

Learning underlying forms: Evidence from child perception and production

Most current work on the acquisition and learnability of phonology has been devoted to understanding of how learners arrive at the target ranking of constraints, i.e. grammars. It is less well understood how learners determine the exact content of underlying forms. Yet, this is important because underlying forms and constraint ranking are dependent on each other. Moreover, the lexicon and constraint ranking need to be learned in tandem.

In this paper we address the nature of phonological representations in children's mental lexicons. The starting point of this research is based on the investigation of *production* data from Levelt (1994) and Fikkert & Levelt (2004), who argued that children's representations start out holistic, and become segmentalized and phonologically specified in the course of development. In the early stages, vowels play a dominant role in determining the place of articulation (POA) representation of entire words. Words tend to be either completely labial, or completely coronal, determined by the POA of the vowel. If children were to learn words like *bon* and *don* in this early phase, these words would initially have a holistic labial specification, due to their labial vowel. Coronal is assumed to be the unmarked, default POA, hence unspecified in the lexical representation. Words like *din* and *bin*, with a coronal vowel, would therefore be unspecified for POA.

These claims make predictions for early word *perception*. If certain features are unspecified, asymmetry in behavior is expected to show up in word recognition as well - perceived features can never mismatch or conflict with features that are absent in the underlying representation (Lahiri & Reetz 2002). That is, there are no faithfulness violations. Perception may be accurate, but the mapping of perceived features to lexical representations will depend on children's underlying representation.

To test these claims, previous research by Werker et al. (1997, 2001, 2004) was replicated and extended for Dutch. Werker and colleagues showed that 14-month-olds Canadian infants do not perceive the /b/-/d/ contrast in the pair of nonce words *bin-din* in a word learning task. Yet, they can perceive the contrast between *bin-din* in a pure discrimination task, and they are also able to perceive the same contrast with a pair of well-known words *ball-doll*. Based on those results, they argue that children do not always use phonetic detail in word recognition; that discrimination is a process distinct from word recognition, and that phonetic detail in word recognition comes with experience and can be used for well-known words. While they account for the asymmetry between *bin-din* and *ball-doll* based on non-word versus real-word status, note that the vowels in these word pairs also have different POA features.

In our experiments we tested two pairs of nonce words *bin-din* (Exp. 1) and *bon-don* (Exp.2) in a word-learning task. In addition, we tested children's behavior on *bin-din* in a pure discrimination task (Exp. 3). Results from Exp. 1 showed that in the case of *bin-din*, Dutch 14-month-old children do not perceive the contrast in a word learning task, just like the Canadian children. However, in the same word learning task, the contrast between the pair *bon-don* of Exp. 2, was perceived. Experiment 3 showed that the 14-month-old children were also able to perceive the difference between *bin-din* in the pure discrimination task.

We argue that the difference between the results of *bin-din* and *bon-don* in the word-learning task is due to children's underlying representation of the perceived words: both words of the *bin-din* pair are stored as (underspecified) [coronal], and both words in *bon-don* are stored as specified [labial]. In *bin-din*, neither the 'b' or 'd' mismatches with coronal representation of the word (from the vowel), since coronal is unspecified in the lexicon. Dutch 14-month-olds do not perceive this contrast in the word learning task (Exp. 1). In *bon-don*, hearing the coronal 'd' in *don*, mismatches with the labial representation of the word. Children can then perceive this contrast in a word-learning task (Exp. 2). Therefore, the asymmetry is seen in infants' perception of *bin-din* versus *bon-don*. The results confirm the hypothesis that children's phonological representations are initially underspecified and holistic. Moreover, they show that the coronal/labial asymmetry also plays a role in word recognition, supporting the hypothesis that coronal is not specified in the lexical representation.