Tara McAllister Byun (New York University)
& Sharon Inkelas (University of California, Berkeley)

Poster Session II
Saturday 4:00 - 5:45

Child consonant harmony and phonologization of performance errors

Although many phonological patterns found in child speech have analogues in adult languages around the world, other common child processes have been found to be entirely without counterparts in adult typology. Developmental consonant harmony (CH) is one of the most frequently cited examples of this category. While adult phonologies also permit long-distance patterns of consonant agreement, the child pattern is unique in allowing assimilation with respect to major place of articulation. Examples of child CH are provided in (1). The parameters of CH, including the direction of assimilation and the participating features, are subject to considerable variation within and across children. However, Pater (2002, p. 364) proposed that several implicational generalizations can be identified regarding the preferred target, trigger, and directionality of CH in English-speaking children; these are repeated in (2).

1) Consonant harmony (Pater, 2002):
   a. Regressive assimilation: Velar or labial trigger, coronal or labial undergoer
      tickle [gɪːguː] bug [gʌg] top [pap]
   b. Progressive assimilation: Velar or labial trigger, coronal or labial undergoer
      coat [kok] cup [kʌk] bed [bɛːp˺]
2) Target/Undergoer: Non-coronal implies coronal
   Trigger: Labial implies velar
   Direction: Progressive implies regressive

The existing literature provides numerous accounts of child CH (e.g. Pater, 1997, 2002; Pater & Werle, 2003, Goad, 2004; Becker & Tessier, 2011). These models succeed in capturing most or all of the properties identified in (2). However, all accounts have found it necessary to assume some qualitative difference between child and adult phonologies, typically in the form of child-specific constraints absent from the adult inventory (Pater, 1997; Becker & Tessier, 2011). We concur that some such differences will be necessary for a satisfactory model of child CH, but we contend that a complete account will also address *why* child and adult grammars differ in this way, and *how* child-specific constraints are eliminated in the course of maturation. Pater (1997) and Becker & Tessier (2011) suggest that the child-specific constraint driving CH is a reflection of articulatory or motor planning limitations specific to immature speakers. We will use a mechanism for phonologization of performance errors (McAllister Byun, Inkelas, & Rose, 2012) to expand on this insight and incorporate it into a more articulated model of child phonology.

Previous work on adult CH has made note of striking parallels between CH and patterns of assimilation in adult speech errors, e.g. *sunshine* → [ʃʌnʃaɪn] (Hansson, 2001). Hansson suggested that adult CH might be a phonologized reflex of the processing and/or motor planning pressures that give rise to speech errors. To date, models of child CH have made limited use of this possibility. However, all of the implicational relations that Pater (2002) identified in child CH also hold true in adult speech errors:

(1) <u>Preference for coronal targets</u>: Pouplier (2008) demonstrated that a large percentage of speech errors that are perceived as categorical substitutions actually involve simultaneous production of intrusive and target gestures. Further, Pouplier & Goldstein (2005) showed that intrusive errors have asymmetrical perceptual consequences, such that coronal targets with intrusive velar gestures are perceived to have velar place, while intrusive coronal gestures during a velar target typically remain undetected. A similar perceptual predominance of labial over coronal place was documented by Byrd (1992). These asymmetries could explain the tendency of coronals to assimilate to velars/labials, and not vice versa.

(2) <u>Preference for velar triggers</u>: Speech sounds that have multiple phonological properties in common are more likely to interact in speech errors (Hansson, 2001). The observation that coronal-to-velar assimilation is more persistent than coronal-to-labial or labial-to-velar assimilation in child CH can be understood as a reflection of this influence of similarity on assimilation: the pressure for assimilation is greater between two lingual consonants than between targets that do not share a major articulator.

(3) <u>Regressive bias</u>: The great majority of adult speech errors are anticipatory in nature, i.e. an earlier segment assimilates to a later one (Hansson, 2001). With their limited motor planning capacities, children may have particular difficulty activating just one gesture while inhibiting those needed later in the utter-

ance. This bias could explain the preferred regressive directionality of CH.

Speech errors have a low frequency of occurrence in adult speech, but in the context of children's more limited motor planning skill, the error rate is much higher. In this talk, we develop the hypothesis that child CH originates as a frequently recurring performance error that becomes phonologized, i.e. becomes a systematic component of the child's grammar. Focusing on positional velar fronting, McAllister Byun et al. (2012) proposed a mechanism by which children's performance errors, driven especially by their speech-motor limitations, can take on grammatical status on an intrinsically transient basis. Following Tessier (2012), Becker & Tessier (2011), and the broader literature on exemplar theory, they posited that speakers store information about their own past productions, including error forms. More specifically, they proposed that speakers unconsciously compile statistics about the frequency of occurrence of phonetic performance errors in their own attempts to produce specific sounds or sequences. This tacit knowledge forms a module termed the A(rticulatory)-map, analogous to Steriade's (2001) P(erceptual)-map. McAllister Byun et al. proposed an accompanying constraint RECYCLE: "Penalize any output whose probability of incurring a performance error is greater than that of the stored previous form," where the stored previous form is an average across the child's previous phonetic realizations of the target. If a child's attempts to match an adult target result in frequent performance errors such as harmonized forms, he/she must negotiate a balance between the pressure to match the adult target (expressed by faithfulness constraints) and the pressure to avoid performance failure (expressed by RECYCLE). The magnitude of the RECYCLE violation is proposed to be proportional to the difference in the probability of a performance error, encoded in the A-map, between a given candidate and the stored previous form. Crucially, as the child's speech-motor capacity increases, the likelihood of performance errors will decrease. As the values in the A-map are continuously updated to reflect the child's expanding articulatory skill, the pressure to recycle stored previous forms is naturally reduced. Thus, the A-map and RECYCLE offer a principled account of how child-specific patterns such as CH could arise from performance limitations, and how these patterns might naturally be eliminated in the course of physical maturation. This model preserves the continuity hypothesis in that child and adult grammars (linguistic competence) contain the same substance; the most striking differences in behavior result from the A-map, which is closely tied to performance factors.

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