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Introduction

Preface to the Special Issue: Select Papers From the 7th International Conference on Speech Motor Control

Ben Maassen,[a,b] Hayo Terband,[c] Edwin Maas,[d] and Aravind Namasivayam[e]

This special issue contains selected papers based on the 7th International Conference on Speech Motor Control, which was held in Groningen, the Netherlands, July 5–8, 2017 (http://www.slp-nijmegen.nl/smc2017). This conference, like its predecessors in Nijmegen (5th edition) and Groningen (6th edition), highlighted new trends and state-of-the-art approaches in theoretical and applied research in the area of normal and disordered speech motor control. The past decades have witnessed a tremendous multidisciplinary development in this dynamic research field, which is reflected in the Nijmegen–Groningen series of conferences. In the first edition in 1985, the research focus was on motor control issues in stuttering. The second conference (1990) highlighted the development at the time of more general motor control models and the inclusion of higher-order psychomotor and psycholinguistic functions, broadening the scope to motor speech disorders other than stuttering. At the third conference (1996), the development of speech motor control became a prominent topic and the emerging field of brain-imaging was highlighted. The fourth edition in 2001 introduced important theoretical neurophysiological and neurobehavioral concepts as well as a growing interest in the interface between higher-order cognitive/psycholinguistic processes and speech production. The fifth and the sixth conferences in 2006 and 2011 witnessed the development of interdisciplinary collaboration in the field of speech motor research on populations with and without speech disorders. Integration was the key concept: integration of principles and models of perception–action relations in general and speech as an audio–visual–speech–motor performance in particular; biomechanical and neurobiological aspects of motor control in general, and the biomechanics and neural control mechanisms of speech in particular; the genetics of motor learning (automation) and of language disorders in general, and of speech motor learning and phonology in particular.

The current special issue consists of 11 keynote and invited papers representing the main topics of the 7th conference. The first topic, newly introduced in this series of conferences, *evolution of speech,* is represented by two review articles. Willem J. M. Levelt, author of probably the most cited book in our field, *Speaking: From Intention to Articulation* (Levelt, 1989), kicks off with a historical overview of how speech evolved. He pays special attention to perspectives and theoretical views in the 18th and 19th century, going back to the etymological work of de Brosses in 1765, that seem forgotten but much of which has returned with different terminology in more recent publications. The paper's conclusion is: "History keeps repeating itself, just like the evolution of speech and language" (Levelt, 2019, p. 2931). The second review article on the evolution of speech, by Bart de Boer (2019), focuses on the use of computer models to investigate not only the unique characteristics of humans that allowed for the evolution of language, but also

[a]Center for Language and Cognition (CLCG), University of Groningen, the Netherlands
[b]Research School of Behavioral and Cognitive Neurosciences (BCN), University of Groningen, the Netherlands
[c]Utrecht Institute of Linguistics-OTS, Utrecht University, the Netherlands
[d]Department of Communication Sciences and Disorders, Temple University, Philadelphia, PA
[e]Oral Dynamics Laboratory, Department of Speech-Language Pathology, University of Toronto, Ontario, Canada
Correspondence to Ben Maassen: b.a.m.maassen@rug.nl

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related behaviors in other species. He argues that adaptations to control overt speech may have been crucial for the human ability for language and that co-evolution between biology and culture is critical to understand the mechanisms.

The second topic, *speech development,* is covered by a review and a research paper. Melissa A. Redford (2019) reviews the literature on theoretical and experimental approaches to speech production from a developmental perspective and proposes a four-stage approach in which feedforward control is dominant during the first two stages. With a growing vocabulary, the threat of motorically driven homophony around the age of 18 months urges the child to pay more attention to the exogenous word form representations, such that feedforward routines are adjusted to match targeted perceptual representations using state feedback control, which drives endogenous motoric representations and processes to appropriately match exogenous perceptual targets. The research paper on speech development, by Aude Noiray and co-authors (2019), examines the temporal organization of vocalic anticipation in German children from 3 to 7 years of age and adults by means of ultrasound imaging in order to test for nonlinear processes in vocalic anticipation. Both adults and children show context-specific anticipatory patterns; however, in addition to that, children demonstrate anticipation for upcoming vowel targets to a globally greater extent than adults. This suggests that, over the course of early childhood, the maturation of vocalic anticipation encompasses substantial reorganization in planning and execution processes.

The third topic, *brain–action–perception,* is covered by one review and two research papers. The review paper by Benjamin Parrell and John Houde (2019) gives a comprehensive summary of the role of auditory and somatosensory information in the control of speech movements—that is, action–perception models—and the neurological structures that subserve these feedforward and feedback functions. Two computational models are extensively discussed: directions into velocities of articulators (DIVA) and state feedback control (SFC), with the conclusion that both can handle the curious phenomenon that speech production is sensitive to sensory feedback when it is available, but can do without if not. Jason A. Tourville and co-authors (2019) pooled data from 12 functional magnetic resonance imaging (fMRI) studies of speech production from their own lab and conducted hierarchical cluster analyses to come up with a functional rather than anatomical parcellation across subjects and tasks. They thus could identify networks of functional regions of interest (fROIs), divided in a core sensorimotor network flanked by a speech motor planning network, which forms a starting point for optimal methods of comparing responses across speakers and tasks. Ludo Max and Ayoub Daliri (2019) investigate motor-to-auditory influences during speech movement planning by using auditory evoked potentials (AEPs), thereby confirming the previously reported reduced or absent pre-speech auditory modulation (PSAM) in stuttering as compared to fluent speakers. In a series of studies, they collected evidence that allows for the interpretation that PSAM optimizes the auditory monitoring process in fluent speakers and that, in persons who stutter, the lack of modulation may lead to maladaptive feedback-driven movement corrections.

The fourth topic, *speech disorders,* is represented by one tutorial, one review paper, and two research papers. Starting from the clinically agreed-upon main diagnostic characteristics of childhood apraxia of speech (CAS)–error inconsistency, lengthened and disrupted coarticulation, and inappropriate prosody—Hayo Terband and co-authors (2019) give a structured overview of the perceptual, acoustic, and articulatory measurement procedures that have been used or could be used to operationalize and assess these three core characteristics. After a comprehensive summary of the clinical literature on CAS, the authors conclude that the measurement procedures in these three domains should be seen as complementary and determine to a large extent the interpretation that can be given regarding the underlying deficit. Emily O. Garnett, Ho Ming Chow, and Soo-Eun Chang (2019) review two recent neuroanatomical studies of children who stutter (CWS), one focused on gray matter, based on surface-based measures of cortical size (thickness) and shape (gyrification), and one focused on white matter by utilizing diffusion tensor imaging (DTI). By comparing CWS with fluent peers, as well as the persistent and recovered cases within the group of CWS, the authors find evidence for aberrant development of cortical areas involved in integrating sensory feedback with speech movements in CWS and diverging developmental trajectories between persistent and recovered cases. Panying Rong and Jordan R. Green (2019) used articulography with the unique X-ray microbeam system at the University of Wisconsin–Madison, already operative in the early 1990s, to determine the effect of disease-related changes in tongue–jaw coordination on speech intelligibility in persons at different stages of bulbar amyotrophic lateral sclerosis (ALS). They find that, in the early-stage of ALS, there is an increase of jaw contribution to compensate for decreased tongue movement. But, in the later stage of ALS, the jaw compensation decreases, and the tongue–jaw coordination is compromised. This may be the critical physiologic factor leading to the eventual loss of functional speech in ALS.

Ingrid Aichert and co-authors (2019) examined 12 patients with apraxia of speech (AOS) and 12 aphasic patients with postlexical phonological impairment (PI) on a sentence completion task where the metrical regularity of the prime sentence (regular vs. irregular prime sentence) and the metrical regularity of the target word (trochaic vs. iambic) were independently varied. The results showed a robust effect of metrical structure on both the phonological and the phonetic planning of stages of speech production, thereby confirming this interaction for AOS and demonstrating this interaction for the first time for PI.

As editors, we hope this special issue gives a comprehensive state-of-the-art of research in speech motor control, its evolution, its development, its disorders, and its neurological implementation. We hope that the content of this special issue is useful and stimulating to seasoned researchers,

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academics, upcoming research students (master's and PhDs) and clinical professionals who are involved in implementing the research.

Ben Maassen, Hayo Terband, Edwin Maas, and Aravind Namasivayam
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References

Aichert, I., Lehner, K., Falk, S., Späth, M., & Ziegler, W. (2019). Do patients with neurogenic speech sound impairments benefit from auditory priming with a regular metrical pattern? *Journal of Speech, Language, and Hearing Research, 62,* 3104–3118. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0172

de Boer, B. (2019). Evolution of speech: Anatomy and control. *Journal of Speech, Language, and Hearing Research, 62,* 2932–2945. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0293

Garnett, E. O., Chow, H. M., & Chang, S.-E. (2019). Neuroanatomical correlates of childhood stuttering: Magnetic resonance imaging indices of white and gray matter development that differentiate persistence versus recovery. *Journal of Speech, Language, and Hearing Research, 62,* 2986–2998. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0356

Levelt, W. J. M. (1989). *Speaking: From intention to articulation*. Cambridge, MA: MIT Press.

Levelt, W. J. M. (2019). How speech evolved: Some historical remarks. *Journal of Speech, Language, and Hearing Research, 62,* 2926–2931. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-19-0017

Max, L., & Daliri, A. (2019). Limited pre-speech auditory modulation in individuals who stutter: Data and hypotheses. *Journal of Speech, Language, and Hearing Research, 62,* 3071–3084. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0358

Noiray, A., Wieling, M., Abakarova, D., Rubertus, E., & Tiede, M. (2019). Back from the future: Nonlinear anticipation in adults' and children's speech. *Journal of Speech, Language, and Hearing Research, 62,* 3033–3054. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0208

Parrell, B., & Houde, J. (2019). Modeling the role of sensory feedback in speech motor control and learning. *Journal of Speech, Language, and Hearing Research, 62,* 2963–2985. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0127

Redford, M. A. (2019). Speech production from a developmental perspective. *Journal of Speech, Language, and Hearing Research, 62,* 2946–2962. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0130

Rong, P., & Green, J. R. (2019). Predicting speech intelligibility based on spatial tongue–jaw coupling in persons with amyotrophic lateral sclerosis: The impact of tongue weakness and jaw adaptation. *Journal of Speech, Language, and Hearing Research, 62,* 3085–3103. https://doi.org/10.1044/2018_JSLHR-S-CSMC7-18-0116

Terband, H., Namasivayam, A., Maas, E., van Brenk, F., Mailend, M.-L., Diepeveen, S., van Lieshout, P., & Maassen, B. (2019). Assessment of childhood apraxia of speech: A review/tutorial of objective measurement techniques. *Journal of Speech, Language, and Hearing Research, 62,* 2999–3032. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-19-0214

Tourville, J. A., Nieto-Castañón, A., Heyne, M., & Guenther, F. H. (2019). Functional parcellation of the speech production cortex. *Journal of Speech, Language, and Hearing Research, 62,* 3055–3070. https://doi.org/10.1044/2019_JSLHR-S-CSMC7-18-0442

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