Word Learning by Adult Speakers of English: Does Practice Make Perfect?

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Background

- ***Practice Effect:*** When children are taught two sets of words sequentially, they learn the second set of words faster than the first set of words (Gershkoff-Stowe & Hahn, 2007).
- The practice effect is thought to occur because the first set of words primes the child's word learning system, facilitating learning of the second set of words.
- It is unclear whether the practice effect is observed in more advanced word learners (i.e., adults)
- It is unclear whether the practice effect is influenced by word characteristics.
  - ***Neighborhood density***: The number of words that are phonologically similar to a given word.
  - Neighborhood density influences word learning by children and adults such that high density words tend to be learned more rapidly than low density words (Hoover, Storkel, & Hogan, 2010; Storkel, Armbruster, & Hogan, 2006; Storkel & Lee, 2011)

Purpose

- Test for the practice effect in more advanced word learners (i.e., adult native speakers) and examine whether neighborhood density amplifies or dampens the practice effect.

Method: Participants

- Sixty-one college students participated for course credit or payment
  - Randomized to a sparse or dense stimulus condition (between-subjects)

	Sparse	Dense
Number	29	32
Age	*M* = 22 years *SD* = 3 years Range = 18-29 years	*M* = 22 years *SD* = 3 years Range = 18-31 years
Receptive Vocabulary Standard Score (PPVT-4)	*M* = 109 *SD* = 13 Range = 89-136	*M* = 115 *SD* = 12 Range = 88-140

Note: Differences between the groups were not statistically significant, all t (59) < 1.7, all p > 0.10.

Method: Stimuli

- Each participant was taught one set of words across two days and then a second set of words on a third day
  - Each set contained 12 words
- Set 1 and Set 2 words were phonologically related
  - Each word in Set 2 was a neighbor of a word in Set 1, sharing either
    - _VC (n = 4 words)
    - C_C (n = 4 words)
    - CV_ (n = 4 words)
- Between participants, words were either sparse or dense
- Novel objects were taken from Kroll and Potter (1984) with the same objects being used across sparse and dense words.

Sample Stimuli

Sparse Group (n = 29 participants)			Dense Group (n = 32 participants)	
Set 1 (n = 12 words)			**Set 1 (n = 12 words)**	
/veɪr/			/ðeɪl/	
/zis/			/zin/	
/fʊb/			/ʤæd/	
Set 2 (n=12 words: 4 of each type of neighbor)			**Set 2 (n=12 words: 4 of each type of neighbor)**	
/neɪr/		_VC	/ʃeɪl/	
/zoʊs/		C_C	/zeɪn/	
/fʊk/		CV_	/ʤæʃ/	

Characteristics of the Words

	Sparse: Set 1	Dense: Set 1
Phonotactic Probability: Segment Sum	0.10 (0.02)	0.11 (0.02)
Phonotactic Probability: Biphone Sum	0.002 (0.001)	0.003 (0.001)
Neighborhood Density	6 (1) 4-7	17 (2) 15-22
	Sparse: Set 2	**Dense: Set 2**
Phonotactic Probability: Segment Sum	0.11 (0.02)	0.11 (0.01)
Phonotactic Probability: Biphone Sum	0.002 (0.001)	0.003 (0.001)
Neighborhood Density	5 (2) 2-7	17 (2) 15-22

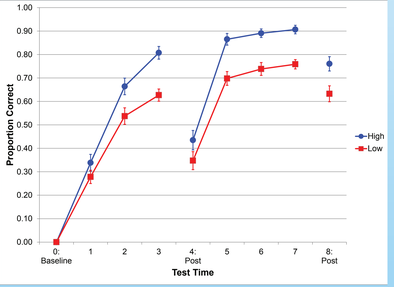
Note: Sparse and Dense do not differ significantly for segment sum, F (1, 44) = 0.33, p > 0.50, η_p^2 < .01; but do differ significantly for biphone sum, F (1, 44) = 11.57, p = 0.001, η_p^2 = .21, and neighborhood density (as intended), F (1, 44) = 503.38, p < 0.001, η_p^2 = .92.

Method: Procedures

- Training = 5 blocked exposures to the word and object in standard carrier phrases (e.g., This is a ___.)
- Testing = picture naming (i.e., see picture, say trained name)
  - Correct = 3 of 3 phonemes correct
  - Incorrect = all other productions
- During a training session, 3 cycles of training and testing were administered
  - **Day 1 = Set 1: Test 0 (baseline);** Training 1, **Test 1;** Training 2, **Test 2;** Training 3, **Test 3**
  - **Day 2 = Set 1: Test 4 (post);** Training 4, Test 5; Training 5, Test 6; Training 6, Test 7
  - Day 3 = Set 1: Test 8 (post)
  - **Day 3 = Set 2: Test 0 (baseline);** Training 1, **Test 1;** Training 2, **Test 2;** Training 3, **Test 3**
  - **Day 4 = Set 2: Test 4 (post);** Standardized Vocabulary Test (PPVT-4)
- Analysis
  - Examine all data points for Set 1 to replicate prior findings that dense words are learned better/more rapidly than sparse words
  - Compare equivalent test points (i.e., tests noted in red above) for Set 1 versus Set 2 to address the main research questions.

Results: Set 1

- 8 Test (within) x 2 Density (between) ANOVA
  - Significant effect of Test, F (7, 413) = 152.90, p < 0.001, η_p^2 = .72
  - Significant effect of Density, F (1, 59) = 18.06, p < 0.001, η_p^2 = .23
  - No interaction, F (7, 413) = 1.62, p > 0. 15, η_p^2 = .03

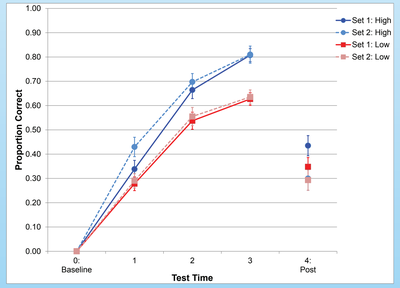


Results: Set 1 vs. Set 2

- 4 Test (within) x 2 Set (within) x 2 Density (between) ANOVA
  - Significant effect of Test, F (3, 177) = 188.37, p < 0.001, η_p^2 = .76
  - Significant effect of Density, F (1, 59) = 10.35, p = 0.002, η_p^2 = .15
  - Significant interactions of:
    - Test x Density, F (3, 177) = 3.83, p = 0.02, η_p^2 = .06
    - Test x Set, F (3, 177) = 10.35, p < 0.001, η_p^2 = .13

Unpacking Interactions with Test

	Effect of Density	Effect of Set
Test 1	***Dense > Sparse*** F (1, 59) = 5.36, p = 0.02, η_p^2 = .08	***Set 2 > Set 1*** F (1, 59) = 5.35, p = 0.02, η_p^2 = .08
Test 2	***Dense > Sparse*** F (1, 59) = 9.81, p = 0.003, η_p^2 = .14	***No Significant Effect*** F (1, 59) = 0.93, p = 0.34, η_p^2 = .02
Test 3	***Dense > Sparse*** F (1, 59) = 32.76, p < 0.001, η_p^2 = .36	***No Significant Effect*** F (1, 59) = 0.04, p = 0.85, η_p^2 < .01
Test 4 (Post)	***No Significant Effect*** F (1, 59) = 0.77, p = 0.38, η_p^2 = .01	***Set 1 > Set 2*** F (1, 59) = 9.75, p = 0.003, η_p^2 = .14



Summary & Discussion

- In Set 1 analysis, dense words were learned more rapidly/ accurately than sparse. Set 1 and 2 analysis generally shows this same pattern.
  - Replicates density effect observed in prior studies, which used a within-participant manipulation (Storkel, et al., 2006).
- Set 2 was more accurate than Set 1 at Test 1.
  - Replicates the practice effect observed in prior studies of children (Gershkoff-Stowe & Hahn, 2007)
  - Extends these findings by suggesting that the practice effect does occur in adults but is short lived
- Set 1 was more accurate than Set 2 at Test 4: Post.
  - Suggests that the initial practice effect is reversed when retention is tested
  - More recently learned Set 2 may be subject to competition/interference from the earlier learned Set 1.
- Overall pattern of the effect of set is consistent with recent models of word learning that separate learning from input versus memory consolidation for retention (Davis & Gaskell, 2009; Dumay & Gaskell, 2007; Gaskell & Dumay, 2003)
  - Set 1 facilitates learning from input for Set 2
  - Set 1 interferes with memory consolidation for retention for Set 2
- Density did not appear to amplify or dampen the effect of set.

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