Learning a novel accent: Implicit acquisition of phonological alternations

Several researchers have used artificial language-learning paradigms to study the acquisition of phonological alternations in adults. Although these paradigms allow us to examine topics such as the role of phonetic naturalness in phonological acquisition, they have the drawback that learning is rather explicit (Schane et al. 1974; Pycha et al. 2003; Peperkamp et al. 2006). That is, participants in these experiments are actively trying to learn a novel rule; they are hence engaged in a problem solving task, the mechanisms of which might be quite different from those at work during first language acquisition.

In this talk, we report on three experiments in which rule learning is quite *implicit*. In a paradigm similar to the one used by Maye et al. (2008) to study perceptual adaptation, adult participants listened to 'accented speech', that is, to their native language equipped with a novel phonological alternation. For instance, we exposed French participants to a novel French 'accent' in which front vowels harmonize for the feature rounding. Harmony is progressive; some examples are shown in (1).

(1)	French	accented French
purée	[pyʁ**e**]	[pyʁ**ø**]
liqueur	[lik**œ**ʁ]	[lik**ɛ**ʁ]

During exposure, participants listened to short stories in accented French for about 40 minutes. In order to make sure that they concentrated on the stories, each story was followed by comprehension questions.

We used a forced-choice grammaticality task to test whether participants had learned the novel rule. Thus, participants heard pairs of French non-words, one of which was a word in the harmony variety to which they had been exposed (harmonized item, e.g. [lik**ɛ**ʁ]), and the other one a matched word in a hypothetical disharmony variety (disharmonized item, e.g. [pyd**ɛ**ʁ], cf. French *pudeur* [pyd**œ**ʁ] 'modesty'). The task was to indicate which of the two items was a word in the accented variety they had listened to. We found that participants chose the harmonized items significantly more often than predicted by chance both for items known from the exposure stories and for novel items, suggesting that they had learned the alternation and generalized it across the lexicon.

A second group of participants was exposed to the same stories read with a different 'accent', that is, front vowels disharmonizing in rounding, an alternation that is less common and less phonetically natural than vowel harmony since it does not involve feature spreading. Thus the second experiment can also inform us whether feature spreading alternations are easier to learn than others, as phonological theories emphasizing the phonetic grounding of alternations (e.g. Donegan et al. 1979; Archangeli & Pulleyblank 1994) would predict.

Participants showed the opposite response pattern to the one in the first experiment, that is, they chose the disharmonized items more often than chance both for exposure and novel items. This result proves that their test responses are really due to learning during exposure, not to a priori preferences. Since their performance was not worse than in Experiment 1, we can also conclude that feature spreading did not influence the acquisition of these vowel rounding alternations.

The latter finding led us to explore what it is precisely that participants learn in our paradigm in a third experiment. It was designed to find out whether participants learn alternations that apply to several sound pairs, as for instance vowel harmony in Experiment 1, as separate correspondences for each sound pair which apply in the same context by chance, as in (2).

(2a) [i] alternates with [y] after **rounded** vowels, and vice versa after **unrounded** vowels.

(2b) [e] alternates with [ø] after **rounded** vowels, and vice versa after **unrounded** vowels.

(2c) [ɛ] alternates with [œ] after **rounded** vowels, and vice versa after **unrounded** vowels.

Alternatively, participants could learn vowel alternation as most phonologists would describe it, that is, as a broader regularity applying to groups of sounds in the same phonological context, as in (3).

(3) Unrounded front vowels ([i],[e],[ɛ]) alternate with corresponding rounded vowels ([y],[ø],[œ]) after rounded vowels, and vice versa after unrounded vowels.

Some experiments have already shown that alternations applying to natural classes of sounds are easier to learn than alternations applying to arbitrary sound groupings (Saffran & Thiessen, 2003; Cristià & Seidl, 2008), and that newly learned alternations are transferred to novel members of a natural class (Finley & Badeker, in press), indicating that some generalization across alternating sound pairs takes place during the acquisition of phonological alternations. We set out to test whether the coherence of the context also plays a role in Experiment 3, by splitting the natural class of front vowels in two and having high vowels disharmonize, as shown in (4a), and non-high vowels harmonize, as shown in (4b) and (4c).

(4a) [i] alternates with [y] after **unrounded** vowels, and vice versa after **rounded** vowels.

(4b) [e] alternates with [ø] after **rounded** vowels, and vice versa after **unrounded** vowels.

(4c) [ɛ] alternates with [œ] after **rounded** vowels, and vice versa after **unrounded** vowels.

Participants' test phase performances in the third experiment were above chance level for exposure items, but at chance for novel items, suggesting that they were merely remembering individual words from exposure but not generalizing the alternation pattern. The fact that they performed worse than participants in the two previous experiments suggests that context coherence is important when learning phonological alternations, and that the latter are not learned for each sound pair separately, but as broader regularities applying to groups of sounds.

To sum up, our results thus show that it is possible to learn novel phonological alternation during passive listening. Feature spreading does not seem to play a role in this process, but the coherence of phonological context does, and our study provides evidence that alternations are not learned on a sound-by-sound basis, but as broader phonological regularities applying to groups of sounds.

References

Archangeli, D., & Pulleybank, D. (1994). *Grounded Phonology*. Cambridge: MIT Press.

Cristià, A., & Seidl, A. (2008). Is infants' learning of sound patterns constrained by phonological features? *Language Learning and Development, 4*(3), 203-227.

Donegan, P., Stampe, D., & Dinnsen, D. (1979). The Study of Natural Phonology. In *Current Approaches to Phonological Theory* (pp. 126 -173). Bloomington: Indiana University Press.

Maye, J., Aslin, R., & Tanenhaus, M. (2008). The Weckud Wetch of the Wast: Lexical adaptation to a novel accent. *Cognitive Science, 32,* 543-562.

Peperkamp, S., Skoruppa, K., & Dupoux, E. (2006). The Role of Phonetic Naturalness in Phonological Acquisition. In D. Bamman, T. Magnitskaia & C. Zaller (Eds.), *Proceedings of the 30th Annual Boston University Conference on Language Development*. Somerville, MA: Cascadilla Press.

Pycha, A., Nowak, P., Shin, E., & Shosted, R. (2003). Phonological rule-learning and its implications for a theory of vowel harmony. In G. Garding & M. Tsujimura (Eds.), *Proceedings of WCCFL 22* (pp. 423-435). Somerville: Cascadilla Press.

Saffran, J. R., & Thiessen, E. D. (2003). Pattern Induction by Infant Language Learners. *Developmental Psychology, 39*(3), 484-494.

Schane, S. A., Tranel, B., & Lane, H. (1974). On the psychological reality of a natural rule of syllable structure. *Cognition, 3-4.*