J. Child Lang. **28** (2001), 213–228. Printed in the United Kingdom

REVIEWS

BARBARA HANDFORD BERNHARDT & JOSEPH P. STEMBERGER, *Handbook of phonological development. From the perspective of constraint-based nonlinear phonology*. San Diego, London, Boston, New York, Sydney, Tokyo, Toronto: Academic Press, 1998. Pp. xiii + 793. ISBN 0-12-092830-2.

In the cognitive era we are immersed in, any theory of language has the duty to ask itself about learnability, i.e. about the feasibility of the acquisition or learning enterprise. GENERATIVE PHONOLOGY, with its complex cyclic domains and variegated rules and rule ordering had some difficulties to make itself credible when approaching this enterprise: young children were supposed to learn phonological processes that they later had to unlearn, in order to be able to one day talk like adults. With the advent of NON-LINEAR PHONOLOGY, these artificial complications could be dispensed with. Given that two tiers are provided by UG, the skeletal or prosodic tier (with its syllabic and metrical structure), and the segmental or melodic tier (with its geometrically structured features), acquiring the phonology of a language became a much more realistic enterprise. The child just ties these two tiers together, associates them, and going from simpler to more complex structures at both levels, the results will gradually approximate the ambient language. No deletion rules have to be posited. The child begins with a simple syllabic structure, CV, which develops into CVC, CCVC, etc., in the direction of the ambient language, in the case that this allows for such complicated structures. At the segmental level, many analyses assume the concept of underspecification, which gives way to the spreading of features, i.e. to assimilations and harmonies. The young learner would leave more features unspecified than the older speaker.

With the advent of OPTIMALITY THEORY (OT), the learnability question has to be defined anew. Some of the most important contributions to the new theory have reflected on the implications of the new perspective: what does it mean to say that a child learns the grammar of a language, given that a grammar is a hierarchy of constraints and that constraints are universal (Smolensky, 1996)? Others have analysed acquisition data within the new paradigm, showing simple and elegant treatments of the data (Gnanadesikan, 1995, Pater, 1997). Bernhardt and Stemberger in their work on acquisition independently adhered to non-linear phonology, and independently showed its advantages for the analysis of typical acquisitional phenomena (see, e.g. Stemberger & Stoel-Gammon, 1991 or Bernhardt, 1992); they also independently experimented with OT in their analyses, which extended from normal development (Stemberger, 1996) to the analysis of several types of abnormal cases (in Bernhardt's unpublished materials). In *Handbook of*

Phonological Development (*HPD*) they have come together to unify efforts, in an impressive piece of work, which connects with a very broad audience. Linguists, linguistics students, investigators of phonological acquisition, psychologists, as well as speech pathologists can profit from reading it.

HPD contains all the tools necessary for understanding non-linear phonology and optimality theory, and for working with their concepts and theoretical constructs in the analysis of child phonological data. It encompasses theory and analysis in an impressively complete way, and it insightfully reflects on acquisition matters. After an introduction in which the objectives are defined, Chapters 2–4 deal with theoretical matters: different theories of phonology and their relevance to acquisition are insightfully reviewed (Chapter 2). For the reasons adduced above, the authors certainly adhere to non-linear phonology and present its theoretical constructs using a wealth of examples from the literature, including acquisition data (Chapter 3). They discuss linguistic theories in which constraints play some role and advocate a theory exclusively based on constraints, as it is nowadays the case in the OT framework (Chapter 4). Here, the authors argue for a theory slightly different from main-stream OT. The theoretical differences concern the names as well as the contents of constraints and the acquisition assumptions relative to the standard OT-model. Constraints should be atomic, i.e. they should just touch upon one unit each. In this vein Bernhardt & Stemberger reject compound constraints, although in the analyses in later chapters they discuss their possible relevance. Names for constraints should be transparent, i.e. they should offer mnemonic support to the reader. Consistent with this suggestion, *HPD* substitutes **Survived** for MAX, **LinkedUpwards** for PARSE, **LinkedDownwards** for DEP. The effects of the Obligatory Contour Principle are taken over by **NotTwice** and by **Distinct(element)**. The authors suggest that renaming the constraints can be an interim step, until the constraints have been mastered by the user (p. 159f), but once these names are learned, supposing they are, why change them? Since the reason for the intended transparency is to teach the constraints to scientists that are not familiar with main-stream OT, like psychologists and speech-pathologists, the success of the enterprise will have to be measured by its results: if *HPD* achieves its objective, publications and discussions in this field should make broad use of OT and its (redefined) jargon.

As regards acquisition, *HPD* presents a different theory from the one defended in the OT contributions mentioned above (Smolensky, 1996, Gnanadesikan, 1995, Pater, 1997). These works assume an initial state, in which Markedness constraints (here called **Not** constraints) are dominant and outrank Faithfulness constraints (here **Survived** or **LinkedUpwards**), and propose that the approximation to the ambient language takes place by means of Demotion of constraints: Markedness constraints have to be

demoted, so that they are dominated by (some of) the Faithfulness constraints. Bernhardt & Stemberger (1998) propose instead that constraints are randomly ordered to begin with, and they contemplate individual differences for this initial state: some children may already begin with some Faithfulness dominating some Markedness. This is reasonable, since it has been shown that the initial state is not as clear-cut as is sometimes assumed, some children beginning their productions without onsets or with codas (Grijzenhout & Joppen, 1999). The authors then propose that the learning mechanism can either be constraint demotion or constraint promotion, and that it is mainly the latter that is at work, with promotion of Faithfulness. This double mechanism gives more power to the theory, but it is debatable whether such power is desirable (see below).

The following three chapters (5–7) concentrate on normal phonological development at the segmental level (Chapter 5), the prosodic level (Chapter 6) and sequentially, i.e. at the level of phonotactic restrictions (Chapter 7). The analysis applied is based on the concepts introduced in the previous chapters: an OT analysis combined with non-linear phonology, based especially on the concepts of the two tiers, skeletal and melodic, as well as on underspecification and C/V tier segregation, by which consonants and vowels are considered to be on different tiers (McCarthy, 1989). These chapters are incredibly rich, not only at the theoretical and analytical levels, but also empirically, with an extremely large empirical coverage, addressing most of the languages about which information is available. *HPD* contains information on aspects of the acquisition of languages as diverse as Arabic, Cantonese, Chichewa, Chipewyan, Dutch, Estonian, Finnish, French, German, Greek, Hindi, Hungarian, Mandarin, Quiche Mayan, Russian, Sesotho, Spanish, Xhosa and Zulu. In spite of this variety, the majority of the data analysed in the book stem from English, and in particular American English. Certainly, this focus on English can hardly be avoided, since it is the language that has attracted the largest coverage in the field. On the other hand, these chapters offer a wealth of partly unpublished data, including the diary studies of Stemberger's three children, carefully and laboriously transcribed and insightfully analysed, as well as data on abnormal development, stemming from many years of research accompanying therapy work by Bernhardt. These latter data cover many different types of cases, from SLI to cleft-palate children and children with some degree of hearing loss. The authors show that most of the cases treated are not essentially different from normal development. They just represent 'protracted' development, and in this sense the data need not be distinguished from normal data as far as their analysability goes. An important task for future research is to describe protracted development in languages other than English.

An aspect of acquisition research that is generally not mentioned is the acquisition of morphophonological alternations. Even assuming that at the

first stages of development, alternations are not yet acquired, the point at which later on children begin to master such alternations is generally not reported. The authors discuss this deficiency and present all available data relating to the acquisition of alternations (Chapter 9). The data include the diary studies of Stemberger's children. It is remarkable that the author so carefully collected data at a time when this research field received such little attention. The authors suggest that in some cases the lack of alternations for a certain morpheme may indicate that faithfulness constraints are ordered higher in the child's hierarchy or grammar than in that of the adult language. This variability in the order of constraints may open the door to some arbitrariness, though: faithfulness constraints, which are generally ranked low in the child's grammar, would appear to climb up the hierarchy until later on, once the alternations have been acquired, they climb down once more. Another way of looking at this phenomenon is by assuming that output forms, besides input forms, have a strong influence on other output forms of the same morpheme. This could then be expressed as output-to-output constraints (Hayes, 1999), which the authors reject on the grounds that they would give too much power to the grammar. Since the freedom with which they treat faithfulness constraints is also extremely powerful, I would prefer output-to-output constraints for the reasons that a) they are more in accord with OT with its focus on output rather than on input, and b) because it acknowledges the notion of paradigm, albeit in an incomplete or immature way.

The last chapter presents an excellent summary of what *HPD* achieves and what it does not (Chapter 10). This chapter constitutes a critical appraisal of the whole book. Possible doubts and uneasiness that the reader might have been collecting while reading the book are here discussed. I will select one point that I consider crucial in the discussion. Their version of OT contains an immense number of constraints. One of the reasons for the large number of constraints is the fact that the authors renounce the use of segments in the formulation of constraints and prefer to use features. This is reasonable, because non-linear phonology with its feature geometry can represent phonological structure much better, and there is no reason for renouncing this advance in OT. Bernhardt & Stemberger acknowledge the fact that their theory involves a very large number of constraints, but dismiss its consequences on the grounds that constraint rankings, albeit complex, are not more complex than processes (p. 633). The problem is that they are not simpler either. Such a rich system of constraints worsens the problem of learnability: there are so many constraints responsible for a single fact that it is not transparent for the child what constraint or constraints should be reranked, since as also pointed out above, reranking can go in any direction, either promotion or demotion. The authors see the virtue of their system as lying in its flexibility: a constraint can be wrongly reranked, giving way to a

form produced by a certain child, still far away from its target (p. 645). The question, though, is whether such a system is capable of guaranteeing the right reranking of the right constraints. Bernhardt & Stemberger point out that their theory can describe the most varied alternative productions by children, but it cannot necessarily deliver explanations for why things are as they are. As they suggest, we should separate phonological theory from learning theory, and not put too much of a burden on linguistic theory (p. 669). But still, they might not push the separation far enough.

One possible point at issue here is that the authors view OT as a theory of performance, rather than as a formal theory of mental representation. This touches upon an actual debate relating to the possible grounding of constraints. In so-called main-stream OT, constraints are viewed as formal universal entities out of which particular grammars are forged. Their ranking is contingent, established by the relevant language and manifested in its particular grammar. There is another stream of OT, which sees constraints as grounded in phonetics, or even in the optimization of usage as user constraints (see the interesting recent debate in *Zeitschrift für Sprachwissenschat* **18**, 1999). Bernhardt & Stemberger deny that constraints are phonetically grounded; they argue that constraints are 'cognitively (and communicatively) grounded', but 'constraint RANKINGS are phonetically grounded.' (p. 155). This claim is problematic, though: since rankings are contingent and language particular, it is not clear how their dependency on phonetics can be justified in a general manner. If rankings were grounded in phonetics, more similar rankings, i.e. grammars, would be expected. The authors clearly align themselves with the theoreticians that defend phonetic grounding by claiming that 'OT can thus be viewed as a modern instantiation of ease-of-articulation theories' (p.154). However, they limit the validity of such a statement: 'OT instead posits that the difficulty of a particular action can be different for different people', which also has as a consequence that 'different individuals start with different constraint rankings' (p. 154). They thus give up a universal initial state. On the other hand, as mentioned above, they reject constraint demotion as the main mechanism of learning, on the basis that demotion was posited in order to prevent regressions, but because regressions do occur, 'constraint demotion is the wrong approach for child phonological development.' (p. 266). One of the virtues that they see in their system is that it allows for the reranking of the wrong constraint (p. 645). This certainly gives rise to many possibilities. In fact, any possible phenomenon encountered in child phonology, normal or protracted, can be accounted for. The system is very powerful, in fact too powerful and unconstrained. Given, for instance, that each negative constraint (banning occurrences of features) has a survive counterpart (allowing a feature present in the input) infinite possibilities are guaranteed. It is not clear, though, how the child trapped in a wrong hierarchy will get out of the error. The theory should be

capable of making certain rankings more costly than others. In my opinion, this is the most urgent task we have ahead of us, if we want to further understand phonological development.

HPD has, among other advantages, the virtue of explicitness. The authors' explicit and insightful way of handling phonological acquisition phenomena clearly reveals the strengths and weaknesses of OT in its application to developmental phenomena. Bernhardt & Stemberger are optimistic about their results. I feel they are entitled to this optimism. The topics and issues they present are so numerous and so insightfully treated, that their book is certain to stimulate much research and work in the field of phonological acquisition.

REFERENCES

Bernhardt, B. H. (1992). Developmental implications of nonlinear phonological theory. *Clinical Linguistics and Phonetics* **6**, 259–81.

Bernhardt, B. H. & Stemberger (1998). *Handbook of phonological development. From the perspective of constraint-based nonlinear phonology*. San Diego, London, Boston, New York, Sydney, Tokyo, Toronto: Academic Press.

Gnanadesikan, A. E. (1995). *Markedness and Faithfulness constraints in child phonology*. University of Massachusetts at Amherst: *ROA-67*.

Grijzenhout, J. & Joppen, S. (1999). First steps in the acquisition of German phonology: a case study. *ROA-304*.

Hayes, B. (1999). Phonological acquisition in optimality theory: the early stages. *ROA-327*.

McCarthy, J. J. (1989). Linear order in phonological representation. *Linguistic Inquiry* **20**, 71–99.

Pater, J. (1997). Minimal violation and phonological development. *Language Acquisition* **6**, 201–53.

Smolensky, P. (1996). On the comprehension/production dilemma in child language. *Linguistic Inquiry* **27**, 720–31.

Stemberger, J. P. (1996). Syllable structure in English, with emphasis on codas. In B. Bernhardt, J. Gilbert & D. Ingram (eds), *Proceedings of the UBC International Conference on Phonological Acquisition*. Somerville: Cascadilla Press.

Stemberger, J. P. & Stoel-Gammon, C. (1991). The underspecification of coronals: evidence from language acquisition and performance errors. In C. Paradis & J.-F. Prunet (eds), *Phonetics and phonology* vol. 2, *The special status of coronals*. San Diego, CA: Academic Press, 181–99.

Reviewed by Conxita Lleó,
Institut für Romanistik,
Universität Hamburg,
Hamburg, Germany
lleo@uni-hamburg.de

Lise Menn & Nan Bernstein Ratner (eds), *Methods for studying language production*. Mahwah, NJ: Erlbaum, 1999. Pp. vi+438.

Good science requires both an interesting question and a method adequate to producing the data necessary to address the question. The scientific study of language has not lacked for interesting questions in many years, but wresting

data from language users has sometimes been an obstacle, particularly when the language users are children acquiring language or populations with a language disorder. This book is a collection of essays about methods for overcoming some of those obstacles.

The first chapter, by Ratner & Menn, is a persuasive argument for taking method seriously. It also lays out clearly a major dilemma in studying language production, which is, in turn, a major dimension on which techniques for studying language production vary. The authors term this the 'naturalness-control' dimension. At the naturalness end, there are techniques for obtaining spontaneous speech samples, which have the advantage of revealing what people actually say, at least in the circumstances under which they were recorded. The disadvantage is that spontaneous speech does not reveal the boundaries of what people CAN say.

The pioneering solution to finding out what people (in this case children) can say was the 'wug test' devised by Jean Berko Gleason. The name of the test comes from the most famous of Berko Gleason's stimuli – a line drawing of first one, and then two bird-like creatures paired with the sentences 'This is a picture of a wug. Now I have two of them. I have two_.' With this method, Berko Gleason first documented that young children have productive knowledge of the morphological patterns of their language (Berko, 1958). Given nonsense syllables, so that they could not possibly have memorized the plural or past tense forms, four-year-old children demonstrated that they knew that the plural of *wug* must be *wugs*, that the past tense of *blick* must be *blicked*, and so on. The essence of this technique has been extended to study other aspects of children's productive knowledge of language and to study the productive knowledge of special populations such as patients with aphasia and children with specific language impairment. Although the introduction never explicitly refers to the book as a festschrift, the book is clearly in homage to Jean Berko Gleason. It is a collection of chapters that together provide a broad survey of the methods that have been used to study language production.

Following the introduction, Chapters 2 through 8 describe other elicitation techniques and extensions of the wug test, exploring the 'control' side of the naturalness–control continuum; Chapters 9 through 13 focus on the naturalness end of the continuum, discussing a variety of settings and techniques for gathering spontaneous speech samples. Chapters 14 through 20 discuss methods of studying language production in populations with language disorders.

Because the unifying theme is method, the content domain is wide ranging. Masur describes elicited imitation techniques used with children aged 1;1 and discusses what imitation might have to do with vocabulary development. Gerken discusses techniques for getting young children to imitate whole phrases and utterances and what the converging results of spontaneous and

elicited speech suggest about early morphosyntactic development. (The value of using a variety of techniques to obtain converging evidence is a theme that recurs in many chapters.) In separate chapters, Clark & Berman describe methods for eliciting word coinages from children and consider what children's performance implies about their knowledge of word formation processes. Gropen discusses the extension of wug-type tests to studying children's knowledge of verb argument structure. Nelson turns the reader's attention to issues of assessing the effects of intervention. Doughty & Long describe a variety of structured elicitation techniques they have used to assess second language knowledge. Several of the chapters point out ways to get children to participate in a task that is not particularly sensible or engaging to small children. Masur used mothers as experimenters to entice children at 1;1 to imitate novel words. To obtain whole utterance imitations from children between 2;0 and 2;6, Gerken asked the children to repeat for her what a difficult-to-understand robot is saying. One great value of this book is that it is full of such little tips.

Chapters 9 through 13 on naturalistic data collection are also varied in the subject matter they cover. Johnson discusses morphosyntactic development; Pan, Perlmann & Snow describe cross-cultural patterns of parent-child discourse; Andersen describes studies of children's sociolinguistic knowledge; Ely, Wolf, McCabe & Melzi discuss children's narratives; and Ervin-Tripp presents the topic of peer interaction.

Reading these chapters is a bit odd sometimes because they are centrally methods sections, and they are only secondarily the theoretical introduction which would normally precede a method section and the results and conclusions which would normally follow. Some chapters nonetheless do an excellent job of illustrating the importance of method by showing just what a particular method uniquely enables the research to uncover. For example, Johnson shows how phonetic transcription allows discovering the gradual course of the development of children's understanding of *wh*-forms. She argues that initially it is easy to overestimate what children know if their speech is made more adult-like by the transcriber. Phonetic transcription reveals that many of children's early uses of *wh-* words are phonetically reduced and part of fixed sequences. The child who says /wʌsæt/ shouldn't really be credited with the word *what*. Knowledge of *what* develops later and is reflected by changes in the articulation of *what*. On a very different subject, Pan, Perlmann & Snow show how conversations collected at mealtimes include types of talk such as explicit socialization, multiparty talk, and talk between fathers and children; these would not be present in the more typically collected, mother–child dyadic interactions. Andersen demonstrates how 'controlled improvisation,' i.e. asking children to role play family scenes or doctors' office scenes, reveals children's exquisite sensitivity to how language is used differently depending on social status. Even across

languages, four-year-olds show they know that discourse markers such as 'well,' and 'now then,' (and their French and Spanish equivalents) are used by adults in talking to children, but not the other way around.

The chapters on populations with language disorders begin with Ratner discussing the elicitation techniques which have revealed that stuttering is not just a speech production problem, but a language problem. Her evidence is the fact that more complex utterances are more likely to be produced with a stutter. Tager-Flusberg describes the difficulty of trying to collect spontaneous speech samples from children with autism; they tend not to produce very much spontaneous speech. Like Masur, she recruited mothers in her effort to elicit speech from these children. Tager-Flusberg concludes that the effort is justified because the speech that mothers are able to elicit reveals that the language development of children with autism follows the same general course that has been found for normally-developing children. Even the echolalic utterances characteristic of children with autism fall within the constraints of the children's productive systems. (This point, that imitation and spontaneous production reflect the same underlying grammatical knowledge, is also made by Gerken.) Tager-Flusberg also confesses her discovery that the Berko Gleason wug test does not work with children with autism. Children with autism, it seems, are so concrete and literal that they are at a loss for what to do with imaginary creatures and nonsense words. Leonard discusses the use of wug-type tests with children with specific language impairment and makes the argument that, contrary to some proposals, children with SLI do have a productive system. Like other children they can form the plural of *wug* and the past tense of *blick*, although in spontaneous speech they clearly struggle to produce these same morphemes in obligatory contexts. Donahue makes the important point that every testing situation is its own pragmatic context, and she discusses the influence of the expectations and attitudes towards assessment that older children who are learning disabled may bring to such contexts.

The final three chapters turn to the subject of studying adult populations with language disorders. First Goodglass describes how the wug test has been used in aphasia research. Next, Menn describes the pragmatic difficulties of right brain damaged patients. She proposes a picture-based method for eliciting productions that reveal in detail the nature of the deficits in this population. For example, she uses a cartoon-like sequence of four or five scenes to elicit narratives. As do other contributors to this book, Menn also discusses what to code in the samples of speech that are elicited, and she reports findings that, for example, aphasics with right hemisphere damage less frequently express empathy for the characters in their stories than do normal controls. In the last chapter, Obler and De Santi discuss the unique problems of studying patients with Alzheimer's disease because their ability to give informed consent is in doubt. These patients are also difficult to study

because they have trouble remembering the task they are supposed to be trying to do.

Written more autobiographically than a standard research report, some of the chapters should provide encouragement to new researchers. These chapters are the true story behind the final method section, complete with recountings of many things that were tried and discarded. Several chapters provide interesting details that do not usually make it into methods sections. For example, we learn from Andersen that experimenter presence is required for studying peer interaction among children in the U.S. in order to inhibit the children's aggression. French children, in contrast, can be left unattended. From Ely *et al*. we learn that 90 minute tapes are thinner and therefore more likely to snarl than 60 minute tapes. From Ervin-Tripp we learn that court room transcription machines are multi-channel and therefore preferable to standard office transcribers which are usually monaural. Ervin–Tripp also tells us that digital recordings degrade in 10 to 15 years, and she remarks that to line things up correctly on a transcript one must use Courier font, in which each character is the same size.

Taken together, the chapters in this book are testimony to the importance of method in the study of language, to the ingenuity of researchers in the field, and to the complexity of the phenomenon under study. Because the scope of the content of this book is so vast – from verb argument structure to sociolinguistic development – the book is not likely to be read in its entirety by very many people. It would be an excellent book for a graduate course in methods in language development, precisely because of the breadth of its content. The book also is a good resource for teaching at the undergraduate level. It is a book to have on one's shelf for the day one wants to try something new.

REFERENCE

Berko, J. (1958). The child's learning of English morphology. *Word* **14**, 150–77.

Reviewed by Erika Hoff,
Florida Atlantic University

David Birdsong (ed.). *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Erlbaum, 1999. Pp. x + 191.

The critical period hypothesis (CPH) is the claim that there is a maturationally determined period in our lives during which we are uniquely able to acquire languages to completion, that is, to the level of a native speaker or signer whose exposure began in infancy.* On Lenneberg's (1967)

[*] I thank Alene Moyer for reading a draft of this review.

formulation of this hypothesis, the maturational window closes roughly at puberty, when – as he understood the data then available – cerebral lateralization is complete and the brain has lost its original plasticity. Outside the critical period (CP), language learning is certainly possible, but may be difficult and incomplete and may proceed through different mechanisms from those of timely first language acquisition. So, late learners may require instruction and corrective feedback and are, in any event, quite unlikely to gain the capacities of the native learner.

The CPH is primarily a claim about first language acquisition, but direct tests are few. The reason for this is a happy one: almost all newborns have immediate and continuing exposure to a full-blown language. The only significant population of children who routinely lack access to any conventional language are deaf children of hearing parents; late learners of American Sign Language (ASL) as a first language (i.e. learners whose first exposure came after twelve years of age) show significantly-diminished control of ASL morphology (but not of basic word order) as compared to native learners or to learners exposed to ASL in early childhood. This is true even after thirty years of experience (Newport, 1991; also Mayberry, 1994).

Faced with the difficulty of testing the CPH as it pertains to first language acquisition, we can look to studies of second language acquisition. David Birdsong's edited volume does just that. Seven chapters make it up: his nicely written introductory chapter is followed by three supporting the CPH and three arguing against it. Those chapters that argue against the CP are relatively rich in data; these are the contributions of Flege, Bongaerts, and Bialystok & Hakuta. Among the chapters that find support for the CP, only Weber-Fox & Neville's chapter reports the results of original research with language learners. Hurford & Kirby's evolutionary arguments for a CP are founded on the outcomes of computer modelling. The contribution from Eubank & Gregg is a wide-ranging review; they observe that evidence from second language acquisition for a CP is not likely to 'be on par with evidence for a CP affecting L1 knowledge' (p. 78), inasmuch as successful acquisition of a fist language has put much of the mental architecture in place for subsequent language learning.[1] Other factors, some of which perhaps work against the adult, also distinguish first and second language acquisition: for example, many prosodic characteristics of child-directed speech that may facilitate the infant's acquisition of language are likely absent from speech addressed to older second language learners.

Rather than examining this book's seven chapters one-at-a-time, I'll look at some key questions raised in this volume, questions that are addressed in many of its chapters:

[1] An ability to learn new languages throughout life is consistent with at least one version of the CPH: the Exercise Hypothesis put forth by Johnson & Newport (1989).

(1) *Is second language acquisition more successful in early childhood*? No disagreement here. In Weber-Fox & Neville's studies, Chinese-English bilinguals whose immersion in English began as early as 7;0 to 10;0 showed poorer performance on a test of their knowledge of English grammar than did monolingual native speakers. In contrast, bilinguals whose immersion in English began at 4;0 to 6;0 did not diverge from native monolinguals. Likewise, Flege reports that the lower the ages at which Italian immigrants to Canada arrived in that country, the more native-like are their accents in English. The effects of age of immersion are not limited to probes of subjects' linguistic knowledge or to the judged quality of their accents but also have electrophysiological consequences, as Weber-Fox & Neville report in their analyses of event-related brain potentials (ERPs).

(2) *Why should language learning be complete by puberty*? For Hurford & Kirby, the answer lies partly in reproductive fitness. Individuals who have fully acquired the language of their community by puberty will be more successful in passing their genes on to the next generation. These authors report a series of computer simulations in which they modelled the effects of language size and speed of acquisition. Their point is that the two factors may have co-evolved so that languages may be learned by the time that learners reach puberty.

(3) *Why is there a decline in language learning ability with age? Why aren't adults able to learn new languages fully*? As Birdsong notes in his introduction, one answer might lie in the costs to the organism in retaining the ability to acquire languages: for Pinker (1994), the brain's 'greedy' metabolism means that unneeded circuitry gets pruned. And, thinking again from an evolutionary perspective, few of us may wander far to find a mate and therefore adults may gain little reproductive benefit by being able to acquire foreign languages fully. Hurford & Kirby hint at still another answer, specifically that the language acquisition capacity is altered by its success and is therefore less adept at making the halting steps necessary in the earliest stages of acquiring a second language. This is not that different from Flege's answer for why language-learning ability declines (although note that he finds no abrupt decline with puberty): 'accuracy in pronouncing L2 varies as a function of how well one pronounces the L1 and how often one speaks the L1' (p. 125). Flege observes that this hypothesis makes a surprising prediction: specifically, with the disuse of L1 in language attrition, the foreign accent characteristic of the speaker's second language may diminish.

According to another class of models, the developmental decline in language-learning ability is neither a consequence of a decline in the language-learning capacity itself (as Pinker suggests) nor a product of interference from the first language (as Flege suggests). Instead, the emergence of other abilities may limit the language-learning capacity. Consider imprinting in ducklings: imprinting is the duckling's tendency to follow the

first moving object it sees, an object that is almost always its mother. Imprinting is most successful nine to twenty hours after hatching. The onset of the critical period is determined by the development of locomotor abilities. The offset is determined, not by a decline in the following response itself, but by the emergence of a competing fear response that causes the duckling to flee novel objects. If this fear response is suppressed by a drug, the CP for imprinting can be prolonged (Hess, 1959). Several theorists about the CP for language have hypothesized that the more sophisticated cognitive and/or memory abilities of the adult interfere with the acquisition of language beyond childhood. On Newport's (1991) model, the limited cognitive capacities of the child – in particular, the limited short term memory capacity – facilitate language acquisition. Less, in this instance, is truly more.

(4) *Is there a single CP for all of language?* Probably not. Certainly vocabulary acquisition continues across the lifespan (see Meier & Newport, 1990, for discussion). Eubank & Gregg remind us that language is not a unitary phenomenon and may not even be an ontologically valid notion; thus there is little reason to expect one CP to embrace all of language. Evidence that delayed experience has differing effects on different domains of linguistic knowledge comes from Weber-Fox & Neville's work, where reliable effects on subjects' accuracy in detecting syntactic anomalies emerged in bilinguals who were first immersed in English during the period from 7;0 to 10;0, whereas comparable effects on the detection of semantic anomalies emerged only when immersion came after 16;0. Similarly, ERPs in response to semantic anomalies showed only minimal effects of delayed exposure to English; specifically, bilinguals whose immersion began after 11;0 showed longer latencies in the appearance of a negative shift in amplitude–N400–that is associated with the detection of semantic anomalies. But syntactic anomalies yielded a different picture: increasingly delayed immersion in English was associated with an increasingly bilateral response over the temporal lobes to the detection of such anomalies. This response, which came 300 to 500 ms after stimulus onset, was restricted to the left temporal lobe in monolinguals.

(5) *In the data, is there some visible cutoff or discontinuity that is associated with the termination of the CP, a point at which learning is no longer predicted by age of acquisition?* A naïve reading of Lenneberg's discussion of the CP might suggest that the function relating age of acquisition to the probability of becoming a native speaker should show an abrupt onset near 2;0 and an abrupt offset at puberty. Between 2;0 and 13;0, the efficacy of the language learning capacity might be thought of as unchanging. However, recent studies – especially Johnson & Newport (1989) – show that the language-learning capacity is already declining as early as 6;0 and continues to do so until levelling off around 17;0. After 17;0, learners are presumably mature and, throughout adulthood, undergo few or no neurological changes that might affect language learning (Johnson & Newport, 1989, although see

Neville & Bavelier, 1999, for discussion of evidence that some brain regions may not reach their adult state until 20;0).

Whether such a marker of the end of the CP is indeed present in Johnson & Newport's data has, as Birdsong notes in his introduction, sparked an ongoing debate (e.g. Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996; Valian, 1999). In his data on accent in Italian immigrants who had been asked to read short English sentences, Flege finds no discontinuity in the function relating age of immersion and strength of accent, but instead a simple linear relationship between these two variables. This finding contributes to his conclusion that there is no CP for the acquisition of a native-like accent. In reviewing discrepant findings from an analysis of spontaneous speech samples (Patkowski, 1990), Flege raises the possibility that there may indeed be a CP for other aspects of language acquisition (e.g. syntax or vocabulary) and that it is this other CP that accounts for the sharp downturn in language learning ability that Patkowski identified. This speculation may surprise some readers who had the perhaps naïve belief that, if any area of language is subject to a CP, it is the acquisition of accent.

Bialystok & Hakuta take a different tack on the problem of identifying the end of any hypothesized CP. They argue that the CPH predicts a qualitative shift in the nature of learning with the end of the CP: 'accepting the experimental hypothesis for a critical period requires evidence of a discontinuity in the quality of rules that are transferred within and outside of that period' (p. 171). They find no such evidence. Note, however, that their argument assumes that the end of the CP is marked by qualitative changes in how language learning works, as opposed to quantitative changes in its efficiency.

(6) *Lastly, on the assumption that there is a CP for language acquisition, are there any late learners who are nonetheless indistinguishable from natives?* Although Flege finds no clear marker of the end of the CP in his data on accent, he observes that no subject whose immersion in English began after 15;0 scored within two standard deviations of his native speaker controls. In Johnson & Newport's (1989) study of Chinese and Korean learners of English, no late learners could pass as natives with respect to knowledge of English grammar, notwithstanding the fact that all were students or faculty at the University of Illinois and were presumably motivated to learn English well.

However, Bongaerts reports evidence that some highly select subjects can indeed escape the CP's clutches. One group of 11 Dutch speakers of British English 'were selected ... because ... EFL experts had designated them as highly successful, very advanced learners with an exceptionally good command of British English' (p. 138), although reportedly none had more than incidental exposure to English prior to 12;0. In this study and in a similar one

of a group of highly select learners of French, a few subjects scored within one standard deviation of the judged performance of the natives. Having said this, note that Bongaerts' larger, less carefully-selected samples of university speakers of British English or French yielded no individuals who even remotely approximated the accents of native speakers. In a similar study, Moyer (1999) found that one of 24 late-learning American graduate students in German – but only one – was judged by a panel of native speakers to have native-like German speech.

Why do some learners apparently succeed to such a degree? Bongaerts emphasizes that his exceptional learners had 'all received intensive perceptual training that focused their attention on subtle phonetic contrasts between the speech sounds of the target language and those of their L1' (p. 155). More generally, assessments of the grammatical knowledge of late learners may uncover more native-like learners than do judgments of their accents; see Birdsong's review of pertinent studies. This leaves open the question of why no such learners were encountered by Johnson & Newport (1989): one possibility is that the typological differences between either Chinese or Korean and English are such that their subjects (who, unlike Bongaerts' select subjects, were not previously identified as exceptional learners) had much more to learn than do late learners of English whose first language is French or Dutch or German.

In sum, Birdsong's book opens a useful way into a compelling intellectual debate that has important implications for educational policy. The CPH is an issue that should be addressed in many linguistics courses: for once, the instructor can anchor a linguistic phenomenon in comparatively well-understood phenomena from biology. Extensive literatures examine hypothesized CPs for birdsong in sparrows, attachment in rhesus macaques, and vision in cats. By exploring the CPH, the instructor of a course in language acquisition can point out the limits of experimentation in our discipline: tests of hypothesized CPs in non-human animals may adopt experimental designs (specifically, deprivation studies) that may not be performed on children. These ethical strictures have profound consequences for how we may test any hypothesized effect (or non-effect) of the linguistic input to children. Discussion of the CP for language allows the instructor to focus on poignant human stories, whether the enduring effects of extreme isolation, as in the case of Genie (Curtiss, 1977), or the role of the slave trade in creating the conditions under which children may have developed creoles (Bickerton, 1984). The everyday experiences of second language learners, as described in Birdsong's volume, and the extraordinary experiences of Genie and of children in plantation societies illuminate a profound hypothesis about the constraints on human-language learning.

REFERENCES

Bickerton, D. (1984). The language bioprogram hypothesis. *Behavioral and Brain Sciences* **7**, 173–221.

Curtiss, S. (1977). *Genie : a psycholinguistic study of a modern-day 'wild child.'* New York: Academic Press.

Elman, J. L., Bates, E. A., Johnson, M. H., Karmiloff-Smith, A., Parisi, D. & Plunkett, K. (1996). *Rethinking innateness : a connectionist perspective on development*. Cambridge, MA: MIT.

Hess, E. (1959). Imprinting. *Science* **130**, 133–41.

Johnson, J. S., & Newport, E. L. (1989). Critical period effects in second language learning: the influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology* **21**, 60–99.

Lenneberg, E. (1967). *Biological foundations of language*. New York: Wiley.

Mayberry, R. (1994). The importance of childhood to language acquisition: evidence from American Sign Language. In J. C. Goodman and H. C. Nusbaum (eds), *The development of speech perception : the transition from speech sounds to spoken words*. Cambridge, MA: MIT.

Meier, R. P. & Newport, E. L. (1990). Out of the hands of babes: on a possible sign advantage in language acquisition. *Language* **66**, 1–23.

Moyer, A. (1999). Ultimate attainment in L2 phonology: the critical factors of age, motivation, and instruction. *Studies in Second Language Acquisition* **21**, 81–108.

Neville, H., & Bavelier, D. (1999). Specificity and plasticity in neurocognitive development in humans. In M. S. Gazzaniga (ed.), *The new cognitive neurosciences*, 2nd edn Cambridge, MA: MIT.

Newport, E. L. (1991). Contrasting conceptions of the critical period. In S. Carey and R. Gelman (eds), *The epigenisis of mind*. Hillsdale, NJ: Erlbaum.

Patkowski, M. (1990). Age and accent in a second language: a reply to James Emil Flege. *Applied Linguistics* **11**, 73–89.

Pinker, S. (1994). *The language instinct : how the mind creates language*. New York: William Morrow.

Valian, V. (1999). Rethinking learning: comments on *Rethinking innateness*. *Journal of Child Language* **26**, 248–53.

Reviewed by Richard P. Meier,
Department of Linguistics,
University of Texas at Austin