Fine-grained phonetics and developmental universals for glottal features

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Résumé: L'universelle de langage Jakobsonien le plus justifié c'est que les occlusives sont réalisées initialement comme non-aspirées sourdes. Alors que cette généralisation soit vraie dans plusieurs langues, elle néanmoins depend des descriptions phonétiques détaillées. Nous examinons les incidences pour l'universelle 'developmental' des études qui documentent des différences phonétiques même plus détaillées à travers des langues qui ont soidisant des catégories phonétiques identiques.

One the most influential ideas to shape modern phonology is Jakobson's (1941/1968) proposal that there are "laws of irreversible solidarity" (implicational universals) that shape the relative order of mastery of different sounds in acquistion in the same way that they constrain the phoneme inventories of adult grammars. Among the best substantiated of his implicational universals was the idea that "so long as stops in child language are not split according to the behavior of the glottis, they are generally produced as voiceless and unaspirated." This claim has been borne out in studies of many languages. These studies further show that voiceless aspirated stops are mastered around two years of age in languages such as English (Macken & Barton, 1980), Cantonese (Clumeck et al., 1981), and Thai (Gandour et al., 1986), and that voiced stops are mastered much later in languages such as French (Allen, 1985), Thai (Gandour et al., 1986), and Hindi (Davis, 1995). As Macken (1980), among others, has pointed out, these generalizations depend on a detailed phonetic characterization of the contrast. If the English contrast is characterized as "voiced" /b, d, ɣ/ versus "voiceless" /p, t, k/, the voiced stops are mastered first, and English becomes an exception. Thus, the developmental universal is a "phonetic" one rather than a purely structural one.

In this study, we explore the implications for the developmental universal of more recent studies documenting much finer-grained phonetic differences across languages having purportedly identical phonetic categories. Fig. 1 illustrates the differences with histograms of voice onset time (VOT) values in adult productions of velar stops in four languages: /k/ vs /k^h/ in Cantonese and English and /ɣ/ vs /k/ in Japanese and Greek. As the figure shows, the Japanese voiceless stops are different from both the aspirated and the unaspirated stops of English and Cantonese in using an intermediate value between short lag and long lag on the VOT continuum. Also, while all the Greek voiced stops in Fig. 1 are realized with voicing lead (negative VOT values), these stops have developed relatively recently from clusters of nasal followed by voiceless stop, and many speakers still produce them as clusters or as pre-nasalized stops in at least some prosodic environments (Arvaniti & Joseph 2000).

Fig. 2 shows some of the results of an experiment in which we used pictures and an accompanying audio prompt to elicit repetitions of words beginning with lingual plosives from 2- and 3- year-old children who are acquiring Cantonese, English, Greek or Japanese (at least 20 children per language). There are two noteworthy aspects of the figure. First, these young Japanese children already show the language-specific pattern of intermediate VOT values for the voiceless category. Second, these young Greek children have already acquired the "voiced" stops of their language, producing them with a robustly negative VOT. Truly voiced stops are difficult to produce because of the aerodynamic conflict between the oral air pressure buildup necessary for a strong stop release and the transglottal air pressure drop necessary to sustain voicing. We suspect that Greek children are venting oral air pressure by producing more or less pre-nasalized variants (some degree of naso-pharyngeal opening) to side-step the aerodynamic difficulties that children must overcome in order to master the voiced stops of French, Thai, or Hindi. These observations call for further investigation of the fine-grained phonetic details of the contrasting phonation types across the four languages, suggesting that we need other measures besides VOT that might let us gauge whether there is a subtle leaking of the air through the nose in the Greek voiced category and that also might let us better characterize the distinction between the Japanese voiceless and voiced categories. Our study will describe further results of these acoustic measures, extending to other places and manners.

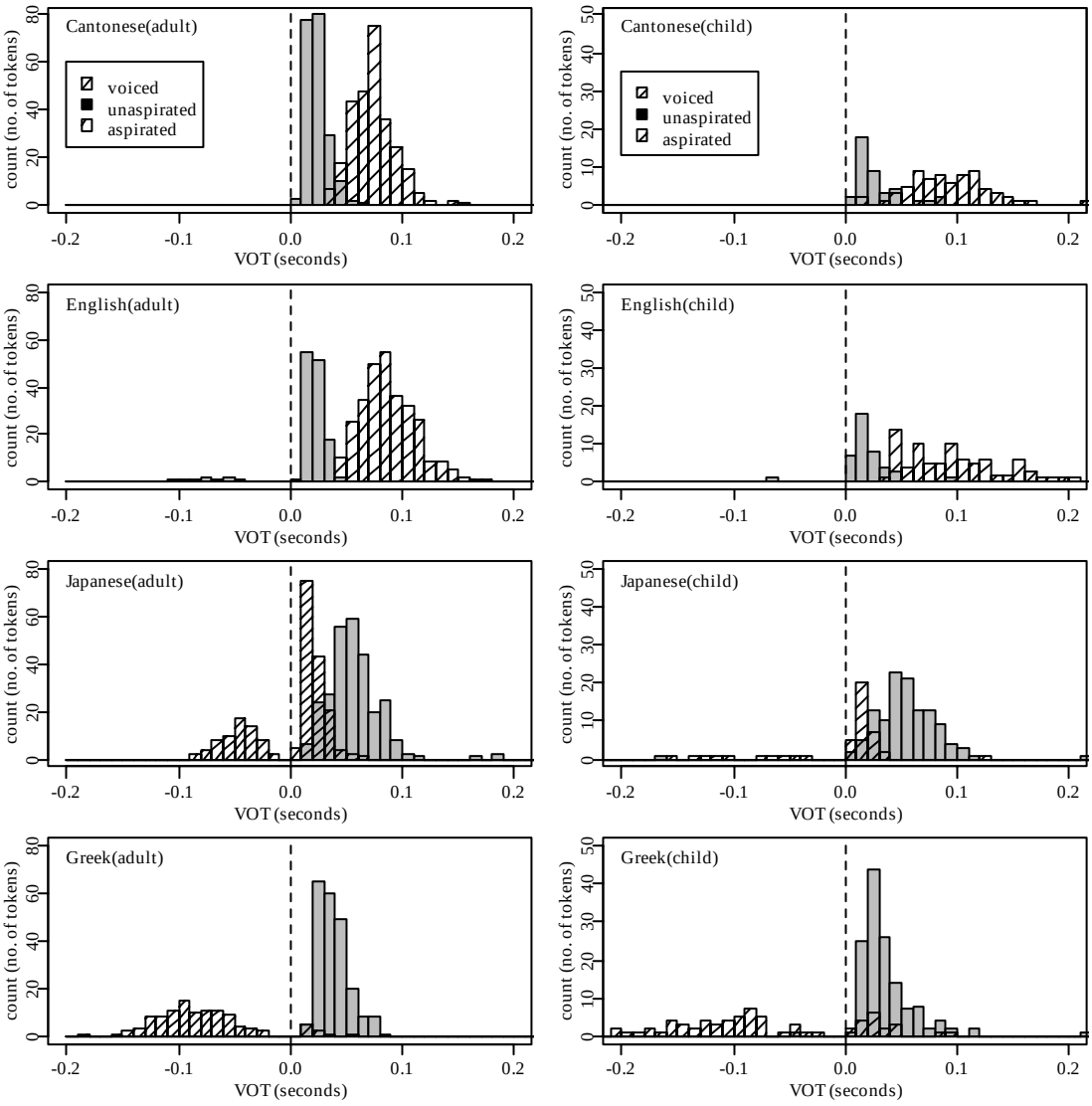

Figure 1: VOT values for velar stops (adults). Figure 2: VOT values for velar stops(children).

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