Review article

René Kager, Joe Pater and Wim Zonneveld (2004). *Constraints in Phonological Acquisition.* Cambridge, Mass.: Cambridge University Press. Pp. v + 417.

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After several years of being cited as in press, the long-anticipated volume *Constraints in Phonological Acquisition* edited by René Kager, Joe Pater and Wim Zonneveld finally appeared in spring 2004. This is the first edited volume to be published that is devoted exclusively to phonological acquisition from the perspective of Optimality Theory. The volume includes important contributions from some of the leading figures in Optimality Theory and/or phonological acquisition. Descriptive, experimental and computational studies relating to typical first-language acquisition and foreign word adaptation are included. The volume is unparalleled in these respects and should serve as essential reading for researchers and students interested in phonological acquisition or Optimality Theory. In fact, the volume has already achieved considerable success as evidenced by its many citations in the work of others. Naturally, as with any volume, some shortcomings are also expected, and this volume has its share. On balance, however, the strengths of the volume certainly outweigh its weaknesses.

My review begins with a brief critique of each of the eleven chapters and then turns to a consideration of the volume's shortcomings. In fairness to all, it is important to keep in mind that there was a rather considerable lag between the time when the volume was conceived and ultimately published. Several of the chapters were drawn from a 1998 workshop on phonological acquisition held in Utrecht. Additionally, some of the work appeared in one form or another dating as far back as 1994. As a result, much of the volume reflects acquisition research that was conducted in the early stages of Optimality Theory. This review will thus attempt to fill in some of the gaps by identifying current challenges and relevant work.

Critique of contributions

The volume opens with two introductory overview chapters from complementary perspectives. The first chapter is by the editors and serves as an introduction to the volume by providing a historical perspective, a tutorial on Optimality Theory, and a summary of the individual chapters. The second chapter 'Saving the baby: making sure that old data survive new theories' is by Lise Menn, who traces the history of proposals relating to output constraints and attempts to identify phenomena from acquisition that Optimality Theory can and cannot account for.

The editors' tutorial on Optimality Theory makes special reference to acquisition issues and could probably stand alone as a brief introduction to the theory. It includes helpful discussion of important topics such as the initial state and the default ranking of constraints, richness of the base, lexicon optimization, learning algorithms, and emergence of the unmarked. Potential accounts for variation and implicational laws are discussed, complete with illustrative examples. Several of the other chapters also provide background on the essentials of Optimality Theory, reinforcing the editors' tutorial but also allowing for the possibility that those chapters could stand on their own. The editors do an excellent job of summarising each of the chapters and connecting them with larger issues in acquisition.

The editors situate the volume by highlighting some of the earlier research on phonological acquisition that led up to work within the framework of Optimality Theory. This was achieved in large part by using extended quotes from Chomsky, Jakobson, Smith, Menn, Stampe, and others. Interestingly, the first quote (repeated below) is from Menn (1980: 35-6) and was selected because it presumably foreshadowed the notion of output constraints in acquisition.

> . . . The child's 'tonguetiedness', that overwhelming reality which Stampe and Jakobson both tried to capture with their respective formal structures, could be handled more felicitously if one represented the heavy articulatory limitations of the child by the formal device of output constraints [. . .] The child's gradual mastery of articulation then is formalized as a relaxation of those constraints.

The editors' focus on this particular quote strikes me as odd because Menn's sense of output constraints appears to be tied to motor immaturity or a lack of articulatory skills and thus does not fit well with most conceptions of markedness constraints in fully developed languages. This discrepancy between Menn's sense of output constraint and that of Optimality Theory might have been clearer if the following quote from Menn (1980: 31) had been selected:

> Child speech, from the possibly prephonemic early stage and on through perhaps the first nine months of speaking, is subject to severe output constraints, stronger than anything found in adult phonology.

If we were to extend Menn's sense of output constraints to Optimality Theory, the claim would be that a highly ranked markedness constraint in some fully developed language reflects a speaker's physical inability to produce a sound that occurs in other languages. Menn's claim ironically would seem to fit better with the perspective of Hale and Reiss (1998), who view children's error patterns as irrelevant to phonology, being mere performance limitations. See especially Bruce Hayes's assessment of Hale and Reiss's position on p. 195-6 in his chapter in the volume.

This brings us to one of the main points of Menn's chapter in the volume, namely her attempt to trace the history of output constraints in acquisition. The comments above suggest that the conceptualization of output constraints may have evolved since Menn's earlier insights, and this evolution should also be kept in mind when considering Menn's commentary. The other main point of her chapter was to identify problems in acquisition that Optimality Theory can and cannot handle. She was, however, quick to acknowledge that she does not work within the framework and thus may not be aware of all of the relevant literature. In fact, in her listing of purported problems for Optimality Theory, most points are accompanied by the comment that she understands that others have addressed the problem, but she herself has not yet evaluated those accounts.

Amalia Gnanadesikan's chapter 'Markedness and faithfulness constraints in child phonology' represents, in my view, one of the most influential papers connecting phonological acquisition with Optimality Theory. The importance of this paper derives largely from the fact that a minimally different version of the paper appeared on the Rutgers Archive in 1995, and it was then the first attempt to spell out in detail how standard Optimality Theory could be brought to bear on the analysis of a child's early speech. It would be difficult to pick up a phonological acquisition article dealing with Optimality Theory that failed to cite this paper. Gnanadesikan reported data from her daughter, G(itanjali), between the ages of 2;3 and 2;9. She formulated an intricate analysis of G's error patterns associated with syllable initial clusters, which were reduced to a single consonant through coalescence. It is convincingly argued that G had internalised accurate underlying representations, and compelling evidence is presented for the emergence of the unmarked. Appeal is also made to universally fixed rankings among certain constraints. While it is strongly argued that children's grammars are like grammars of fully developed languages, Gnanadesikan does make the more controversial claim that G's inputs included prosodic structure. A reasonable amount of data is presented in this chapter in support of the various claims. However, no information is provided about how the data were elicited, the representativeness of the data, or transcription reliability. Also, while G was claimed to be typically developing, it is unclear how this determination was made. On a different front, some of the discussion at the end of the chapter comparing Optimality Theory with earlier approaches, especially relating to the processing demands entailed by those approaches, is weak and unsubstantiated. Finally, a

number of editors' notes appear in the endnotes to correct some of the author's misstatements or to identify alternative positions that have been taken. It is unclear why those corrections were not made in the text in the first place, obviating the need for a comment.

Heather Goad and Yvan Rose, in their chapter 'Input elaboration, head faithfulness, and evidence for representation in the acquisition of left-edge clusters in West Germanic', re-examine published data on English, German and Dutch children's error patterns associated with the acquisition of onset clusters. They lay out quite clearly a series of intricate assumptions and arguments to support their particular views about the nature of children's underlying representations, which they maintain are at the heart of different developmental error patterns. The problem that they pose is that, while left-edge clusters tend to be reduced to the less sonorous consonant (e.g., both /sp-/ and /pl-/ are realised as [p-]), there is some variation with s-sonorant clusters (e.g., /sn-/, /sl-/). That is, some children reduce the cluster to an obstruent, and others reduce the cluster to a sonorant consonant. Goad and Rose attribute the different error patterns to differences in the prosodification of input representations. Their claim is that children who reduce these ambiguous clusters in favor of the less sonorous consonant have prosodically impoverished input representations, while children who reduce these clusters in the other way have more elaborate prosodic representations. It is important to note that their analyses depend first on the rather controversial assumption that both children and adults incorporate prosodic structure in input representations. This is, however, similar to the position adopted by Gnanadesikan in her chapter. Second and more importantly, their appeal to differences in the substance of children's input representations violates a central tenet of Optimality Theory, namely richness of the base. Finally, their argument (pp. 133-5) that languages such as Brazilian Portuguese require fully prosodified input representations is not particularly compelling because the cluster reduction evidence that was presented could as easily have been accounted for in terms of sonority considerations alone. Whether or not one buys all of their arguments, Goad and Rose have formulated an intriguing proposal that all future accounts of the acquisition of clusters will need to consider.

The volume includes two chapters on learnability, one of which is by Bruce Hayes and the other by Alan Prince and Bruce Tesar. The chapters are strikingly similar in their focus and proposed modifications to the constraint demotion algorithm. What emerges from their convincing arguments and demonstrations is that markedness and output-to-output correspondence constraints must outrank faithfulness constraints in the initial state, faithfulness constraints must be ranked as low as possible throughout, and positionally restricted faithfulness constraints must be ranked above their general counterparts. Hayes's chapter does a good job of connecting some of the empirical findings from acquisition research with some of the more technical learnability issues. However, his arguments and discussion might have been aided by inclusion of comparative tableaux. Prince and Tesar point out that while the learning algorithm has problems with positionally restricted faithfulness constraints, there is no similar problem with contextually conditioned markedness constraints. Prince and Tesar also make the interesting observation that chain shifts arise in conjunction with morphophonemic learning. While they do not elaborate on this point, the recent paper by McCarthy (2004) begins to shed some further light on the issue. However, morphophonemic learning, in my view, remains a significant challenge for Optimality Theory.

The chapter 'Syllable types in cross-linguistic and developmental grammars' by Clara Levelt and Ruben van de Vijver is a recast of the previously published article by Levelt, Schiller & Levelt (2000). They compared developmental grammars with grammars of fully developed languages in terms of inventories of syllable shapes and found that there are some developmental grammars that do not correspond with grammars of fully developed languages, and that not all cross-linguistic grammars are attested in the path from an initial state to a final state. It is argued that input frequency from the target language may determine the more limited path that children adopt. Local conjunction of markedness constraints is assumed to account for some of the presumed peculiarities of developmental grammars. For example, ONSET and NOCODA are conjoined to account for the absence of onsetless closed syllables in a developmental grammar

that otherwise allowed closed syllables and onsetless syllables. While it is first claimed that such a restriction is unattested in grammars of fully developed languages, the authors do eventually identify (p. 211) Central Sentani as a language with these same characteristics. The one developmental grammar that does not yet have a cross-linguistic counterpart excludes CCVCC syllable shapes while allowing other syllables with complex onsets and complex codas. To account for such a developmental grammar, it is argued that *COMPLEXONSET and *COMPLEXCODA must also be conjoined. It is, of course, not difficult to imagine that the presumed disparity between developmental and cross-linguistic grammars might have been obviated if a criterion other than the Guttman scale (e.g., Babbie 1998) had been used to determine whether a syllable shape occurred.

The chapter by Joe Pater, 'Bridging the gap between receptive and productive development with minimally violable constraints', re-examines the comprehension-production dilemma and attempts to refine some of the proposals for dealing with the problem. Among his various proposals, he argues that we need perception-specific faithfulness constraints and that they are universally fixed in their ranking over production-specific faithfulness constraints. While his proposal has many advantages, it fails to account for those more troublesome cases where some children (and adults) produce distinctions that they do not perceive (e.g., Eilers & Oller 1977; Gierut 2004).

The sole chapter of the volume with a focus on foreign word adaptation is by Shigeko Shinohara, who reports experimental findings from her 1997 dissertation. She argues that Japanese speakers' adaptations of French words reveal elements of Universal Grammar. Evidence is presented relating to segmental assimilation, pitch accent assignment and syllabification. Interestingly, this is also the only chapter of the volume that attempts to account for the emergence of an opacity effect (i.e., a generalization that is either not surface-true or not surface-apparent). Given the challenges that opacity effects pose for Optimality Theory and acquisition, it is surprising that such phenomena did not receive more attention in this volume. Nevertheless, the opacity effect considered in this chapter involves pre-final syllable lengthening due to the interaction of a stem alignment constraint and a ban against certain geminates. An early version of sympathy was invoked to preserve the mora of a failed candidate. The analysis is, however, suspect on several counts. First, it is based on a 1997 handout by McCarthy rather than the more fleshed-out version of sympathy presented in McCarthy (1999) and elsewhere. Also, while the selector constraint is never identified, it appears that Shinohara is assuming that a highly ranked markedness constraint would serve as the selector. This runs counter to McCarthy's proposal that only low-ranked faithfulness constraints can be the selector.

The chapter co-authored by Lisa Davidson, Peter Jusczyk and Paul Smolensky brings together the results of a truly collaborative venture to assess the psychological reality of richness of the base. Each author makes a unique contribution from his/her earlier work. More specifically, Smolensky clearly provides the theoretical foundation for the predictions about the initial state and learnability. Jusczyk, who is of course well known for his many ground-breaking and ingenious experiments with infants, summarises the results from Jusczyk, Smolensky and Allocco (2002) showing that infants as young as four and a half months respond in accord with the prediction that markedness constraints outrank faithfulness constraints in the initial state. Davidson contributes to our understanding of the final state through her experiments with adults who had the task of producing nonnative clusters. Her results revealed systematic variation in the realization of those clusters, suggestive of hidden rankings among constraints, which in turn come to light if faithfulness constraints 'float' or are partially ordered in the sense of Anttila (1997).

The final chapter of the volume by Wim Zonneveld and Dominique Nouveau is an experimental investigation of Dutch children's (age 3;0-4;0) acquisition of stress. The substance of the chapter is drawn from Nouveau's 1994 dissertation. They found that children have more difficulty imitating irregular and prohibited forms. The theoretical significance of their findings is that a constraint prohibiting stress clash must be active in the children's grammars even though Dutch presumably provides little evidence for the constraint. The authors do acknowledge (p. 399) that the constraint must be active in Dutch, although other analyses might at first suggest otherwise.

Shortcomings

Without question many important aspects of phonological acquisition are addressed in this volume. Of course, given the current state of research in Optimality Theory and phonological acquisition, there are several other relevant topics and populations that might have been included, but are not represented. For example, while mention is made in some chapters of second-language acquisition and atypical phonological development, no chapter is devoted to either population. This is an unfortunate omission because both populations afford unique opportunities for descriptive and experimental evaluation of theoretical claims and hypotheses relevant to Optimality Theory and acquisition. Additionally, some important topics that might have received more attention include the emergence and loss of opacity effects, the role of the input, and presumed disparities between developing and fully developed phonologies. The work cited below begins to address some of these shortcomings and could easily serve as a supplement to the volume.

A good example of research on second-language acquisition that takes up some of these issues, but was not included in this volume, is the work of Eckman, Elreyes and Iverson (2003). In a series of published descriptive and experimental studies from 1997 onward, they have documented the emergence and loss of an opacity effect involving the blocking of a transferred L1 phonological process in a nonderived environment. They have also formulated and evaluated analyses of these phenomena within different theoretical frameworks. Interestingly, they found that second-language learners have greater difficulty acquiring phonemic contrasts (i.e., suppressing their L1 allophonic process) in morphologically derived environments versus non-derived environments. This result obtained regardless of the environments in which the contrast was taught. Their findings are important on several counts. First, opacity effects have in general posed a significant challenge for Optimality Theory, giving rise to proposals such as sympathy (McCarthy 1999), local constraint conjunction (Łubowicz 2002), and comparative markedness (McCarthy 2002b). Some of these proposals would predict (contrary to the Eckman et al. findings) that contrasts should be equally learnable whether taught in a derived or non-derived environment. Second, the emergence of an opacity effect in a developing phonology raises difficult questions about the role of the input, especially when the target language does not exhibit the opaque generalization. These and other opacity effects have also been documented and analysed in optimality theoretic terms for children with and without phonological delays (e.g., Dinnsen, McGarrity, O'Connor & Swanson 2000; Dinnsen, O'Connor & Gierut 2001; Dinnsen 2004; Dinnsen & McGarrity 2004). The opaque generalizations that these L1 and L2 learners have acquired are common in fully developed languages, but happen not to be observable in the language that is being acquired and are moreover marked relative to the initial state.

While the role of the input may be unclear vis-à-vis the acquisition of opacity effects, certain other acquisition phenomena have challenged Optimality Theory to pay closer attention to input factors. For example, in some acquisition work not reflected in this volume, it has been found that high frequency words, on the one hand, and nonwords with high phonotactic probability, on the other hand, are produced more accurately than low frequency words or nonwords with low phonotactic probability, respectively (e.g., Gierut, Morrisette & Champion 1999; Zamuner, Gerken & Hammond 2004). The implication for Optimality Theory is that the substance of certain constraints may need to incorporate input factors such as lexical frequency and phonotactic probability.

One of the central topics of this volume that might have benefited from more in-depth consideration of atypical development is the acquisition of clusters. For example, Goad and Rose in their chapter are careful to point out that typologically there is no implicational relationship between s-clusters (e.g., /sp-/) and true clusters (e.g., /pl-/). While this may be true cross-linguistically, no effort is made to reconcile the claim with the results from experiments which show that children who were taught true clusters generalised across all cluster types, while children who were taught s-clusters did not (e.g., Gierut 1999). Some other more recent

optimality theoretic papers dealing with atypical development that also add to our understanding of the acquisition of clusters include Barlow (2001), Pater & Barlow (2003), and Chin (2004).

One apparent disparity between developing and fully developed phonologies that was not considered in the volume (and has also been given little attention in the broader literature) relates to the contexts where contrasts are preserved/acquired. It is generally understood that contrasts are preserved in strong, prominent contexts and neutralised elsewhere. Some examples of prominent contexts, at least in fully developed languages, include word-initial or foot-initial position. We thus do not expect a contrast to be merged word-initially while also being preserved elsewhere in the word. While this expectation is largely borne out in fully developed languages, just the opposite seems to occur in many cases of early acquisition. That is, many children acquire contrasts first in the so-called nonprominent contexts while continuing to merge them in prominent contexts. For example, Amahl acquired the voice contrast first in final position but continued to merge it in initial position (Smith 1973; Dinnsen 1996). Similar results have also been documented for other children involving place and manner contrasts and are suggestive of a prominence paradox (Dinnsen & Farris 2004). The challenge is to resolve the paradox without violating richness of the base or attributing different constraints to children versus adults.

Finally, the reader will encounter some minor lapses in the way the references and indexes were handled. More specifically, each chapter included its own listing of references, occupying almost 10% of the entire volume. If the references had instead been consolidated at the end of the volume, the rather considerable duplication in the cited works could have been eliminated, making room for other work while also avoiding many inconsistencies and inaccuracies. For example, McCarthy's book *A Thematic Guide to Optimality Theory* is consistently cited as 2001 even though it has a copyright date of 2002. Additionally, some of the inconsistencies relate to dates and titles of cited works. For example, Bernhardt and Stemberger's book and a particular paper by Anttila are each variously cited as appearing in 1997 and 1998; Menn's 1980 paper was also given two different titles. Additionally, it appears that there was little effort to update citations of previously unpublished papers that were then published after 2000. In fact, only a handful of citations appear for work after 2000. Naturally, many advances have been made in Optimality Theory and acquisition since then. For example, while several of the chapters appeal to fixed rankings among constraints, there is no mention of stringency (de Lacy 2002), which offers an alternative to fixed rankings with some advantages for the characterization of certain phenomena in acquisition (e.g., Morrisette, Dinnsen & Gierut 2003). Additionally, the recent proposal by Coetzee (2004) regarding rank ordering of suboptimal candidates may offer an alternative to some of the accounts of variation presented in this volume.

The subject index and the index of names also include a number of unfortunate errors. For example, Michele Morrisette is erroneously identified as Alanis Morrisette, and B. Terrell is cited but has no corresponding page number. The subject index also includes a topic, Manner (features in acquisition), with no corresponding page numbers. The subject index might have been more useful if related topics had been better cross-referenced. For example, while 'opacity' has two citations, it is never connected with other cited topics such as chain shifts or sympathy. There are yet other instances where opacity issues are discussed in the text (e.g., p. 196), but are not mentioned in the index.

In closing and despite any of the above cited shortcomings, this volume is a must for anyone working in the area of phonological acquisition or Optimality Theory. It includes landmark articles that reveal much about acquisition and offer compelling evidence in support of Optimality Theory. The volume would also make an excellent textbook for a graduate course on phonological acquisition, especially if supplemented with some more current and representative work.

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