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Reviews

Daniel A. Dinnsen and Judith A. Gierut (eds.) (2008). *Optimality theory, phonological acquisition and disorders*. (Advances in Optimality Theory.) London & Oakville, Conn.: Equinox Publishing. Pp. xiii + 513.

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This collection of articles presents a range of results achieved by the editors and their colleagues at the Indiana University Learnability Project, including former students in that programme. The work has cumulatively produced, and benefits from, a large database of phonological disorders in 279 children aged 3 to 7. In addition to Dinnsen and Gierut, there are five other contributors; all but one chapter includes at least one editor as sole or co-author. Consequently, the editors are also the main authors of the volume. Two guiding principles are that 'anomalies in language development actually help to delineate the basic principles and properties of linguistic systems' (p. 38), and that 'optimality theory offers a principled explanation for the effects' observed in treatment (p. 24). (The name of the theory (henceforth OT) is not capitalised, contrary to general practice in the field.) The longitudinal data for children before and after treatment for their phonological disorders provide particularly valuable points of comparison for constraint reranking in OT.

The book begins with three chapters of background material (Part I), intended to make the remaining articles accessible to a wide range of readers. Dinnsen's 'Fundamentals of optimality theory' (pp. 3–36) provides a good overview of the technical aspects of this theory; the examples are all drawn from the disordered speech that constitutes the focus of the book, and therefore provides some useful background even for those already acquainted with OT. Gierut's 'Phonological disorders and the Developmental Phonology Archive' (pp. 37–92) explains the nature of the disorders studied in the book, as well as the extensive data at the Learnability Project on which the analyses are based; it includes very detailed lists of words used to probe for disordered pronunciations, and classification of deviations from the adult target form. The final background chapter, Gierut's 'Fundamentals of experimental design and treatment' (pp. 93–118), lays out the sorts of experiments used to investigate disorders and their remedies, and includes details about the protocols of the project. These two chapters are useful for readers with limited experimental background, as well as those wishing to know the specific practices of the lab.

Following this substantial introduction – it occupies over a hundred pages – are three sections (Parts II–IV) that focus on particular issues in phonological acquisition, and the ways in which OT can help us to understand them. Part II contains three papers on opacity in child phonologies, interesting because it differs from the common case of child speech simply being less marked than the adult target. A famous example is the chain shift in which *puzzle* is heard as

/pʌdl/, but *puddle* is /pʌgl/ (Smith 1973); in ordered-rule terms, the stopping /z/ → /d/ must follow (and counterfeed) the velarisation /d/ → /g/. Dinnsen's 'A typology of opacity effects in acquisition' (pp. 121–176) provides a general typology of chain shifts and other opacities, but focuses on a child who developed an opaque interaction during treatment for consonant production. The child (4;3 years) changed initial affricates to alveolar stops (*chin* → /tɪn/), and assimilated initial alveolars to a following velar consonant (*ticket* → /kɪkɪt/); deaffrication originally fed place assimilation, yielding a transparent result (*chicken* → /tɪkɪn/ → /kɪkɪn/). Treatment for place assimilation was undertaken first; the child was taught nonce words of the general shape /t…k…/. Therapy succeeded in correcting words such as *ticket*, but not for example *cheek*, which remained /kik/, with apparent application of place assimilation only to the /t/ that derives from /ʧ/. The term OPAQUE is perhaps not the first to come to mind here, in the sense of over- and underapplication of a rule with respect to triggers in the output form (Kiparsky 1973); other than words like /kik/, there is no evidence that /t…k…/ is ill-formed in the child's grammar. More striking is an apparent GLOBAL RULE that knows the derivational history of a form. If we accept that /kik/ requires an active rule of place assimilation, then unmodified /tɪkɪt/ is indeed opaque by underapplication. Of course, another possibility is that *cheek* was reanalysed as /ʧ/ → /k/ once simpler /t/ → /k/ was lost from the child's grammar, and no opacity arises.

Opacity is a long-standing problem for the two-level theory of classic OT, although the rise of harmonic serialism (McCarthy 2007) has changed the terrain dramatically. Dinnsen argues that the prevalence of opacity in acquisition means that such relations are not difficult to learn, as sometimes claimed. He shows that two approaches are effective for the /kik/ case: local conjunction, for a derived environment effect; and comparative markedness, which takes into account whether the offending /t/ is underlying. He applies comparative markedness also to the *puddle* case, where again an underlying /dl/ can be made to behave differently from underlying /zl/. A further technique, sympathy, accounts for overapplication opacity in a child grammar with lengthening of a vowel before a voiced stop, but then deletion of that stop in coda position: surface *dog* /dɔː/ is sensitive to the length in the rejected candidate /dɔːg/.

The two remaining papers in this section deploy similar analyses of opacity, although this is not the main point addressed in either of them. In 'An unusual error pattern reconsidered' (pp. 177–204), Dinnsen & Ashley W. Farris-Trimble argue that an idiosyncratic grammar by which a child inserted /s/ after final vowels (*two* /tus/) is the result of the constraint FINALC, attested in some adult languages; and the error is uncommon because this constraint conflicts with NOCODA. Comparative markedness plays a role in accounting for a further aspect of this grammar, whereby all final consonants except labial stops are changed to /s/, as in *dog* /dɔs/, but *cup* /kʌp/: final labial stops are preferred over /s/ only when they are underlying. In 'Innovations in the treatment of chain shifts' (pp. 205–220), Michele L. Morrisette & Gierut discuss /s/ → /θ/ → /f/ chain shifts in three children; all showed variation in pronunciation of the fricatives as they moved toward the target forms, motivating partial ranking of some constraints. Local conjunction of featural faithfulness prevents /s/ → /f/ and thus accounts for the basic opacity in the shift.

Part III takes a more psycholinguistic orientation. 'Developmental shifts in children's correspondence judgments', by Gierut & Dinnsen (pp. 223–246),

describes similarity judgments by children aged 3 to 5 years. Those with an 'initial-state grammar' did not yet produce the fricatives /θ ð/; those with a 'final-state grammar' had mastered these sounds, and in OT terms had demoted the markedness constraints against interdentals below input–output faithfulness. The subjects were presented with non-word triads such as /pɪd bɪd rɪd/, and asked to choose the pair that was most similar (or rather, which two associated pictures were 'friends'); the experimenters considered this to be a test of output–output faithfulness. One notable result is that the initial-state children tended to find similarity in shared place, such as /t θ/, rather than shared manner, /t p/; this is consistent with the greater frequency of manner substitutions in early speech such as /f/ → /p/, compared to the place change in /f/ → /s/. Dinnsen's 'Recalcitrant error patterns' (pp. 247–276) explores why certain phonological errors are more difficult to treat. Briefly, they require the demotion of multiple markedness constraints (as in a chain shift) and therefore a more complex learning task than an error that can be corrected by a single demotion (as in a simple substitution). The difficulty of treatment therefore correlates with the grammatical complexity predicted by OT. The last paper of this section, 'The prominence paradox', by Dinnsen & Farris-Trimble (pp. 277–308), addresses the fact that the strong positions (word-initial, stressed, etc.) that tend to license more contrasts in adult speech are sometimes the locus of neutralisation in child speech. For example, one child maintains /p/ *vs.* /b/ word-finally, but merges them as /b/ initially; parallels are found for place and manner neutralisation, and even word-initial consonant deletion. The authors propose an OT constraint family FinalProm alongside more standard InitialProm. The early ranking FinalProm ≫ InitialProm is reversed as the child learns more vocabulary and needs to differentiate similar words, but it is not clear that this pressure can completely eliminate the typological prediction of adult languages that favour final over initial contrasts.

Part IV has five papers on the topic of consonant clusters. 'Syllable onsets in developmental perception and production', by Gierut, Holly L. Storkel & Morrisette (pp. 311–354), reports on three experiments testing the perceived similarity of various onsets: singleton /k/, internally complex /ʧ/, a true cluster /tw/, which rises in sonority, *vs.* an adjunct cluster /sp/, which does not, and a three-element cluster /skw/. Observed groupings according to greater similarity include /ʧ tw/ *vs.* /sp/ or /skw/, /k tw/ *vs.* /sp/, and /sp skw/ *vs.* /tw/; these suggest that the adjunct category is especially distinctive. But since /ʧ tw/ group against /k/, the complexity at the segmental and onset levels appears to be treated as somehow analogous, at least when compared to a singleton with no complexity at either level; no consistent pattern emerges in comparing /k ʧ sp/, since the criteria conflict. (However, since no other examples of these categories were used, it is possible that the shared coronal place was important for /ʧ tw/.) Notably, the number of segments, which would group /k ʧ/ and /tw sp/, did not play a role in similarity judgements. The results hold equally for typical and delayed children.

Gierut's 'Experimental instantiations of implicational universals in phonological acquisition' (pp. 355–376) investigates two claimed implications based on the course of acquisition. First, in typical first-language acquisition, clusters imply affricates. In treating disordered phonologies, the more marked structure should enable the less marked. Sure enough, teaching clusters helped with the production of affricates, while teaching affricates had a weaker effect on

clusters; the latter effect may be attributable to generalisation of the branching structure, albeit at different levels, perhaps encoded in a single *COMPLEX constraint. Second, in second-language learning (of English by Korean speakers), consonant + liquid clusters imply the /l r/ contrast. This result was not borne out in treating children with disordered phonology, pointing to a fundamental difference between L1 and L2 acquisition.

In 'Gapped s-cluster inventories and faithfulness to the marked' (pp. 377–406), Farris-Trimble & Gierut discuss children with incomplete, or gapped, inventories of clusters contrary to recognised markedness; for example, /sn sm/ are acquired before /sl/, despite being more marked in sonority. They propose that, while the nasal clusters may be more marked, the grammar requires greater faithfulness to the marked /sn sm/ clusters than to the less marked /sl/ cluster. One alternative, also mentioned, is that the /s/ + nasal clusters are structurally distinct, and have an adjunct /s/, just as /s/ + stop clusters do.

'A typological evaluation of the split margin approach to syllable structure in phonological acquisition', by Jessica A. Barlow & Gierut (pp. 407–426), addresses apparent connections between the consonants permitted to occupy second position in an onset cluster and those permitted as a coda. The authors adopt two constraint hierarchies on the sonority of consonants in the margin: M_1 for the first element in a CC onset cluster, and M_2 for the second element of CC, as well as the coda consonant; this would directly link the typology of these consonants and perhaps make NOCODA unnecessary. They studied the acquisition of CLV and CVL syllables by 16 children learning English and Spanish, where L is a liquid, to look for a correlation. They found a tendency for CLV to imply CVL, but NOCODA remained necessary to account for the children's grammars. A complication of analysis arises if seeming clusters are actually treated by some children as complex segments, for which there is some precedent in the literature.

The final paper, 'Constraints on consonant clusters in children with cochlear implants', by Steven B. Chin (pp. 427–447), examines ten deaf children at two intervals after receiving cochlear implants. They were considerably older than the children in the Learnability Project; at the second testing they ranged in age from about 10 to 16 years. Nevertheless, the nature of errors in production of consonant clusters was similar to those found among hearing children, such as deletion of a consonant or insertion of a vowel; this commonality is expected if the same OT constraints are operative. Significant variation in production, both synchronically and longitudinally, suggests non-ranking of some constraints even into the teen years.

Also included are three indexes for authors cited, OT constraints used in analyses and subjects (including languages). The epilogue by Dinnsen & Gierut, 'On the convergence of theory and application' (pp. 451–459), emphasises the mutual contributions of empirical and theoretical work.

This is indeed an admirable property of the book. The broad swath of data on disordered and typical phonological acquisition is valuable by itself, but the formulation of generalisations using the tools of OT makes the book a resource for the study of grammar change in acquisition. The theoretical analyses are mainly focused on the specific questions at hand and may have limited application to work on adult phonologies, but they embody a number of innovative claims, and deserve the attention of phonologists.

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