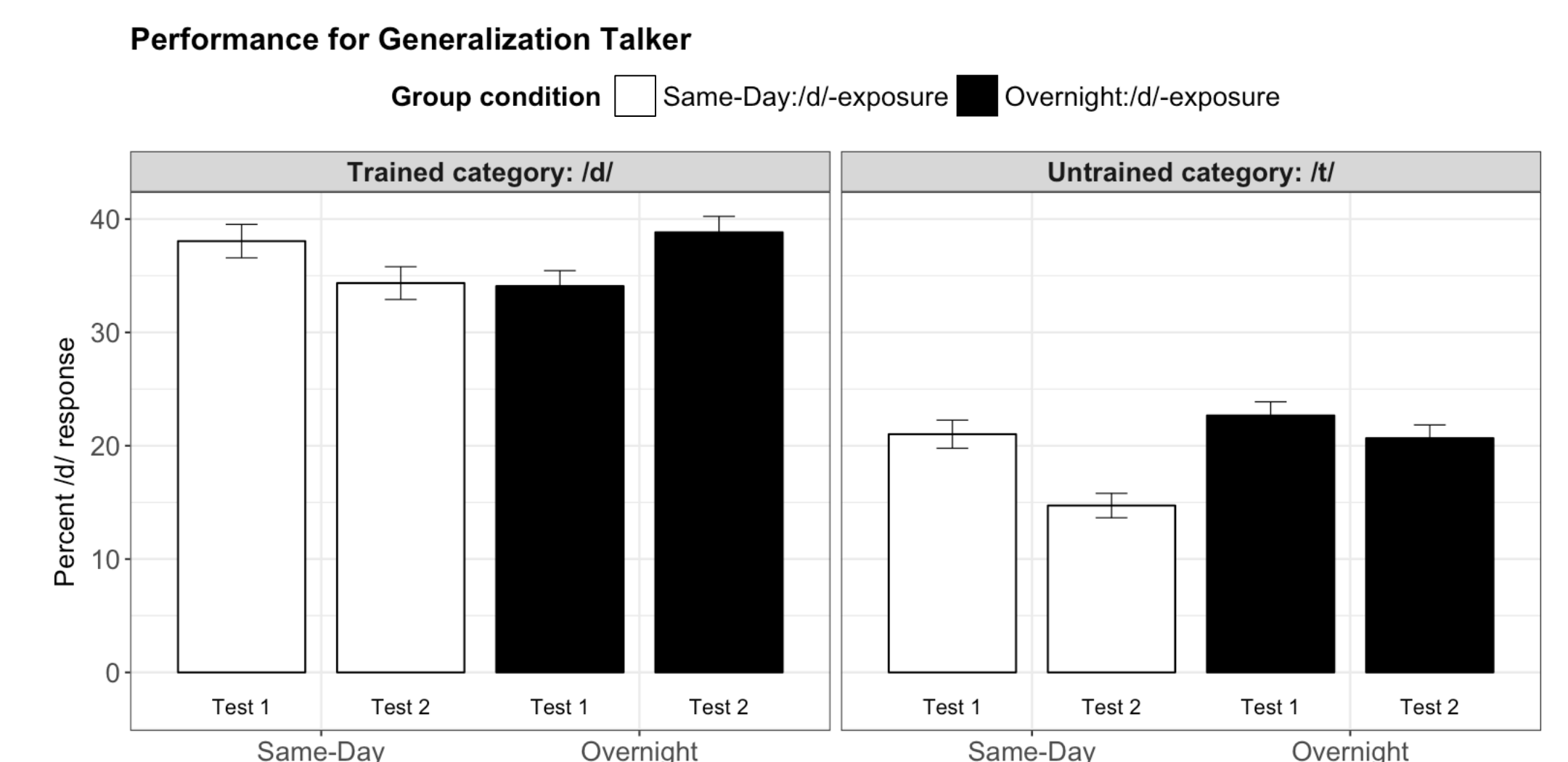
Exp2: Maintenance of Talker-Specific Adaptation and Generalization over 12 Hours: An Examination on the Role of Sleep (N = 38)



➤ Trained Talker:

Trained Category: no difference between *Same-Day* and *Overnight* groups ($\beta = -.11$, $SE = .11$, $p = .32$); *Immediate Test* group had more /d/ responses than *Same-Day* group ($\beta = .28$, $SE = .13$, $p < .05$), but did not differ from *Overnight* group ($\beta = .18$, $SE = .13$, $p = .15$).

Untrained Category: no difference between *Same-Day* and *Overnight* groups ($\beta = -.20$, $SE = .17$, $p = .24$). Neither group differed significantly from *Immediate Test* group ($ps > .10$).



➤ Generalization Talker:

Trained Category: Test Session X Group interaction ($\beta = .12$, $SE = .05$, $p = .01$).

Untrained Category: Main effect of Test Session ($\beta = .17$, $SE = .07$, $p < .05$) but no interaction ($\beta = .09$, $SE = .07$, $p = .21$).

Overnight group showed a weak advantage over Same-Day group with the trained talker, but had significantly better performance with the generalization talker for the trained category.

DISCUSSION

The Maintenance of Talker-Specific Adaptation

- **Sleep seems to modulate the retention of talker-specific adaptation:** compared to the /d/-exposure group in Exp1, both groups of listeners in Exp2 exhibited a memory decay with the trained talker over a 12-hour interval. Specifically, both had numerically lower accuracy for the trained category than the *Immediate Test* group, with the *Same-Day* group being affected to a greater extent than to the *Overnight* group.
- **Sleep thus might protect listeners from interfering speech input (e.g., native-accented speech).**

Generalization of Adaptation across Talkers

- **Sleep facilitates generalization of accent adaptation to a novel accented talker:** generalization was not observed in the immediate test (Exp.1); after a 12-hour interval, the *Overnight* group gained a perceptual advantage (increased categorization accuracy for the trained category) with the generalization talker over the *Same-Day* group.

➔ Taken together, sleep appears to facilitate perceptual learning of speech in two ways:

- improving access to previously encountered acoustic-phonetic features.
- storing salient acoustic-phonetic features abstracted away from the training experience, thereby facilitating perceptual encounters with unfamiliar talkers.

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