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Reviews

R. M. W. Dixon and Alexandra Y. Aikhenvald (eds.) (2002). *Word: a cross-linguistic typology*. Cambridge: Cambridge University Press. Pp. xiii + 290.

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This book addresses the intriguing issue of defining the 'word', a concept assumed by most linguists, but one whose precise meaning has proved difficult to establish.*

Three chapters deal with general issues bearing on the notion of the 'word': Chapter 1 (Dixon & Aikhenvald: 'Word: a typological framework'), the first part of Chapter 2 (Aikhenvald: 'Typological parameters for the study of clitics, with special reference to Tariana') and Chapter 11 (P. H. Matthews: 'What can we conclude?'). Most remaining chapters focus on phonological and grammatical words in specific spoken languages or groups of languages: Chapter 3 (Anthony C. Woodbury: 'The word in Cup'ik' – Alaska), Chapter 4 (John Henderson: 'The word in Eastern/Central Arrernte' – Central Australia), Chapter 5 (Dixon: 'The eclectic morphology of Jarawara, and the status of word' – Southern Amazonia), Chapter 7 (Robert Rankin, John Boyle, Randolph Graczyk & John Koontz: 'Synchronic and diachronic perspectives on "word" in Siouan' – aboriginal North America), Chapter 8 (Knut J. Olawsky: 'What is a word in Dagbani?' – Northern Ghana), Chapter 9 (Alice C. Harris: 'The word in Georgian' – South Caucasia) and Chapter 10 (Brian Joseph: 'The word in Modern Greek'). Besides presenting some general typological features of the languages studied, all of these chapters provide phonological and grammatical tests for phonological and grammatical words for each language, and mismatches between the two notions of word are identified. These usually involve clitic–host combinations (where two grammatical words correspond to a single phonological word) or some compounds or compound-like constructions (where one grammatical word corresponds to two or more phonological words).

The second part of Chapter 2 looks specifically at cliticisation in Tariana (spoken in Amazonia). Chapter 6 (Ulrike Zeshan: 'Towards a notion of "word" in sign languages') considers the word, including clitics and compounds, in various sign languages. The book also contains three indexes, organised by author, language and language family, and subject, respectively.

One of the most attractive features of this paper collection is the wide range of languages surveyed, belonging to various families and in general not very well known. In each chapter we can identify some unusual trait, such as the

* I am very grateful to Alexandra Y. Aikhenvald and R. M. W. Dixon, as well as to Sharon Hargus, for comments on an earlier version of this text.

property of synchronicity characteristic of sign languages (Chapter 6), the existence of 'bound adjectives' in Dagbani (Chapter 8), the occurrence of phrases embedded into words in Cup'ik (Chapter 3) or the presence of a constituent formed only of prefix + suffix in Jarawara (Chapter 5).

The book sets out with an overview chapter by Dixon & Aikhenvald. Besides raising a number of problems regarding the notion of 'word', the authors examine some of the traditional assumptions and confusions surrounding the concept. The crucial separation between the grammatical and the phonological notions of 'word' is made, and a set of well-defined criteria for identifying grammatical and phonological words is established. These criteria, listed in (1) and (2), are used in subsequent chapters as reference points.

(1) A GRAMMATICAL WORD consists of a number of grammatical elements which:
   a. always occur together, rather than scattered through the clause …;
   b. occur in a fixed order;
   c. have a conventionalised coherence and meaning. (p. 19)

(2) A PHONOLOGICAL WORD is a phonological unit larger than the syllable … which has at least one (and generally more than one) phonological defining property chosen from the following areas:
   a. *Segmental features* – internal syllabic and segmental structure; phonetic realisations in terms of this; word boundary phenomena; pause phenomena.
   b. *Prosodic features* – stress (or accent) and/or tone assignment; prosodic features such as nasalisation, retroflexion, vowel harmony.
   c. *Phonological rules* – some rules apply only within a phonological word; others … apply specifically across a phonological word boundary. (p. 13)

The selection of these criteria deserves a few comments. It is suggested that the grammatical criteria presented define grammatical words universally. Nevertheless, criterion (1b) seems irrelevant to sign languages, where elements within grammatical words occur simultaneously (see Chapter 6). Furthermore, however intuitive criterion (1b) may seem, in Chapters 4 and 7 some affixes are reported to occur in more than one position (see also Fulmer 1992 and Noyer 1994 for possible cases of 'mobile affixes'). Additionally, a major drawback of criterion (1c) is the difficulty of determining what is 'a conventionalised coherence and meaning' (as also noticed by Woodbury in Chapter 3). In Chapter 4, Henderson further observes that criterion (1c) may reflect phonological rather than grammatical words. This seems to leave criterion (1a) as the most reliable diagnostic to the grammatical word.

As far as phonological criteria is concerned, Dixon & Aikhenvald assume that none necessarily defines the phonological word in every language. Leaving aside sign languages, it seems to me that there has now been enough research to perhaps allow a stronger position. There is in fact one property that is essential for every independent phonological word, the presence (but not necessarily the location) of one (and only one) word-level stress (or accent). The presence of word-level stress and/or phonological phenomena that depend on it is reported to characterise phonological words in all the languages described in detail in this book. Notice that even a language like French – often said to have just phrasal

prominence – shows evidence for such a level of stress (for example, according to Ladd 1996 and Hannahs 1995, respectively, tonal distribution and blocking of glide formation can only be understood in terms of the presence of word stress). As well as the proposed cues to the phonological word, we might also identify two other phenomena where phonological words play a part (at least in some languages): clipping and deletion in partially identical coordinate structures (see Vigário 2003).

Although the editors' introduction looks like a tentative comprehensive overview on the topic, a thorough discussion on clitics is postponed to the first part of Aikhenvald's Chapter 2. Not included here or elsewhere in the book is a detailed synopsis of the questions raised by compounds and compound-like structures. This seems to me to be a major limitation on the coverage of constructions relevant to (and in several respects problematic for) the study of words – the topic of the book; constructions that are referred to in most of the chapters. Related to this, the possible distinction between 'syntactic words' and 'morphological words' is hardly mentioned.

The first part of Chapter 2 focuses on various parameters that can be used in the classification of clitics. This is a comprehensive review of most of the sorts of features that have been associated with clitics, resulting in a list of fifteen properties in terms of which clitics may be characterised. These include direction of cliticisation, selectivity regarding the host, position within the sentence, (im)possibility of forming independent phonological words, specific phonological properties of clitics, phonological cohesion between clitics and host, clitic combinations, their phonology and ordering, clitic position with respect to affixes, syntactic scope of clitics, possibilities of lexicalisation and semantic and morphological idiosyncrasies.

Among the numerous possible behaviours of clitics, one important one is not examined, however. It is said that clitics may be phonologically defective while their syntactic distribution may either be similar to or different from other types of words; nevertheless, the alternative of having clitics that have a 'defective' syntax but form an independent phonological word is not mentioned. Notice, nevertheless, that this possibility is not dismissed either, since such a state of affairs may obtain through the conjunction of specific choices in some of the parameters that may characterise clitics. Examples of elements that have the distributional patterns of clitics but behave like phonological words have been reported for some, though not many languages (e.g. Biko, Tagalog, Italian and European Portuguese – see Zwicky 1977, Anderson 1992: 204, Nespor 1999 and Vigário 2003: 152, respectively).

Another issue which deserves more detailed discussion concerns the possible types of phonological hosts for clitics and the various phonological relations between clitics and their hosts. There is a substantial amount of literature in Prosodic Phonology on the topic; clitics are reported to behave phonologically as incorporated or adjoined to a phonological word or a higher-level prosodic constituent (see Vigário 2003: ch. 1 for a review). By acknowledging the possibility that clitics may have different prosodic relations with their hosts, we accept that not all clitic–host combinations have to show the same phonology. This may be relevant, for instance, for understanding some of the Greek data presented by Joseph in Chapter 10, to which I return below.

Some further distinctions made in Chapter 2, but whose importance is perhaps not sufficiently emphasised since they are in general neglected in

subsequent chapters, concern the relation between stress and clitics, and the separation between phonological processes that belong to the lexical component and those that operate postlexically. The lack of word-level stress is an intuitive property of (phonological) clitics – this is why they require a host to lean on. However, in many languages, clitics may *end up* bearing primary word stress (see e.g. Chapters 2, 4, 7 and 9). To enable the reader to understand the precise status of 'little elements', it might have been made clearer that some units may be postlexically reduced, while others may be lexically unstressed, but end up stressed either through postlexical incorporation into a phonological word and consequent operation of phonological word stress, or because they occupy a position in the prosodic tree which bears a higher level of prominence. Notice that, at first glance, postlexical incorporation and prosodic word stress assignment may give the impression that there are languages with no clitics, as Dixon claims for Jarawara (Chapter 5). Also, the existence of clitics bearing (postlexical) stress may seem to suggest that lack of stress is not a fundamental property of phonological clitics. However, if the distinction between lexical and postlexical phonology is recognised, the absence of stress may be assumed to characterise all phonological clitics *at some point in grammar*.

These limitations may be due to the fact that most of the languages considered are not very well studied. They may also result from the editors' goal that the language descriptions should be as far as possible stripped of theoretical assumptions. This is understandable in the sense that such assumptions are often specific to a given framework and quickly become dated. Nonetheless, in my view this goal does not preclude the production of theoretically informed descriptions. To the extent that some of the papers do not present enough relevant data on several points that are currently in debate in morphological and phonological circles, the specialised reader may feel that some descriptions are rather superficial or general.

The book contains a few more or less controversial proposals with theoretical implications, often bearing on the status of clitics. In several chapters it is suggested that there is a 'continuum, from a fully bound to a fully independent morpheme' (Aikhenvald: p. 43), as clitics may show various degrees of affix-like and word-like properties (Chapters 2, 7 and 8). Joseph goes a step further by arguing that 'clitic' is simply not a basic linguistic category. The claim is supported by the fact that 'little elements' in Greek do not behave homogeneously, as some pattern like affixes with respect to some phenomena and others behave more like independent units. Here, it would have been revealing to see the proposal evaluated against alternative views incorporating the separation of lexical and postlexical components (e.g. Arvaniti 1992) and/or allowing different prosodic organisations of clitic–host combinations. Matthews' closing chapter is possibly the most controversial: phonological distinctions among words are questioned and those between words and phrases are presumed to be not necessarily universal, and the status of the clitic as a linguistic prime is cast in doubt, in the spirit of Joseph's claim. Some proposals also relate to prosodic structure: on the basis of phonological evidence, Woodbury distinguishes between 'PW', corresponding to a grammatical word plus enclitics, and 'PW– ', consisting of a grammatical word minus enclitics, and Henderson suggests that prosodic words in Eastern/Central Arrernte can behave as groups within a higher prosodic word. Again, the separation between lexical and postlexical components might be useful to account for the data observed.

Given that every chapter is written in a very clear style, and there are few theoretical assumptions, the book can be used by a wide range of readers, including students interested in the topic or in specific features of not very well-known languages. Researchers working on morphology or phonology may find some descriptions rather superficial, but they will also encounter linguistic data that will be most valuable for drawing generalisations about the grammars of languages, together with peculiarities that constitute a challenge to anyone aiming at understanding the scope and limits of grammatical variation.

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Edmund Gussmann (2002). *Phonology: analysis and theory*. Cambridge: Cambridge University Press. Pp. xiii + 234.

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This book is intended to serve as an introductory text in phonology for students with no previous background in the discipline, but with basic knowledge of phonetic terminology and transcription and some general linguistic concepts. Gussmann does not attempt to give a survey of alternative theoretical models of phonological analysis, nor a thorough introduction to a particular formal model. Instead, he seeks to 'identify a body of data that most or perhaps all models would regard as calling for a phonological description' (p. ix), and to provide a very general framework within which hypotheses about such data can be proposed and evaluated – the leitmotif of the book being that while 'models come and go, problems remain' (p. xi). However, though Gussmann claims not to adopt any specific theoretical doctrine or theory explicitly, his theoretical preferences are reflected quite strongly throughout the book, as Gussmann freely admits in the preface and as will be evident from the discussion below.

The book consists of nine chapters of roughly even length, which, along with some supplementary reading material from other sources, could provide the basis for a semester-long introductory course at the undergraduate level. The organisation of the subject matter covered is as follows. Chapter 1 ('Sounds and segments') introduces the notion of phonological segments, discusses contextual variability in the phonetic manifestation of such entities and explains such concepts as alternation and complementary distribution. In Chapter 2 ('The melody and the skeleton'), Gussmann argues that phonological segments are complex entities consisting of melodic units associated with skeletal slots, and posits an Association Condition to the effect that in order to be phonetically manifested ('pronounceable phonological expressions', p. 23), melodic elements must be associated with one or more skeletal positions and *vice versa*. Chapter 3 ('Domains and phonological regularities') carefully examines the question of what constitutes a domain within which phonological generalisations are enforced. Gussmann concludes that though phonological domain structure often mirrors its morphological counterpart fairly closely, the former is in fact independent of the latter. Among other things, Gussmann argues for the existence of 'pseudo-morphemes', complex phonological domain structure that is not motivated by (real) morphological structure, e.g. to explain the anomalous occurrence of intervocalic [ŋ] in English *dinghy* and *hangar* (as [[dɪŋ]i] and [[hæŋ]ə], respectively).

The remainder of the book is almost exclusively devoted to syllables, syllable structure and related issues. Chapter 4 ('The syllable') introduces Gussmann's conception of syllabic constituents as a level of phonological structure independent of both the skeletal and the melodic levels. The phonological syllable is claimed to consist of two obligatory constituents, an Onset (O) and a Rhyme (R). The latter obligatorily contains a Nucleus (N) and, if N is not branching, potentially an extranuclear skeletal slot as a rhymal complement

(i.e. a coda); O, R and N may each be at most binary branching. An important claim is that the level of syllable structure is not derivative of other levels, and that syllabic constituents are thus *not* projections of vocalic or consonantal melodies. Consequently, an N can be melodically empty (containing an unassociated skeletal position), and an O can likewise be phonetically inaudible in one of two ways: by containing a bare skeletal position (as in French *h-aspiré* words) or by having no content at all, even at the skeletal level (e.g. in genuinely vowel-initial words). Chapter 5 ('More on codas') elaborates on this general framework of analysis, arguing that word-final consonants are in fact onsets, and that the occurrence of a coda consonant (and, in many cases, certain aspects of the phonetic content of that consonant) must be licensed by the presence of a following onset. Gussmann examines /sC(C)/ consonant sequences in detail, and argues that /sC/ is never a branching onset, but rather a coda + onset sequence or else an onset + nucleus + onset sequence (with an intervening empty nucleus); an English word like *student* is thus in fact quadrisyllabic, /∅s.tjuː.dən.t∅/. Chapter 6 ('Some segmental regularities') re-examines the notion of the segment inventory in light of the structures established in previous chapters, by looking at a variety of phenomena which fall under the general heading of positional neutralisation: Turkish vowel harmony, English and Russian vowel reduction, German final devoicing, Polish nasal vowels and Icelandic coda spirantisation.

Chapter 7 ('Syllable structure and phonological effects: quantity in Icelandic') constitutes a detailed case study of Icelandic vowel length and the evidence it provides about the syllabic affiliation of surrounding consonants: a long V indicates that a following C is an onset, a short V that it is a coda. The analysis of Icelandic is extended in Chapter 8 ('Segmental double agents'), where it is argued that in certain [sC] clusters such as [sl], [s] may syllabify as a coda in particular words but as an onset (of a syllable with an empty N) in others. Other potential 'double agents' considered in this chapter include Russian [v] (sonorant in some contexts but obstruent in others), Polish [x] (velar in some words, placeless in others) and Welsh [ɨ] (front in some words, back in others). The final chapter of the book (Chapter 9, 'Words and feet: stress in Munster Irish') is again a detailed case study, serving to introduce metrical foot structure as an additional level of phonological representation. In Munster Irish, left-headed feet are erected upon (non-empty) syllable nuclei, and stress falls on the (head of) the second foot of a word, with certain well-defined exceptions.

Though the cases cited as illustrative examples in the book are often quite interesting and challenging – not always the usual suspects one expects to encounter in an introductory text – the range of languages is somewhat disappointing. Examples are drawn from a very small number of languages, all spoken in Europe, nearly all of which represent four branches of the Indo-European family: Germanic (Old English and various dialects of Modern English, German, Dutch, Icelandic), Romance (French, Italian), Slavic (Polish, Russian) and Celtic (Irish, Welsh). The only non-Indo-European languages featured are Turkish and Finnish. Regarding Turkish, its vowel-harmony system is outlined on pages 119–123, and optional deletion of [h j v] with compensatory vowel lengthening is briefly discussed on pages 29–30 as evidence for a separate skeletal tier. Earlier in the same chapter (pp. 24–25), Finnish long vowel shortening and short vowel deletion before superlative /-in/ are also adduced as evidence for skeleton–melody separation: both phenomena are

interpreted as 'mechanical consequences of the suppression of a single skeletal position' (p. 25). However, the facts of short vowel deletion in Finnish are far more complex than Gussmann suggests (see Karlsson 1999: §16). The only stem-final vowels that delete before superlative /-in/ are /a æ e/ (not e.g. /u/ or /ø/), and deletion of /a/ is only consistent before this particular suffix whereas in other similar contexts it may instead remain intact or alternate with /o/, depending on a variety of factors. By the logic applied by Gussmann himself to [l] ~ [lʲ] alternations in Muskerry Irish a few pages earlier, we can only conclude that the vowel ~ zero alternations observed in Finnish adjectives should in fact 'not be regarded as belonging to phonology proper' (p. 11).

Factual errors or misinterpretations of this kind are unfortunately commonplace in phonology textbooks, and Gussmann certainly does no worse than others in this respect. On the contrary, his presentation of descriptive facts is typically very careful, with an attention to detail that is unusual for the genre. This is particularly evident in his discussion of Icelandic phonology (throughout the book, but particularly in Chapters 7 and 8), which covers various generalisations overlooked or ignored by the standard descriptive sources. In fact, I suspect that it is Gussmann's general concern for empirical accuracy that lies behind his decision to circumscribe so narrowly the range of languages and phenomena dealt with in the book.

Another laudable aspect of the book is the fact that all data are consistently presented in IPA transcription, avoiding the misunderstandings and misinterpretations that often arise from the use of many different (and inconsistent) transcription or transliteration systems. More textbooks should follow Gussmann's example in this respect. At times, though, the reliance on IPA transcription provides a false sense of security. In his discussion of aspiration in English *vs*. Icelandic (pp. 4–6), Gussmann juxtaposes English words like *plate* [pl̥eɪtʰ] with Icelandic *plata* ['pʰlaːtʰa] 'disc', etc. As the discussion surrounding these examples clearly suggests, Gussmann assumes that in English, sonorants occurring after an (otherwise aspirated) plosive are voiceless whereas the same is *not* true in Icelandic. This premise is erroneous, however, and is based on an overinterpretation of what are merely distinct conventionalised traditions of phonetic transcription, incorporating different degrees of phonetic detail. Phonetically, both languages treat clusters like *pl* the same way: the stop closure is released directly into the sonorant (i.e. in close transition) and consequently the phonetic aspiration of the stop (a long VOT lag) is superimposed in its entirety on the sonorant. Thus both of the above examples should either be transcribed (narrowly) with [pl̥] or possibly [pˡl] or else (more broadly) as [pʰl]. This example highlights the extent to which phonological analysis is dependent on phonetic transcription, which itself constitutes a partial *analysis* of phonetic realities rather than the 'pure facts' as such – a useful reminder for beginning students of phonology.

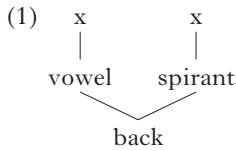
As mentioned in the outline above, the book is largely devoted to syllable structure and the way this level of phonological organisation is reflected in segmental phonotactics. Subsegmental structure (e.g. features and their interactions) is dealt with in an extremely cursory fashion – the term 'distinctive feature' is not introduced at all in the book, and the feature-like labels that are used are mostly taxonomic-phonetic terminological shorthand. For example, the brief outline of the basic aspects of Turkish vowel harmony (pp. 119–123) only hints in the direction of autosegmentality, and Gussmann simply concludes

the discussion in the following way: 'Although we cannot go into the issue much further here, it is clear that the melodic tier must be seen as broken up into or consisting of independent subtiers. Contemporary phonology has devoted a lot of research to the study of tier structure' (p. 123). What little discussion there is of phonological harmony does not even raise the important issue of locality (e.g. transparency and opacity effects). Similarly, there is no mention whatsoever of tonal phonology in the book.

True, Gussmann states quite explicitly in the preface that this textbook 'should not be viewed as a survey of the various types of phonological regularities in existence' (p. x), and at the end of Chapter 6 he refers the reader to Lass (1984) and Kenstowicz (1994) for such surveys. However, the result is that from this textbook alone, the student reader gets a somewhat impoverished perspective on the range of issues dealt with by phonological theory and of the phenomena that provide evidence bearing on those issues. In my view, this is the biggest drawback of the book, making it less suitable as the sole (or even the main) textbook in an introductory course in phonological theory. Many readers will no doubt also find it inconvenient that Gussmann's treatment of syllable structure and phonotactics is couched in terms specific to government-based (also known as principles and parameters) approaches to phonology, replete with empty syllable nuclei – cf. the above example, where English *student* is phonologically quadrisyllabic and lacks a word-initial onset. For instructors wishing to use this framework as the theoretical backdrop of an introductory phonology course, this textbook answers a very real need which should not be downplayed; for others, it is less useful as a general purpose textbook. Though I count myself as belonging in the second category, there are portions of the book that I would definitely consider adopting as supplementary reading material in an introductory course. In particular, I found Chapter 3 to provide an especially lucid and theory-transcending discussion of how to identify and interpret phonological regularities, evaluate potential counterevidence and in general how to structure a phonological argument.

As stated in the preface, Gussmann's emphasis is not on 'formalising … definitive answers' (p. x), but the analytical approach to which he introduces the reader is decidedly formal in nature. On such an approach, careful and explicit formulation of individual theoretical constructs and assumptions is of utmost importance, especially in an introductory text of this kind. I found the book to be somewhat lacking in this area. For example, the notion is introduced in Chapter 2 that observed (phonetic) pronunciations are *interpretations* over phonological representations. Likewise, Chapter 3 introduces the vague notion referred to as 'the phonetic effect', whereby certain (often systematic) sound properties are 'in some sense … not essential or are accidental' and have 'little phonological significance' (p. 64) – including the palatality of German [ç] *vis-à-vis* [x]. The abstract relationship of phonological representations to phonetic realities is evident from the discussion of English plural [-z]∼[-s]∼[-ɪz] alternations in Chapter 2. All three are seen as 'interpretations' of a single phonological representation (with [ɪz] on the melodic tier) – under certain conditions, the [ɪ] melody is 'de-associated from its skeletal position' (p. 40), and the [z] 'adjusts itself in voicing' (p. 35), presumably all as part of the phonology–phonetics mapping relation referred to as 'interpretation'. However, the interpretation relation is never given any kind of formal definition or characterisation; just how abstract is it allowed to be? Can elements other

than associations be introduced/removed (e.g. features, or even entire segments)? Can a particular phonological melody be 'interpreted' as a different melody (/p/ as [f], say)? How do different constraints on the interpretation relation interact with one another – e.g. why is the voicing adjustment in /z/ dependent on the de-association of the /ɪ/ in the English plural – and so forth? A related area where more attention to explicit formalisation would have been desirable is in the discussion of conditions and constraints. A typical example is the formulation of German Backness Sharing, which on page 62 is defined as follows:



The intended effect of this constraint is an implicational statement: *if* a back vowel is followed by a spirant which (otherwise) has no place specification of its own, *then* that spirant must share the [back] property of the vowel. However, it is hard to see how the formalisation in (1) is restricted to this particular reading and no others. What is it about (1) that makes it not require *all* spirants to be [back] after [back] vowels, as opposed to just placeless spirants? Why would (1) not mean that before a [back] spirant, a vowel (which otherwise may not be [back]) must share the [back] property of the spirant – or does it? And why would it not mean that the only vowel–spirant sequences allowed at all in German are [back]-sharing ones? This and other similar examples highlight the need for supposedly formal constructs to be given an explicit formal grounding. Otherwise, we run the risk of encouraging habits of sloppy argumentation and a disregard for formal rigour in our students.

On the editorial side, there is a significant number of typographical errors and inconsistencies in representational diagrams throughout the book. Association lines sometimes link the wrong elements, e.g. in (23) on page 136, or are missing, as in the first branching O in (14) on page 104, or superfluous, as where a branching N dominates a single skeletal position in (26b) on page 139. Empty (nuclear) skeletal slots have an association line descending from them on pages 33–34, 38 and 85, but not elsewhere; examples (26) on pages 138–139 and (20a) on page 169 combine both practices for different empty nuclei within a single representation. In some cases constituents are wrongly affiliated, e.g. the final N in (5) on page 95, or reside on the wrong tier, as with all O nodes in (14) on page 104, and a word-final empty R/N structure is missing entirely in (25) on page 85. A particularly confusing error is found in (25) on page 218: it appears that in (25a), the second foot should dominate a single branching N rather than two non-branching ones, and in (25b) the first foot should dominate a non-branching N and not a branching one.

What makes such mistakes and inconsistencies all the more unfortunate is the fact that the representations assumed by Gussmann are often debatable and not justified explicitly enough in the text. For example, the German agentive suffix *-er* [-ɐ] is analysed in (46) on page 150 as being an /r/ in onset position, surrounded on both sides by empty nuclei, i.e. *Bildner* ['bɪldnɐ] 'sculptor' is really /bɪl.dØ.nØ.rØ/. Why not instead treat [ɐ] as syllabic /ɾ̩/, i.e. as a dependent

of N rather than of O, yielding /bɪl.dØ.nɻ/? On page 129, in the analysis of English [təˈrenʃɻ] (alongside [tɔˈrenʃəl] as a variant pronunciation of *torrential*) and similar examples, Gussmann takes /l/ to be simultaneously affiliated with both the onset of a word-final syllable (with an empty nucleus) and the nucleus of the preceding syllable – in effect, /tə.ren.ʃl̪͡.lØ/. Why not instead assume trisyllabic /tə.ren.ʃl̪/, i.e. why should we assume that [l] remains a word-final onset in both pronunciation variants? No doubt there are reasons for Gussmann's choices in these particular cases, but the reader is left in the dark on what they might be.

In the text itself, typographical mistakes are relatively few and far between, though I noticed a small number of such errors in IPA transcriptions and orthographic representations here and there, mostly of little consequence. Example (45) on page 149 is an unusually egregious case (*Biler* and *Bilner* instead of *Bilder* and *Bildner*; [ˈbɪtnɪs] and [ˈbɪdnɐ] instead of [ˈbɪltnɪs] and [ˈbɪldnɐ]). A potentially confusing mistake occurs in the text at the top of page 41, where a statement about the distribution of English dark [ɬ] must instead be taken to refer to clear [l], its allophonic counterpart.

As an introductory textbook in phonology, this book is unusual in many respects. While it devotes a great deal of attention to the basic underpinnings of phonological argumentation and theory-building, and does so quite well for the most part, it falls short on various fronts as a general purpose introductory text. Its particular theoretical slant, though no doubt welcomed by many, will likely make the book less appealing to a great number of potential users. The same applies to the limited coverage of phonological phenomena and analytical issues that go beyond the relation between syllable structure and segmental phonotactics. However, both shortcomings can likely be balanced out by careful selection of additional material with which to supplement the book on a course reading list.

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Bruce Tesar and Paul Smolensky (2000). *Learnability in Optimality Theory*. Cambridge, Mass.: MIT Press. Pp. vii + 140.

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This review is not only for people interested in learnability in OT, but for everybody who believes in OT's claim of FACTORIAL TYPOLOGY, i.e. the prediction that all language types generated by a permutation of the rankings of the constraints are attestable human languages. Learnability considerations are capable of shooting holes in that claim. As the study of formal models of language acquisition, learnability theory is capable of making precise predictions not only about how children acquire the same language as their parents, but also about acquisition-induced language change (e.g. Clark & Roberts 1993, Lightfoot 1999, Jäger 2003), with typological consequences. Although the authors do not discuss such issues, I will address in this review a couple of typological points that can be extracted directly or indirectly from the book.

For the most part, the book is a slightly edited or re-edited collection of earlier work. §7.6 on Recursive Constraint Demotion and Chapter 8 on production-directed parsing are from Tesar's 1995 dissertation, while Chapters 1–3 and 5–7 (up to §7.5) constitute the authors' article in *Linguistic Inquiry* (1998), which again mainly recapitulated or copied Tesar (1995). Chapter 4, 'Overcoming ambiguity in overt forms', is relatively new work. This chapter is the latest and perhaps final version of a paper that appeared four times earlier in various forms (Tesar 1997, 1998, 1999, 2000); unlike these earlier versions, it acknowledges the fact that the proposed learning algorithm *fails* for some possible and perhaps attested grammars.

The reader might think that in noting this record amount of recycling, I am advising against buying this book. The opposite is true. Anybody interested in learnability in OT (and anybody interested in possible holes in factorial typology) should buy it and forget about reading the earlier work (i.e. Tesar & Smolensky 1993, 1996, 1998, Tesar 1995, 1997, 1998, 1999, 2000). This is possible because this book incorporates all relevant parts of that earlier work (obsolete versions of their learning algorithms, like Batch Constraint Demotion, are ignored), and because it does not redefine or reinterpret that earlier work at all. In other words, the book supersedes the earlier work by virtue of finishing it (Chapter 4) or leaving it as it was (the other chapters).

The oldest part of the acquisition model presented in the book is Error-Driven Constraint Demotion (EDCD). This is an algorithm capable of turning a current child grammar (i.e. an intermediate stage at some point during the acquisition process) into a new child grammar (the next stage) on the basis of a single piece of incoming language data. Consider a child grammar as in (1). This is a PRODUCTION TABLEAU, i.e. an underlying form is given, and a surface structure will have to be chosen (since we will have to distinguish three kinds of representations, I will denote underlying forms with pipes, surface structures with slashes and overt forms with square brackets).

(1) *Before EDCD* (*fully informed*)

$\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$	TROCHAIC	IAMBIC	FEETR	FEETL
a. $/(\acute{\sigma}\,\sigma)\,\sigma\,\sigma/$		*	*!*	
✓ b. $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$	*!		**	
c. $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$		*	*!	*
d. $/\sigma\,(\sigma\,\acute{\sigma})\,\sigma/$	*!		*	*
☞ e. $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$		*		**
f. $/\sigma\,\sigma\,(\sigma\,\acute{\sigma})/$	*!			**

The underlying form is $\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$, i.e. a sequence of four syllables not marked for stress (we assume that this language has no lexical stress). Based on the ranking of the constraints, the output of the grammar will be $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$, i.e. a right-aligned trochaic foot preceded by two extrametrical syllables. This is represented by the familiar pointing finger. Now suppose (unrealistically, as we will see) that we tell the child explicitly that the actual form in the language she is trying to acquire is $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$, i.e. a left-aligned iambic foot followed by two extrametrical syllables (this is possible if the adult grammar has the rankings IAMBIC ≫ TROCHAIC and FEETL ≫ FEETR). This form happens to occur in the child's tableau, which we represent with a check mark. Now that the child's form and the adult form are different, EDCD will take action by looking up the highest-ranked constraint that prefers the adult form to the learner's form (i.e. IAMBIC) and demoting all the even higher-ranked constraints that prefer the learner's form (in this case, only TROCHAIC) below this pivotal constraint. The constraint TROCHAIC thus ends up with the same ranking as FEETR. The resulting new grammar is in tableau (2).

(2) *After first EDCD*

$\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$	IAMBIC	TROCHAIC	FEETR	FEETL
a. $/(\acute{\sigma}\,\sigma)\,\sigma\,\sigma/$	*!		**	
✓ b. $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$		*	*!*	
c. $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$	*!		*	*
d. $/\sigma\,(\sigma\,\acute{\sigma})\,\sigma/$		*	*!	*
e. $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$	*!			**
☞ f. $/\sigma\,\sigma\,(\sigma\,\acute{\sigma})/$		*		**

The adult form $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$ has now become better in the child's grammar than the child's former form $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$, although a third form ($/\sigma\,\sigma\,(\sigma\,\acute{\sigma})/$) is now optimal in the child's grammar. The fact that the adult and child forms are still different means that we can apply EDCD again on the same underlying form. The pivotal constraint is FEETL, and FEETR is the only constraint that has to be moved below it. This leads to tableau (3). The child's form is now identical to the adult form, and EDCD will stop chewing on the underlying–surface pair $\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$ – $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$.

(3) *After second EDCD*

$\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$	IAMBIC	TROCHAIC	FEETL	FEETR
a. $/(\acute{\sigma}\,\sigma)\,\sigma\,\sigma/$	*!			**
✓☞ b. $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$		*		**
c. $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$	*!		*	*
d. $/\sigma\,(\sigma\,\acute{\sigma})\,\sigma/$		*	*!	*
e. $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$	*!		**	
f. $/\sigma\,\sigma\,(\sigma\,\acute{\sigma})/$		*	*!*	

The learner can now go on to learn from other underlying–surface pairs like $\lvert\sigma\,\sigma\,\sigma\rvert - /(\sigma\,\acute{\sigma})\,\sigma/$ and $\lvert\sigma\,\sigma\,\sigma\,\sigma\,\sigma\rvert - /(\sigma\,\acute{\sigma})\,\sigma\,\sigma\,\sigma/$. But the grammar in (3) already happens to work correctly for those pairs, since the ranking is that of an iambic left-aligning language. So this example was a quick success, in which only a single informative form was needed to establish the adult ranking. In general, however, EDCD will require several different pairs of underlying forms and surface forms before homing in on the target language. In the book, Tesar & Smolensky show that if the learner is given enough randomly selected pairs of underlying form and surface structure, EDCD will eventually change the grammar in such a way that it assigns correct surface structures to all underlying forms. In other words, EDCD is guaranteed to succeed when full structural descriptions of surface forms are given.

But full structural descriptions of surface forms are not generally provided to the learner. In reality, the child only hears the overt form $[\sigma\,\acute{\sigma}\,\sigma\,\sigma]$, not the phonological structure $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$, i.e. she may be able to hear which syllable is stressed, but the foot structure is hidden. Tesar & Smolensky now propose that the learner uses her OT grammar to infer a surface structure from the overt form. Thus, if her current constraint ranking is as in (1), i.e. trochaic right-aligning, the learner will interpret the overt form $[\sigma\,\acute{\sigma}\,\sigma\,\sigma]$ as the phonological structure $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$. The INTERPRETATION TABLEAU (4) shows how this works (both candidates have stress on the second syllable, so that they are compatible with the given overt form).

(4) *Grammar-guided interpretation by the learner*

$[\sigma\,\sigma\,\sigma\,\sigma]$	TROCHAIC	IAMBIC	FEETR	FEETL
a. $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$	*!		**	
☞ b. $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$		*	*	*

Tesar & Smolensky call this ROBUST INTERPRETIVE PARSING (RIP): the learner will assign to the overt form a structure that minimally violates her constraint ranking, even if this structure is ungrammatical in her own production (as it is here, because she would produce an underlying $\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$ as $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$). This makes a large difference for EDCD, which is now given not the correct adult form, but a possibly incorrect form that results from the child's interpretation. Instead of (1), we now have (5).

(5) *Before EDCD* (*partly informed*)

$\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$	TROCHAIC	IAMBIC	FEETR	FEETL
a. $/(\acute{\sigma}\,\sigma)\,\sigma\,\sigma/$		*	*!*	
b. $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$	*!		**	
✓ c. $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$		*	*!	*
d. $/\sigma\,(\sigma\,\acute{\sigma})\,\sigma/$	*!		*	*
☞ e. $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$		*		**
f. $/\sigma\,\sigma\,(\sigma\,\acute{\sigma})/$	*!			**

EDCD will demote FEETR below FEETL. This leads to tableau (6), where $/(\acute{\sigma}\,\sigma)\,\sigma\,\sigma/$ has become the child's form.

(6) *After EDCD* (*partly informed*)

$\lvert\sigma\,\sigma\,\sigma\,\sigma\rvert$	TROCHAIC	IAMBIC	FEETL	FEETR
☞ a. $/(\acute{\sigma}\,\sigma)\,\sigma\,\sigma/$		*		**
b. $/(\sigma\,\acute{\sigma})\,\sigma\,\sigma/$	*!			**
c. $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$		*	*!	*
d. $/\sigma\,(\sigma\,\acute{\sigma})\,\sigma/$	*!		*	*
e. $/\sigma\,\sigma\,(\acute{\sigma}\,\sigma)/$		*	*!*	
f. $/\sigma\,\sigma\,(\sigma\,\acute{\sigma})/$	*!		**	

The learner can try to proceed by processing the same overt form $[\sigma\,\acute{\sigma}\,\sigma\,\sigma]$ again. The interpretation is again $/\sigma\,(\acute{\sigma}\,\sigma)\,\sigma/$, as in (4), since TROCHAIC is still top-ranked. The learner will therefore demote FEETL below FEETR (imagine a check mark for the third candidate), and return to the situation in (5). This is an example of the general way in which RIP/CD (i.e. RIP with EDCD) can get stuck: because of a non-adult-like interpretation of overt forms, the learner will rerank the wrong constraints and end up visiting an eternal cycle of inadequate grammars, i.e. grammars that produce a non-adult-like overt form for at least one underlying form. In the example at hand, no sequence of adult overt forms $[\sigma\,\acute{\sigma}\,\sigma]$, $[\sigma\,\acute{\sigma}\,\sigma\,\sigma]$, $[\sigma\,\acute{\sigma}\,\sigma\,\sigma\,\sigma]$ will lead to a correct reranking of the two foot-form constraints TROCHAIC and IAMBIC; only if the language contains the disyllabic form $[\sigma\,\acute{\sigma}]$ will the learner be able to rank these constraints correctly and ultimately come up with an adequate grammar.

This is the most interesting point that Tesar & Smolensky make. The algorithm (RIP/CD) can fail to converge on a correct ranking for the target language. Of course, the success of the algorithm will depend on the initial ranking of the constraints. Tesar & Smolensky describe a computer simulation of a metrical stress example with twelve constraints, starting with all constraints having the same ranking. They fed RIP/CD with 62 overt forms (from two to seven syllables, with varying syllable weights and varying main and secondary stresses) from each of 124 artificial languages. Only 75 of those languages were learned correctly by RIP/CD. When starting with high-ranked constraints for foot form (trochaicity and iambicity), the number of successes rose to 94. When the weight-to-stress principle was initially raised above even the foot-form

constraints, the number rose to 120. Your reviewer is somebody who wants to check such claims, so I recreated Tesar & Smolensky's metrics grammar in the Praat program (www.praat.org), giving 62 tableaux, with a total of 15,344 candidates and 370,404 violation marks. I then taught ten groups of 124 virtual learners the same 124 languages as Tesar & Smolensky did (Bruce Tesar kindly supplied the 124 sets of 62 overt forms). Although the overt forms were presented to every learner in the same order (beginning with the shortest forms), the ten learners of a particular language sometimes performed in slightly different ways, because in interpretation several candidates may tie for optimality, and the learner has to choose randomly from them. With an equal initial ranking, the average number of successful learners was 72·1, with an initial high ranking of the foot-form constraints, it was 92·1, and with an initial high ranking of weight-to-stress, it was 114·5. These averages are slightly lower than the ones reported by Tesar & Smolensky, probably because of a different handling of ties in interpretation (Tesar (personal communication) says that when two candidates tied for optimality in their simulations, Tesar & Smolensky deterministically but unrealistically chose the one that happened to occur earlier in the tableau).

The high performance of RIP/CD reported by Tesar & Smolensky depends on several assumptions. To see this, I considered 36 supergroups of ten groups of 124 learners. The supergroups varied with respect to the order of presentation of the overt forms: for one third of the learners the forms were presented in Tesar & Smolensky's cyclically applied fixed short-to-long-order, one third heard each cycle of 62 overt forms in randomly permuted order and one third heard the data randomly drawn from the 62 possible forms, which arguably resembles best the actual acquisition process. The supergroups also varied with respect to the handling of tied constraints: one half of the learners allowed crucial ties, i.e. constraints whose violation marks count together if they are ranked at the same height, as in Tesar & Smolensky's simulations; since crucial ties may be unrealistic (for how can one weigh a single violation of the binary constraint NON-FINALITY against multiple violations of the gradient constraint FEETL?), the other half of the learners had the variationist interpretation of tied constraints (Anttila 1997), in which constraints are randomly ordered at each evaluation if they have the same ranking (this can be simulated in Praat by using a tiny bit of evaluation noise). The supergroups furthermore varied with respect to their initial rankings, as before: one third of the learners started with equal rankings, one third with high foot-form constraints and one third with even higher weight-to-stress. Finally, the supergroups varied with respect to how often every single datum was processed: one half of the learners was allowed to chew five times on each language datum, and to backtrack if this form did not become grammatical (Tesar & Smolensky, p. 69); the other half interpreted and reproduced each datum only once, with no backtracking. It turned out that on average: (i) a group of 124 learners who hear the fixed order acquires six more languages than a group of 124 learners who hear randomised or random orders; (ii) learners with crucial ties acquire twelve more languages than those with variationist ties; (iii) the number of chews on each language datum did not have any effect on acquisition performance; and (iv) learners with the foot-form-high initial state acquired seventeen languages more than learners with an equally ranked initial state, but eighteen languages fewer than learners with an initial state in which weight-to-stress was ranked even higher.

It is not generally bad for a learning algorithm to fail on certain input data. In fact, Eisner (2000) shows that such failures must be expected from *any* OT learning algorithm when the language data are only partially known (as is the case with overt forms): Eisner showed that for any learning algorithm and every size of the constraint set one can construct a combination of constraints, candidates and a surface-to-overt mapping for which the learning algorithm, in order to be 100 % successful, would not be qualitatively faster than enumerating all possible rankings, which is impractical for real language learners. If, then, an OT learning algorithm can predict that certain constraint rankings are unlearnable, and exactly these rankings turn out not to occur in the languages of the world, such an unlearnability result constitutes positive support for that algorithm. Any of the following things may influence learnability: the constraint set (according to Apoussidou & Boersma 2003, there is no ranking of Tesar & Smolensky's twelve constraints that can describe Latin stress if there is main stress only), the initial hierarchy (as Tesar & Smolensky show), the order of presentation of the data (perhaps the children pay attention to shorter forms first), or details of the learning algorithm. As an example of the latter, pride forced me to have a look at what the performance would be if EDCD is replaced with GLA (Boersma & Hayes 2001), an algorithm that indiscriminately promotes the ranking of all the constraints that prefer the adult form over the child's form (in (1) these are IAMBIC and FEETL) and demotes the ranking of all the constraints that prefer the child's form over the adult form (in (1) these are TROCHAIC and FEETR). Compared to RIP/CD with randomly drawn language data and variationist ties, a group of 124 RIP/GLA learners acquired eleven languages more (averaged over the three different initial states), which is comparable to the performance of RIP/CD with crucial ties. It is clear that much research is needed to find out whether there is any combination of algorithms, constraint sets and initial states that accurately predicts the learnability of attested languages and at the same time is capable of showing that many attested gaps in the factorial typology are not accidental, but can be explained by the formal unlearnability of such languages. An example of such research is Jäger (2003), who goes even further by predicting not only some learnable and unlearnable languages but also some learnable but diachronically unstable languages.

While the typological gaps predicted by the metrical examples of Chapter 4 are the result of complicated constraint interactions and therefore hard to explain, Chapter 5 contains an example from which we can easily produce a prediction of a straightforward typological gap. In § 5.2 Tesar & Smolensky discuss the learning of underlying forms by means of lexicon optimisation. Their example is the German overt paradigm [tak ~ tagə] 'day ~ days'. Since German has voice neutralisation word-finally and a voicing contrast intervocalically, the underlying paradigm must be |tag + ∅ ~ tag + ə|, and a possible OT explanation for the surface forms is Lombardi's (1999) ranking ONSETFAITH ≫ *[+voi] ≫ FAITH, as shown in (7) (subscript <voi> in the tableaux below indicates that voice has been deleted; subscript [voi] that it has been inserted).

(7) *Final devoicing in German: production*

|tag+∅ ~ tag+ə|	OnsetFaith	*[+voi]	Faith
a. /tag ~ tagə/		**!	
☞ b. /tag$_{<voi>}$ ~ tagə/		*	*
c. /tag$_{<voi>}$ ~ tag$_{<voi>}$ə/	*!		**

Tesar & Smolensky show that the underlying paradigm is learnable. In the LEXICON-OPTIMISATION TABLEAU (8), several candidate underlying–surface pairs are compared, under the condition that the surface paradigms share the given overt paradigm [tak ~ tagə].

(8) *Final devoicing in German: lexicon optimisation*

[tak ~ tagə]	OnsetFaith	*[+voi]	Faith
☞ a. |tag+∅ ~ tag+ə| – /tag$_{<voi>}$ ~ tagə/		*	*
b. |tak+∅ ~ tak+ə| – /tak ~ tak$_{[voi]}$ə/	*!	*	*

The first pair of underlying and surface paradigms violates Faith (final devoicing), whereas the second pair violates both OnsetFaith and Faith (intervocalic voicing). Note that the constraint *[+voi] evaluates surface forms only, and thus has no preference for either of the two paradigm candidates. The first candidate, which is appropriate for German, wins, independently of the ranking of the constraints, so that we can conclude that this German alternation is learnable. But now consider a language that I will call 'anti-German', a hypothetical language with final voicing contrasts but with intervocalic voicing. Such a language is predicted by a ranking like the one in tableau (9).

(9) *Intervocalic voicing but no final devoicing in anti-German: production*

	|tak+∅ ~ tak+ə|	*V[−voi]V	OnsetFaith	Faith	*[+voi]
a.	i. /tak ~ takə/	*!			
	☞ ii. /tak ~ tak$_{[voi]}$ə/		*	*	*
	iii. /tak$_{[voi]}$ ~ tak$_{[voi]}$ə/		*	**!	**
b.	|tag+∅ ~ tag+ə|				
	☞ i. /tag ~ tagə/				**
	ii. /tag$_{<voi>}$ ~ tagə/			*!	*
	iii. /tag$_{<voi>}$ ~ tag$_{<voi>}$ə/	*!	*	**	

We see that in this language the overt paradigm [tak ~ tagə] can only derive from the underlying paradigm |tak + ∅ ~ tak + ə|. However, as tableau (10) shows, lexicon optimisation can again only propose the underlying paradigm |tag + ∅ ~ tag + ə|, independently of the ranking of the constraints, because the two structural constraints again make no difference between the candidates.

(10) *Anti-German: lexicon optimisation fails*

[tak ~ tagə]	*V[−voi]V	OnsetFaith	Faith	*[+voi]
☞ a. |tag+∅ ~ tag+ə| – /tag$_{<voi>}$ ~ tagə/			*	*
b. |tak+∅ ~ tak+ə| – /tak ~ tak$_{[voi]}$ə/		*!	*	*

Thus, Tesar & Smolensky's version of lexicon optimisation must predict that all learners come up with a German analysis of anti-German, and hence that anti-German cannot exist for more than a single generation, so that it must constitute a gap in factorial typology. Now suppose that anti-German, a language with intervocalic voicing but without final devoicing, does not exist. It used to be the case that such a situation was regarded as evidence against this set of four constraints. But now we know that the non-existence of anti-German is actually predicted by learnability issues, although the constraint set could be fine. Of course, if anti-German turns out be a stable existing language after all, either the constraint set or the acquisition model must be wrong. Unfortunately, Tesar & Smolensky appear to be concerned only with maximising the learning scores of their algorithms. Never do they themselves draw the conclusion that a failure to learn can point to a genuine gap in factorial typology. But this should be the standpoint of anybody who, when confronted with the lack of attestation of a language type predicted by factorial typology, has drawn the conclusion that there must be something wrong with the constraint set. Rather than insisting on a constraint set that produces the precise attested typology under ranking permutation, more OT researchers should start to take into account the possibility that some typological gaps could be caused by a lack of learnability.

And now for some minor critical remarks. For child-language researchers who want to dive into formal learnability, the book presents some confusing terminology. Tesar & Smolensky use the term 'input' in the sense of 'underlying form', and the term 'output' in the sense of 'fully structured surface form'. This is traditional OT usage, and appropriate when we are talking only about production, but the terms are unfortunate when we are talking about interpretation, in which case the overt form should be regarded as the 'input'. In Chapter 4, where Tesar & Smolensky take overt forms into account, the terms 'input' and 'output' are correctly replaced with 'underlying form' and 'full structural description', but the problematic terms still occur in most of the book, simply because of the slightness of the editing. In the child-language literature, moreover, the term 'input' is used in the sense of 'primary language data', which is the same as what Tesar & Smolensky call the 'overt form'. It may be true that language-acquisition researchers often regard the child's underlying form as identical to the overt adult form, but that does not make these forms *the same*. Another problematic pair of terms is 'loser' *vs.* 'winner'. Tesar & Smolensky call the candidate that is optimal in the learner's grammar the 'loser', and the form that the learner considers to be the correct adult form the 'winner', as if the learner is taking an adult standpoint when judging the appropriateness of her grammar; in the more common child-centred approach, the two terms clearly need to be reversed. A third problematic term is 'interpretive parsing', i.e. the mapping from overt to surface form. This process is known among psycholinguists and phoneticians as 'perception'. The renaming may have been due partly to a shyness about using terms that sound extragrammatical, partly to the tacit understanding that the mapping from surface

form to underlying form (what others call 'recognition') could be part of the interpretive parsing stage, and partly by the need to find a term that would cover the analogous process in syntax.

This discussion of the terms for the stages of comprehension brings us to another problematic theoretical issue, the authors' reliance on the CONTAINMENT model of Optimality Theory. This model assumes that both the underlying form and the overt form are 'contained' in the full structural description or can be trivially derived from this surface structure. For instance, the containment view of the finally devoiced surface form of the German underlying form |tag| is /tag$_{<\text{voi}>}$/. McCarthy & Prince (1995) replaced this model by the CORRESPONDENCE view of faithfulness, in which this surface form is just /tak/. This obviously renders the surface-to-underlying mapping non-trivial. The same fate must befall the surface-to-overt mapping (i.e. phonetic implementation), which is language-dependent (e.g. stress is implemented by different cues in different languages), and hence non-trivial as well. The extension of RIP/CD to these more comprehensive theories of phonological representation will involve a major research effort in the future.

The slightness of the authors' editing leads to conflicting remarks about the implications of their learning algorithms for the 'subset problem', i.e. the problem that a learning algorithm may lead to a 'superset language', a language that consists of all possible adult forms *and some more*. On page 76, they claim that this can be solved by assuming an initial ranking of structural over faithfulness constraints. On page 100, they grant that sometimes EDCD 'may converge on a superset language'. Crucially, however, page 110 explicitly states that EDCD automatically generates informative 'losers', i.e. that the negative evidence needed to get out of a superset language is provided by the learner herself. To solve the riddle posed by these three disparate remarks, the reader would have to work out by herself that the first two claims refer to the *covert* subset problem, the situation in which the grammar would allow unattested forms (e.g. /CVC/ structures) for possibly non-occurring underlying forms (e.g. |CVC| in a no-coda language), as required by Richness of the Base, and that the third claim refers to the *overt* subset problem, the situation in which the learner actually produces forms that are ungrammatical in the adult language. The overt subset problem referred to here only appears if some underlying forms have multiple optimal outputs in the superset language. The discussion about this in Tesar (1995: §4.6.2) is the only relevant earlier work that did not make it into this book. I can think of two reasons for this: first, a discussion of optionality would require reference to later work by others (e.g. Boersma 1997), violating the authors' slight-editing principle; secondly, Tesar's (1995) solution was that optionality did not exist, which is a standpoint not necessarily shared with the other author.

Tesar & Smolensky claim that OT learning algorithms are specific to the language faculty, unlike P&P (Principles & Parameters) learning algorithms. This claim is argued for by the assertions that P&P learning algorithms could equally well be applied to problems outside linguistics, such as 'training a neural network (with binary weights) to classify radar images of submarines' (p. 4), and that OT learning algorithms have no application outside linguistics. But it seems to me that P&P and OT do not differ that much in their applicability outside linguistics. In fact, OT can be applied as a general decision scheme. For instance, OT seems to be the natural framework for describing the

ranking of what are called 'rules' in everyday life. The ordering of traffic rules is a good example (until recently, the Dutch ranking for right of way was: being directed by the police ≫ being (in) an ambulance ≫ having a green traffic light ≫ being a pedestrian on a pedestrian crossing ≫ originally being on the same road (as the competitor) while either going straight on or being (in) a tram ≫ having a diamond-shaped priority sign and not being a pedestrian ≫ being (in) a tram ≫ being (in) a car ≫ coming from the right ≫ being (on) a bicycle). EDCD would work perfectly if fed with traffic situations, and information as to who has priority. Finally, I am sure that if OT can be used for classifying phonological feature values (e.g. Escudero & Boersma 2003), it can just as well be used for classifying radar images.

In all, this book has been and will be the starting point for all subsequent work in the modelling of actual acquisition data (e.g. Curtin & Zuraw 2002), the modelling of learnability in more comprehensive views of the grammar (e.g. Escudero & Boersma 2003), the modelling of covert subset phenomena (e.g. Prince & Tesar 1999 and Hayes, to appear), the modelling of optionality (e.g. Boersma & Hayes 2001) and the modelling of language change (e.g. Jäger 2003). For the general OT phonologist, the failures of the learning algorithms noted in this book and those predicted in this review should be a warning that the connection between constraint ranking and typology cannot be as intimate as was claimed in the original papers that defined Optimality Theory. Children have to learn their languages from incomplete representations of adult linguistic structures, and it is likely that this incompleteness places large restrictions on what types of languages are possible and what types are not.

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