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Eric Raimy & Charles E. Cairns (eds.), *The segment in phonetics and phonology*. Chichester: Wiley Blackwell, 2015. Pp. x + 348.

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Following on from their 2011 volume *Handbook of the Syllable*, which canvassed a diverse range of researchers to expand existing definitions, explanations and theories surrounding the syllable, Eric Raimy and Charles E. Cairns now turn their attention to a similarly problematic phonological entity: the segment. Offering fifteen papers on the subject with varying perspectives and theoretical frameworks, the volume succeeds in showcasing the difficulty in demonstrating the existence of the segment, providing arguments against its central role in present-day phonetics and, more often than not, in phonological research.

Following a format similar to that in the *Handbook of the Syllable*, this book consists of a general introduction and fourteen articles, mainly arising from presentations given to the CUNY Phonology Forum Conference on the Segment, hosted by the editors in January 2012. The chapters cover an impressively broad array of topics – from overviews of acoustic and articulatory phonology to psycholinguistic, cognitive and language acquisition approaches – and are split into three thematic subsections. These topic strands address the following issues: (i) on what levels the segment exists, (ii) the nature of the segment in phonetics and phonology, and (iii) empirical case studies. A useful twelve-page index of subjects, authors and languages is also provided.

The editors' introduction provides a brief summary of the history of the segment, reviewing chronologically the change in theoretical standpoints in phonology from the nineteenth century Neogrammarian proposal of atomic segments to more recent autosegmental approaches from the late 1970s onwards. They then offer an excellent critique of the current issues in the debate on segments, comprehensively unravelling the methodological tensions surrounding the assumption of the existence of segments, not only in terms of phonemic analysis but also with reference to the syllable. The main argument is that the rationalist tradition fails to adopt an adequately critical examination of the segment, and

as such, the volume positions itself squarely in response to previous edited collections of such work, such as Lombardi (2001), which advocate the central role of the segment in myriad phonological processes including neutralisation and assimilation. The authors argue that while segment-like units are found in studies of lexical access, word formation rules, and acquisition of lexis, they are not supported at levels of language beyond the lexicon. The following subsection provides concise overviews of the succeeding chapters that build upon these themes.

Chapters 2–6, which make up the first section, debate the existence of segments. Largely focusing on the difficulty of demonstrating clearly demarcated segment boundaries, they collectively call for a re-evaluation of the role of the segment as a carrier of contrast. In Chapter 2, Carol A. Fowler adopts an Articulatory Phonology framework to advance an argument against segments as particles. She proposes that there is no level of phonology where strings are clearly divisible into segments because articulatory gestures blur temporal boundaries by overlapping. Fowler revisits work proposing articulatory phonology, such as Browman & Goldstein (1990), and concludes that the negative assumptions of the segment's ability to function as a unit within a phonological system is borne out according to various considerations relevant to her data. Alphabetic writing systems and evidence from speech errors suggest that particles of form similar to segments are observable, but the particulate principle and duality of patterning are not equivalent to conventional segments.

In Chapter 3, Marcus A. Pöchtrager also challenges the validity of the segment in terms of its status as the unit of acoustic contrast which distinguishes minimal pairs. He presents evidence of an interaction between vowel length and voicing in determining the contrast in VC sequences such as *bit* and *bid*, with these results dispelling the notion that the link between final consonants and the length of immediately preceding vowels is not arbitrary. Furthermore, the findings allow him to posit that contrast is not necessarily solely restricted to one individual speech sound but instead can operate on more than one layer beyond the level of the segment.

In Chapter 4, Chris Golston & Wolfgang Kehrein build on their own previous work (for example, Kehrein & Golston 2004) to show that prosodic nodes, rather than segments, distinguish phonetic oppositions. Vocalic features such as palatalisation and rounding occur on consonants only once per syllable margin, separately from consonantal features like place and manner of articulation, suggesting that syllable margins license these vocalic features, rather than segments. This suggests that IPA contrasts, while useful in conceiving sounds, do not reflect how sounds are actually produced.

In a clearly presented empirical study in Chapter 5, Jonathan Keane, Diane Brentari & Jason Riggle provide compelling evidence that a segment cannot be separated from the context surrounding it. As in speech, neat segment boundaries cannot be drawn in non-verbal language such as American Sign Language (ASL), despite the fact that, in contrast to continuous speech, the input for ASL is formed of discrete representations. Using an articulatory phonology model, the

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research shows that handshapes in fingerspelling vary according to coarticulatory pressures from the immediate linguistic environment. That is, rather than counting all fingers on the hand, only the fingers actively involved in forming the contrast in fingerspelling are involved in a process of underspecification, easing the articulatory effort of the selected fingers and maintaining the overall rhythmic structure.

Chapter 6 presents perhaps the most positive appraisal of segments in the first section of this volume, eschewing the distinction between categorical segments and gradient representations in favour of new probabilistic models that add gradience to categories in phonological relationships in order to capture the degree to which sounds are predictably distributed in a language. In an extensive overview of the current controversies regarding the role of gradience and categoricality in sound systems, author Kathleen Currie Hall convincingly proposes a probabilistic metric of phonological relationships for use in sound change, perception and inter-speaker variation.

Chapter 7 opens the second section, which consists of five papers on the role of segments in phonology, and begins with two chapters drawing on dependency-based models of Element Theory. In the first of these, Harry van der Hulst introduces Radical CV Phonology, a development from his own theory of Dependency Phonology, and defends its architecture in terms of place and manner properties of vowels. This approach is governed by a cognitive principle that assumes polar opposites to form phonemic contrasts, favouring the mapping of elements to phonetic forms over segments as bundles of distinctive features. The elements are unary primes, which, unlike other feature theories, are not necessarily motivated by a unique phonetic correlate.

Continuing the theme of elements as phonological primes, Chapter 8 redefines the internal structure of the /j/ segment through a re-evaluation of Japanese syllable structure. Challenging the view that /j/ is a consonantal glide that forms the second segment in a CC onset sequence, Kuniya Nasukawa describes the dependency relations between /j/ and other sounds. The results show that /j/ only appears immediately before a non-front vowel, forming the onglide of a light diphthong complex nucleus, rather than representing a consonant in a CV sequence, in common with other East Asian languages such as Chinese and Korean.

Psycholinguistic experiments are employed in Chapter 9 to show that cross-linguistic similarity of segments is strongly influenced by phonological factors in language acquisition. Specifically, the relationship between L2 and L1 segments is different from the way that L1 segments are related to other L1 segments, because L1 and L2 have different phonological systems. Thus, the segment is shown to be a crucial tool in determining phonological similarity. Employing the phoneme as his unit of analysis, Charles B. Chang explores the many different types and hierarchical organisation of phonological similarity in L2 production and perception. Reviewing a number of studies, his results support the finding that phonemic similarity tends to override cross-linguistic acoustic perceptual similarity.

San Duanmu relies on the concept of 'feature bounding' (Clements 2009) to show that all the possible vowels in the world's languages are delimited by fewer features than previously considered. In Chapter 10, the author analyses two databases to propose that the four binary distinctive features of [back], [high], [round] and [ATR] (advanced tongue root) are all that is required to differentiate the sixteen basic vowels in the universal inventory of contrastive segments.

Chapter 11 rounds off the middle section with a proposal by Christina Bjorndahl that the phonetic properties of a phone cannot be wholly mapped onto the phonological identity of a segment. She explores the role of cognition in defining the segment with the same phonetic feature, showing that Greek, Serbian and Russian have different contrastive and distributional patterns for /v/, in terms of whether it is realised as a fricative or an approximant. This is tested acoustically by calculating the degree of frication by measuring the concentration and skew of frequency energy in a spectrogram, with the results suggesting a correlation between phonological status and phonetic realisation in only some of the different languages.

Chapter 12 begins the final section of empirical case studies of segments. The first paper, by Katherina Nimz, reports on an L2 perceptual experiment on vowel quality and quantity, dimensions that are used differently in the two languages of the study: in L1 Turkish, contrastive length is absent, and in L2 German, it is present. The study finds that vowel length can be used as a cue in L2 vowel perception despite the differences in the use of that feature across the two languages. This suggests that a feature does not need to be contrastive to be salient.

Chapter 13 tackles the assumption that compensatory lengthening is a phonological process containing ordered sequences of discrete phonemes. In an experiment on Hungarian VnC (i.e. vowel - /n/ - consonant) sequences, Mária Gósy & Robert M. Vago provide evidence that there are robust gradient effects too, and suggest that a mix of both approaches provides the best analysis of this phenomenon.

The final two chapters of the volume support the need for underspecified segment representations in the interaction between phonology and morphology. In Chapter 14, Jochen Trommer analyses a pattern of bipositional consonant mutation in the morphophonology of Päri, focusing on radically underspecified segmental root nodes without distinctive feature content. The closing paper, in Chapter 15, presents an optimality theoretic analysis of suffixes in Southern Sierra Miwok. Assuming feature-geometric CV slots, Eva Zimmermann shows that both empty moras and underspecified segments are affixed, meaning that segmental structure is supported by prosodic representations to explain the templatic aspects of the language.

As with Raimy & Cairns' previous handbook, on syllables, the extent to which these chapters cohere as a summary collection of work on phonology rests directly on their contribution to augmenting the definition and operationalisation of the segment as a theoretical construct. Across the volume, support for the segment is uneven, with only around one-third of the papers arguing positively

in favour of its value in linguistic analysis. Answers as to whether this trend against the existence or worth of the concept of the segment is representative are not provided, nor is there any overarching commentary on what the implications of these collective arguments may be for the fields of phonetics and phonology. Nevertheless, the eclecticism of viewpoint is undoubtedly the book's key strength, with its scholastic diversity, both theoretical and methodological, providing rich insights that would benefit researchers from many subdisciplines of linguistics intersecting with phonetics or phonology.

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