Situating language production within the matrix of human cognition: The state of art in language production research.
Goldrick, M.; Costa, A.; Schiller, N.O.

Ψ **Psychology Press**
Taylor & Francis Group

Situating language production within the matrix of human cognition: The state of the art in language production research

Matthew Goldrick

Department of Linguistics, Northwestern University, Evanston, Il, USA

Albert Costa

Department Psicologia Básica, Universitat de Barcelona, Barcelona, Spain

Niels O. Schiller

Leiden Institute for Brain and Cognition, Universiteit Leiden, Leiden, the Netherlands

A summary of recent work in language production is presented, focusing on the *Third International Workshop on Language Production* (Chicago, USA, August 2006). The articles included in this special issue focus on three overlapping themes: language production in dialogue (Arnold; Costa, Pickering, & Sorace); multilingual language production (Costa et al.; Abutalebi & Green); and control processes in production (Abutalebi & Green; Dell, Oppenheim, & Kittredge). Points of convergence and divergence between these contributions are discussed.

This special issue on language production contains three selected papers based on presentations on the *Third International Workshop on Language Production*, hosted by Northwestern University on its campus in Chicago,

Illinois (USA) in August 2006. This is the first North American venue for the conference, which was previously held in Marseille in 2004 (Alario, Costa, Ferreira, & Pickering, 2006; see the articles in *Language and Cognitive Processes*, volume 21, issues 7/8) and Maastricht in 2005 (Schiller, Ferreira, & Alario, 2007; see the articles in *Language and Cognitive Processes*, volume 22, issue 8). The paper by Costa, Pickering, and Sorace was selected from the contributions to this second workshop in Maastricht (note: Victor S. Ferreira was the action editor for this contribution).

These papers build on and enhance the integrative approach exemplified by contributions to the previous special issues. A hallmark of this series of workshops is to bring together researchers that utilise a variety of methodologies across a wide range of processing domains to address critical issues in models of language production. Echoing this diverse range of research interests and techniques, the papers in each of the special issues attempt to integrate findings and models across domains and methodologies. The papers in this issue deploy this approach to tackle three overlapping issues: language production in dialogue; production in the context of multiple languages; and control at multiple levels of language processing. Below, we briefly introduce the contributions and discuss points of connection between them.

The first paper introduces the theme of language production in dialogue. Arnold (2008) reviews the production of referential expressions. Languages afford a variety of linguistic forms to refer to the same object. For example, we can refer to *the evil robot from the future* or more simply just *the robot* or an even more reduced form such as *it*. (Note that in addition to changes to lexical items, the articulatory/acoustic properties of forms can also be modified – for example, de-accenting, reducing duration, or using reduced allophonic variants of component sounds; see e.g., Aylett & Turk, 2006.) Accounts of how speakers choose among these options have often assumed an active speaker (who selects among various options) and a relatively passive listener (who simply attempts to parse whatever form is uttered). Arnold's paper enriches this theoretical landscape by proposing that listeners dynamically allocate their attention based on their expectations regarding which entities in the discourse the speaker will refer to – expectations which are in part informed by knowledge of the processing demands of the production system. This *expectancy hypothesis* allows us to understand how the hearer might take advantage of the rich information in the speech signal regarding the speaker's internal processing state (e.g., the relative difficulty the speaker is having in accessing different forms). In the context of this hypothesis, she reviews the interplay of speaker- and addressee-oriented processes in referential communication.

Continuing the theme of production in dialogue, the second paper by Costa, Pickering, and Sorace (2008) examines the demands of conversation

in the context of multilingual language processing. Current models of dialogue have focused on those involving two native speakers (e.g., Pickering & Garrod, 2004). Costa et al. explore the issues that arise when extending these models to a new processing domain – interactions involving a non-native language (where one or both interlocutors are participating in the conversation by using a second language). Echoing Arnold's emphasis on the active role of both speaker and hearer, Costa et al. discuss the issues faced by both native and non-native participants in such conversations. In this context, they outline a number of empirical studies to further illuminate the cognitive processes involved in these communicative situations.

An interesting point of contrast between the first two contributions concerns the nature of the mechanisms that allow interlocutors to effectively communicate with one another. Costa et al.'s (2008) discussion is framed within the context of Pickering and Garrod's (2004) interactive alignment account, which places considerable weight on automatic, passive mechanisms such as priming (i.e., enhanced activation of representations at various levels of cognitive processing). In contrast, Arnold (2008) places more emphasis on active mechanisms – for example, those that allow listeners to generate expectations about upcoming productions. Note that along this dimension these accounts primarily differ in terms of which mechanisms/strategies they emphasise – both assume that passive and active mechanisms play important roles in language processing in dialogue. For example, Costa et al. argue that in non-native dialogues strategic alignment processes that do not solely depend on automatic alignment may make a large contribution to communication. This may make distinguishing these perspectives quite difficult. A more specific point of contrast concerns the extent to which purely formal/structural information is utilised by listeners. As noted by Arnold, her account emphasises enhancement of perceptual processing of references to entities (the things expressions refer to); in contrast, accounts based on structural priming assume there should be enhanced access to particular linguistic forms and structures. This may provide a more fruitful basis for further empirical work contrasting the interactive alignment and expectancy hypotheses.

The final two papers turn away from dialogue to the third issue of this volume – how individual speakers control production. First, continuing the multilingualism theme, Abutalebi and Green (2008) examine how speakers control the language in which they produce an utterance (e.g., if one is a Spanish/English bilingual, does one refer to a particular picture in an experimental trial as *vampire* or *vampiro*?). As reviewed by Abutalebi and Green, there are a number of competing theories of the cognitive mechanisms involved in control; they argue that none of these provides a comprehensive account of the behavioural data. The aim of their contribution is to integrate findings from cognitive neuroscience to help constrain

and inform psycholinguistic accounts. They situate language control within the more general context of task switching – where participants must switch between different stimulus-response sets. Functional neuroimaging and neuropsychological studies of task switching are used to frame the discussion of results from language switching studies. On the basis of these findings, they sketch a model of bilingual control that integrates both cognitive and neurobiological mechanisms.

Dell, Oppenheim, and Kittredge (2008) conclude the special issue by examining issues of control in lexical access. A great deal of work in speech production has examined these questions in the context of the production of single words. The previous two special issues provide ample evidence of this type of work (e.g., Gumnior, Bölte, & Zwitserlood, 2006; Kuipers, La Heij, & Costa, 2006; La Heij, Starreveld, & Kuipers, 2007; Roelofs, 2007a,b; Schiller & Caramazza, 2006). Dell et al. build on this rich body of work with single utterances to develop an account of lexical selection in the context of syntagmatic competition – that is, the activation of non-target words due to their presence within the production context. They examine syntagmatic activation driven by the sentential context (e.g., while accessing *robot* in the sentence of *The evil robot chased the humans*, words such as *chased* and *humans* become active) as well as activation driven by previous productions (e.g., while accessing *robot* in a series of a picture naming trials *vampire, rocket, robot, spider, …*, words such as *vampire* and *rocket* may become active). Extending models of lexical selection based on single word data, they propose (and simulate) a dynamic control mechanism that offers an account of a number of findings from both neurologically impaired and neurologically intact speakers.

In formulating their theories of control, the contributions by Abutalebi and Green (2008) and Dell et al. (2008) both invoke prefrontal areas that appear to be involved in the selection among alternative response options (see Ganushchak & Schiller, 2008, for RT and ERP evidence from semantic blocking effects in picture naming consistent with Dell et al.'s claim). However, they propose two rather different mechanisms to realise this selection process. Abutalebi and Green assume that these regions inhibit the activation of non-target language representations – in line with their general emphasis on the importance of inhibitory mechanisms. In contrast, Dell et al. assume that competition between response options is resolved via an amplification mechanism (which boosts activation levels until a difference threshold is reached). Both papers agree that there is a need for competition among alternative response – the question is whether this competition is resolved by inhibition of non-target responses or simply by selection or boosting of the target response. This contrast echoes persistent debate in both the single word production (e.g., Finkbeiner & Caramazza, 2006a,b; La Heij, Kuipers, & Starreveld, 2006; Mahon, Costa, Peterson, Vargas, &

Caramazza, 2007) and language selection (see Abutalebi & Green, 2008, for discussion) literatures. Hopefully, the integrative approaches adopted by these authors will in time help to resolve such issues. Theory development may be greatly advanced by using neurobiological data to constrain hypothesised mechanisms (as advocated by Abutalebi and Green) and/or using computational techniques to more precisely specify such mechanisms (as illustrated by Dell et al.).

Dell et al. (2008) conclude their contribution by challenging theories to place production 'within the matrix of human cognition' – to connect core processes such as lexical access to other language-related as well as more general cognitive processes. This special issue represents important steps in this direction. By considering production in processing domains outside of the traditional focus of production theories (dialogue, multilingualism), and by situating core production processes within more the context of more general cognitive and neural mechanisms (control), these papers help to situate production theories within a broader context. Work such as this will enrich not only language production research but also enhance our broader understanding of the cognitive and neural mechanisms underlying a range of complex behaviours.

REFERENCES

Abutalebi, J., & Green, D. W. (2008). Control mechanisms in bilingual language production: Neural evidence from language switching studies. *Language and Cognitive Processes*, *23*, 556–581.

Alario, F.-X., Costa, A., Ferreira, V. S., & Pickering, M. J. (2006). Architectures, representations and processes of language production. *Language and Cognitive Processes*, *21*, 777–789.

Arnold, J. E. (2008). Reference production: Production-internal and addressee-oriented processes. *Language and Cognitive Processes*, *23*, 495–526.

Aylett, M., & Turk, A. (2006). Language redundancy predicts syllabic duration and the spectral characteristics of vocalic syllable nuclei. *Journal of the Acoustical Society of America*, *119*, 3048–3058.

Costa, A., Pickering, M. J., & Sorace, A. (2008). Alignment in second language dialogue. *Language and Cognitive Processes*, *23*, 527–555.

Dell, G. S., Oppenheim, G. M., & Kittredge, A. K. (2008). Saying the right word at the right time: Syntagmatic and paradigmatic interference in sentence production. *Language and Cognitive Processes*, *23*, 582–607.

Finkbeiner, M., & Caramazza, A. (2006a). Lexical selection is not a competitive process: A reply to La Heij et al. (2006). *Cortex*, *42*, 1032–1035.

Finkbeiner, M., & Caramazza, A. (2006b). Now you see, now you don't: Turning semantic interference into facilitation in a Stroop-like task. *Cortex*, *42*, 790–796.

Ganushchak, L. Y., & Schiller, N. O. (2008). Motivation and semantic context affect brain error-monitoring activity: An event-related brain potentials study. *Neuroimage*, *39*, 395–405.

Gumnior, H., Bölte, J., & Zwitserlood, P. (2006). A chatterbox is a box: Morphology in German word production. *Language and Cognitive Processes*, *21*, 920–944.

Kuipers, J.-R., La Heij, W., & Costa, A. (2006). A further look at semantic context effects in language production: The role of response congruency. *Language and Cognitive Processes*, *21*, 892–919.

La Heij, W., Kuipers, J.-R., & Starreveld, P. A. (2006). In defense of the lexical-competition account of picture-word interference: A comment on Finkbeiner and Caramazza (2006). *Cortex*, *42*, 1028–1031.

La Heij, W., Starreveld, P. A., & Kuipers, J.-R. (2007). Structural complexity is not the (big) issue: A reply to Roelofs (2007). *Language and Cognitive Processes*, *22*, 1261–1280.

Mahon, B. Z., Costa, A., Peterson, R., Vargas, K. A., & Caramazza, A. (2007). Lexical selection is not by competition: A reinterpretation of semantic interference and facilitation effects in the picture-word interference paradigm. *Journal of Experimental Psychology: Learning, Memory,and Cognition*, *33*, 503–535.

Pickering, M. J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences*, *27*, 169–225.

Roelofs, A. (2007a). A critique of simple name-retrieval models of spoken word planning. *Language and Cognitive Processes*, *22*, 1237–1260.

Roelofs, A. (2007b). On the modeling of spoken word planning: Rejoinder to La Heij, Starreveld, and Kuipers (2007). *Language and Cognitive Processes*, *22*, 1281–1286.

Schiller, N. O., & Caramazza, A. (2006). Grammatical gender selection and the representation of morphemes: The production of Dutch diminutives. *Language and Cognitive Processes*, *21*, 945–973.

Schiller, N. O., Ferreira, V. S., & Alario, F.-X. (2007). Words, pauses, and gestures: New directions in language production research. *Language and Cognitive Processes*, *22*, 1145–1150.