Main Point
Fine phonetic detail is perceived and stored in memory. A few dozen exposures to the phonetic detail of overlong VOT affected perception of the voicing contrast. The effect did not pervade the lexicon (i.e., training did not generalize) but was sensitive to lexical status (word vs. non-word) and usage frequency (high vs. low). Results are incompatible with the traditional linguistic model but are easily accounted for in an exemplar-type, rich-memory language model, and are likely to have practical applications.

Background
Memory for language is affected by experience over a fairly short time frame of hours (Shookley et al 2004) or days (Goldinger 1996; Esiner & McQueen 2006).


Experiences or exposures add to memory representations (Pierrehumbert 2001), affecting language use, speech production, and speech perception.

Rich memory (or: exemplar, episodic, high- or rich-dimensional) account for facts mentioned above (see, Port & Levy 2005), but the traditional linguistic model fails.

Research Questions
1. Does modest exposure to words with lengthened VOT affect perception of VOT boundary?
2. If there is an exposure effect, a. does it generalize to similar forms or is it lexically restricted? b. are high- and low-frequency words affected differently?

Methods
Design and Procedure
Pretraining: 2AFC, word-ID test on 12 voicing continua (top pair in each cell in Table 1 below).
Training: participants in the Lengthened-VOT training group (n=10) heard the 12 target words with VOT 180% longer than natural; a control group (n=10) heard targets with VOT 80% of natural. Listen-and-repeat ordered phrases from 600-word story four times on each of five training days.
Posttraining: same as pretraining, plus 12 similar continua (bottom rows or words in matrices below).

Comparison to test for... in Figure
a. pretraining vs. posttraining training effect 1, 2
b. test words vs. new words generalizability 1
b. high vs. low-frequency frequency bias 3
d. word vs. non-word lexical bias 3

Stimuli
One man and one woman (both 25 yrs old) naturally produced the training story and voicing continua endpoints. Target VOT was then lengthened to 180% of the natural VOT or shortened to 80% of the natural VOT. The lengthened-VOT training group were exposes to the overlong targets and the control group to the slightly shorter targets, but otherwise received identical stimulus.

Participants
13 women, average 25.3 years old
7 men, average 31.4 years old
Monolingual American English talkers, normal hearing and vision, no speech or language deficits, all right-handed.

Materials
The training story (~600 words) contained each target word twice:...so they decided to go down from their hill...to a neighboring city...to dine humbly at a local pub...and yet dye to try some of the local for their project...

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Phonetic experience with specific words affects categorical perception of those words
Mark VanDam1 & Robert F. Port2
1Boys Town National Research Hospital, Infant Development Lab
2Indiana University, Department of Linguistics
markvandm@boystown.org  www.VanDamMark.com
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Results

Conclusions
1. Fine phonetic detail a. is easily, quickly trained (~40 exposures)
   b. can be lexically specific (i.e., does not generalize)
   c. can be sensitive to usage-frequency
   d. is used differently in various linguistic conditions:
      i. non-word categorization bias (anti-Ganong)
      ii. important for voiced series but not voiceless
      iii. shift in the direction of training (i.e., longer)
      iv. the lack of difference in the generalization condition (checkered bars) suggests the effect did not pervade the lexicon.

2. Rich-memory models account for the present results but the traditional language model does not.

3. A better understanding of the plasticity of perceptual categories may have implications for clinical or rehabilitative applications (hearing impairment, stroke, SLI), language acquisition (native or L2), language learning (educational testing standards, artificial intelligence, automatic speech recognition), language change (rate or location of change, dialect research), methodological design (rate and number of exposures required), and improving language models (testing or verifying assumptions, claims, and hypotheses).