

The sources of phonological knowledge: A cross-linguistic perspective

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Abstract

Early word production profiles for children learning different languages reflect both similarities and differences. Experimental evidence of a link between speech perception and vocal production supports the idea that a match between the child's own babbling forms and input speech is the source of the constrained but relatively accurate first word forms, a point of similarity across language groups. Measurements of the duration of medial consonants in adult speech and in the early words of children exposed to languages differing in their phonetic and/or phonological treatment of consonantal length make it possible to distinguish between (1) direct learning of distributional frequencies and (2) lexical learning, which alone can account for the emergence of language-specific phonological contrasts and cross-linguistic differences in phonological patterning. It is argued that complementary implicit and explicit memory systems are sufficient to account for both of these kinds of learning, affecting the initial registering and later retrieval of phonological patterns and the establishment of lexical representations as well as the development of motoric routines and the matching of those routines to input speech. These learning mechanisms are thus able to account for the construction of phonological knowledge, given adequate exposure to an ambient language, with no need to posit innate linguistic knowledge or Universal Grammar.

Key-words : Cross-linguistic studies, Implicit and explicit learning (phonology vs. lexicon), Word templates

Résumé

Les données expérimentales, obtenues pour des enfants apprenant des langues cibles différentes, se caractérisent par des similitudes et des différences. Elles montrent également une continuité entre la perception de la parole et les premières vocalisations. Ceci invite à considérer que la mise en relation précoce entre les formes du babillage et les formes des mots entendus est à la base des premières unités produites qui au départ sont structurellement très limitées mais relativement correctes. C'est cette conception que nous retenons pour rendre compte aussi bien des similarités que des différences dans la forme des premiers mots produits pour des langues cibles différentes. Des mesures de la durée de consonnes médiales dans la parole adulte et dans les mots des enfants dans des langues où la longueur consonantique a une valeur phonologique vs. phonétique différente permettent d'établir que la mise en place des représentations phonologiques repose sur (1) l'apprentissage direct de fréquences de distribution et (2) l'apprentissage du lexique, qui suffit à expliquer le développement des contrastes phonologiques pertinents pour chaque langue-cible. Selon nous, les systèmes complémentaires de mémoire implicite et explicite permettent de rendre compte des deux types d'apprentissage. Nous défendons donc le point de vue selon lequel une exposition régulière à l'environnement linguistique suffit pour expliquer la

construction de la connaissance phonologique sans avoir recours à une connaissance linguistique innée ni de la Grammaire Universelle.

Mots-clés : Approche typologique, comparaison inter-langues, Apprentissage implicite et explicite (phonologie vs. lexique), Gabarits lexicaux

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1. Introduction

A central concern of the study of child language is to account for the developmental source of linguistic knowledge. In one influential approach to this problem innately given Universal Grammar (or UG) is assumed to provide the knowledge of linguistic structure that serves as the starting point for language acquisition, leading to the basic question, WHAT EXACTLY NEEDS TO BE LEARNED ? (Peperkamp, 2003). This must then be followed by the question of the nature of the triggering process needed to establish the specifics of a

given language : HOW DOES THE CHILD RECOGNIZE THE CRITICAL DATA THAT WILL MAKE IT POSSIBLE TO SET THE APPROPRIATE PARAMETERS, OR TO RERANK CONSTRAINTS IN THE APPROPRIATE WAY ? For approaches that deny the existence of UG the questions are the converse : WITH WHAT KNOWLEDGE, IF ANY, DOES THE CHILD BEGIN ? , followed by the complementary question, HOW CAN THE CHILD GAIN KNOWLEDGE OF LINGUISTIC STRUCTURE OR SYSTEM ? The phonological side of this problem is often given short shrift by researchers interested in word learning (e.g., Bloom, 2000 ; Golinkoff, 2000). Yet before a child can begin to develop linguistic meaning he or she must first be able to represent and access word forms or phrases, which can then come to be associated with recurrent situations, objects or events.

The field of phonological development is presently able to draw on at least two different lines of empirical research : (1) production studies, based on diary entries and/or regular recordings of individual children or small groups, sometimes supplemented by acoustic analysis ; (2) experimental studies of larger groups of infants' perceptual responses to speech. An important additional benefit of recent work in both perception and production has been the expansion from a heavily anglocentric field to the collection of data from a wider range of languages. This paper will draw on both of these sources of evidence, based on data from four languages, in attempting to provide answers to three broad questions:

1. How similar is phonological development cross-linguistically and across individuals learning the same language ? Early word production profiles for 11 children each learning one of four different languages will provide a basis for us to identify both similarities and differences.
2. When does a link between speech perception and vocal production emerge, if it is not there to begin with ? We will consider evidence for the formation of such a link toward the end of the first year, or in the period immediately preceding first word production.
3. What learning mechanism(s) could account for both ambient language differences and individual differences among children acquiring the same language ? The idea of complementary memory systems underlying implicit and explicit learning (McClelland, McNaughton & O'Reilly, 1995 ; Ellis, 2005) is now sufficiently well supported by both neuroscientific and modelling studies to suggest that (a) both memory systems must inform early word learning and (b) these systems are sufficient to account for the construction of phonological knowledge, given adequate exposure to an ambient language.

2. Early words and templates

Despite Jakobson's well-known view (1941/68) to the effect that the babbling sounds produced in the prelinguistic period are wholly unrelated to the speech sounds found in early word forms, continuity between babbling and speech has

been firmly established for many years now. Studies bringing clear empirical evidence to bear on the question have involved both the general patterning of babble in relation to early word production (Oller, Wieman, Doyle & Ross, 1976) and the particular babbling of individual children in relation to their own first word forms (Vihman, Macken, Miller, Simmons & Miller, 1985) ; more recently first signed words have also been found to be rooted in prelinguistic gesture (Cheek, Cormier, Repp & Meier, 2001).

Yet the implications of continuity have received relatively little attention : If the patterns found in first words are foreshadowed in babbling, then when and how does phonology begin ? In recent work within the Optimality Theory (OT) framework ‘the initial state’ virtually always receives some mention (e.g., in all but two of the chapters in Kager, Pater & Zonnefeld, 2004), yet no definition of what the expression ‘the initial state’ actually means in developmental or lexical terms is typically provided – although Menn (2004) notes that “even at the time they are producing their very first words, children cannot be said to be in an ‘initial state’ with respect to acquiring phonology” (p. 61). Menn bases her conclusion on the ample evidence of the influence of ambient language production values on infant production of vowels and accentual patterns already in the prelinguistic period (Boysson-Bardies, Hallé, Sagart & Durand, 1989; Levitt & Wang, 1991); experience of the ambient language distributional frequency of within-repertoire consonants (labials and alveolars, stops and

nasals) also affects infant production within the first year (Boysson-Bardies & Vihman, 1991).

In the OT framework universal markedness and faithfulness constraints are together taken to constitute a phonological system, with a particular ranking being required by each language. Given the logic of OT, current formalist approaches to phonological development assume with some consistency that learning can only be accounted for by assuming that markedness constraints are all ranked above faithfulness constraints “in the initial state”; additionally, the course of development can only be modelled by positing that markedness constraints are gradually reranked below faithfulness constraints if and only if exposure to the input language provides evidence for such a ranking. This developmental sequence will necessarily result in a relatively linear progression, much as Stampe (1968, 1971) and Smith (1973) proposed many years ago.

The difficulty is that longitudinal study of one or more individual children generally fails to reveal such a linear course of development or learning. Instead, as observed thirty years ago in an analysis of the early words of three children acquiring English (Ferguson & Farwell, 1975), such studies consistently show that relatively accurate first word forms are followed, in a period of more prolific production, by an overall regression in accuracy

accompanied by an increase in systematicity or inner coherence among the child's own forms.

Table 1 provides some examples of such non-linear developmental sequences, drawing on the first recorded words of three children each learning English, Finnish and French and two learning Welsh as well as a subset of the later words of each of those children, drawn from the point at which each of them had a cumulative lexicon of some 50 words or more.ⁱ Under 'early words' are listed ALL of the words recorded in the first one or two sessions in which the child spontaneously produced 3 to 4 identifiable words (excluding onomatopoeia, which were included in the count establishing the 4-WORD-POINT (4wp), however). In the columns to the right of the early words are presented a subset of the words produced a few months later, at the 25-WORD-POINT session, divided into those that were 'selected', meaning that the target word attempted roughly matches the pattern that the child produces, and those that were 'adapted', meaning that the target word has been adapted to fit the child's pattern. The pattern itself can be seen as a TEMPLATE that emerges as the product of word learning and which may differ for each child ; we schematize the template, which applies to both selected and adapted later words, in angle brackets. A brief characterisation of the adaptation observed for each of the word forms is noted in the last column on the right.