Guest Editorial

New and Interdisciplinary Approaches to Language and Cognition

Jie-Hui Hu and Guillaume Thierry

Abstract—This Special Section on Language and Cognition of Journal of Electronic Science and Technology (JEST) presents a collective of state-of-the-art interdisciplinary research on language and cognition. It features empirical and theoretical studies on cognitive approaches to language, using a variety of methodological approaches, from behavioral measures to neuroimaging. The topics discussed are varied, ranging from language comprehension and acquisition to the language-emotion interactions, reflecting marked broadening of the research agenda in this field. We invite yet more integrated research to move the field forward.

Index Terms—Cognition, language, interdisciplinary, methodologies.

1. Introduction

Language is a distinctive human behavior at the core of social communications. It allows exchange of meaning between people and enables the assembly of sophisticated expressions to convey abstract and complex conceptualizations[3]. From a cognitive linguistic perspective, language is also a repository of world experiences, a collection of meaningful categories, and constructs that help us deal with new experiences and store information about old ones, i.e., a means for organizing, processing, and conveying knowledge[2]. Although Cognitive Linguistics is fundamentally committed to the psychological reality of its theoretical constructs, much of the traditional work is based purely on the linguistic intuition of theoreticians.

The past two decades have seen a growing interest in grounding linguistic theory into observable effects and experimental tests of language use. Substantial methodological advances in signal processing and computational modeling have made it possible to expand the empirical scope of language research. Technical developments of behavioral measurements (e.g., eye-tracking), electrophysiology (e.g., event-related potentials (ERPs)), and hemodynamic neuroimaging (e.g., functional magnetic resonance images (fMRIs)), have opened new perspectives in the study of language representation and processing. This is especially evident in the field of cognitive neuroscience of language, which is a good example of joint research effort by the international academic community.

Interdisciplinary work on language has great potential to contribute to our understanding of generic human cognition and philosophy. This special section of JEST covers a series of articles and reviews on the broad range of language processing with the goal to provide theoretical and practical impetus for future interdisciplinary research on language and cognition.

2. Methodological Considerations

There has long been a tension between traditional cognitive linguistics that considers introspection the most appropriate method for studying meaning and a marginal but increasing tendency to apply empirical methods that are customary in the cognitive sciences[3]. Indeed, the fields of linguistics and applied linguistics have been shaken by a paradigmatic earthquake, caused by the rapidly growing influence of brain research proliferating in psycholinguistics, neurolinguistics, neuropsychology, neurobiology, and more generally, in cognitive science and neuroscience[3]. Ignoring these new methods and technological approaches is not an option because these advances lead to fundamental restructuring of our knowledge base of language representation and processing. Disregarding them would only result in a marginalization of the cognitive linguistics in its traditional sense.

Data from ERPs and fMRI, for example, is now routinely used to describe statistical interdependencies between brain regions that have substantial repercussions for cognitive structure[4]. Network analyses suggest that the organization of the brain’s connections enables the efficient processing of information and thus supports complex brain functions[4], such as language. Whilst such structural organization might be both modular and hierarchical, Berwick et al.[9] argued that language is grounded on a particular computational mechanism that yields an infinite array of structured expressions. Each expression is assigned an interpretation at two ‘interfaces’, a sensory-motor interface that connects the mental expressions formed by syntactic rules and a...
conceptual-intentional interface that connects these same mental expressions to semantic-pragmatic interpretation, reasoning, planning, and other mental activities.

These results are particularly interesting if one considers that connectivity within the brain makes a distinction between language and the rest of the mind essentially meaningless\(^\text{[9]}\). Neurolinguistics is the study of language-brain relationships, that is, how language is represented in terms of neuronal organisation and function. A view often expressed is that neurological studies of language tend to deal with global aspects of language structure and language processing, rather than specific, precise language phenomena which are the main preoccupations of linguists. Taylor\(^\text{[8]}\) considers cognitive linguistics a descriptive label for a rather broad movement within modern linguistics and believes that it includes a variety of approaches, methodologies, and emphases, which are, however, unified by a number of common assumptions. Foremost among these is the belief that language forms an integral part of human cognition and that any insightful analysis of linguistic phenomena will need to be embedded in what is known about human cognitive abilities. Here, we wish to argue that methodological consideration is not an end in itself, but rather a means to an end. A more interdisciplinary approach to language and cognition can only offer opportunities to test traditional questions with more objectivity and increase the relevance of the cognitive sciences as a whole.

### 3. Topics in This Section

A brief survey of language science from behaviorism through to cognitivism could reveal a great variety of themes in each stage of development. Yet, recurrent theme that is core to language is the study of meaning. Whilst behaviorism reduced meaning to stimulus-response mappings, classical cognitive science has marginalized and subordinated it to syntactic form. In reaction against the dominant generative paradigm, cognitive linguists have placed meaning back at center stage and have given it a broader remit than linguistics’ semantics\(^\text{[6]}\). The topics in this special section reflect an attempt to study language by incorporating cognitive, psychological, and neurocognitive approaches in the broad range of language comprehension, language learning, and the interaction of language and cognition.

Wang et al. investigated how relative clauses are processed in language comprehension by comparing ERPs elicited by four types of Mandarin Chinese relative clauses. They demonstrated that the brain shows a preference for object-extracted relative clauses modifying both the subject and object of a sentence. This result offers a new perspective on the universality and language specificity of relative clause comprehension. In *Cognitive Study of the Linear Order of the English Construction “X and Y”,* Liu and Fan adopted a typical linguistic approach and discussed linear order construction from the perspectives of cognitive salience, cognitive iconicity, and cognition of formal rules.

Studies into the cognitive mechanisms of first and second language learning have been a central question for both linguists and cognitive scientists of language. Using the Intermodal Preferential Looking Paradigm, a well-established behavioral test, Ma et al. examined child language acquisition mechanism in *Lexical Tones and Word Learning in Mandarin-Speaking Children at Three Years of Age.* Results show that Mandarin lexical tones can be used in native Chinese word learning. Furthermore, the difficulty of using Tone 3 as a cue to word identity may be related to its lower level of perceptual distinctiveness compared with other tones.

The studies by Gao et al. and Cheng et al. focus on different aspects of second language learning. Both studies used questionnaires to measure cognitive and psychological abilities. Cheng et al. used the Embedded Figure Test and the Pragmatic Competence Test to characterize cognitive style and pragmatic competence, respectively, and found a significant and positive correlation between field dependent (FD) cognitive style and inter-language pragmatic competence while no significant correlation was found between field independent (FI) cognitive style and pragmatic competence. Using Research Skills Assessment, Gao et al. showed how Academic English reading promotes critical thinking and deeper cognitive involvement beyond language proficiency.

Beyond psychological approaches and linguistic approaches idiosyncratic to language, the questions of whether language shapes the way we think and interpret reality and if so, how, have long fascinated scholars interested in language-cognition interactions. German philosophical Wilhelm von Humboldt, for instance, claimed more than one century ago that “A language can reflect a unique paradigm of how a nation looks at, perceives and understands the world”\(^\text{[10]}\). The so-called linguistic relativity hypothesis, implicitly sketched out by linguists Benjamin Lee Whorf and Edward Sapir, even proposed that if different languages carve up reality in different ways in one form or another, then it follows that speakers of different languages have different worldviews\(^\text{[10]}\).

In the paper *Language as Context Modulates Social Judgments* by Gao et al., strong behavioral evidence is provided to show how verbal statements impact on social judgments by biasing neutral faces with descriptors of differentially-valenced behaviours (criticizing or praising) targeting others or objects. Critical individuals were rated lower in likeability than praising ones. In particular, those who criticized others were the most unlikeable. In *Embodied Emotion—Turn from Traditional to Post-Cognitive Perspectives,* Tang contributed a state-of-the-art review of the interdisciplinary studies of embodied emotion. Embodied emotion, and embodied cognition in general, has attracted the attention of both cognitive linguistics and empirical scientists in the past two decades. The embodied nature of language and cognition can be traced as early as Lakoff and Johnson’s discussion of metaphor and categorization\(^\text{[12]}\). Our cognitive processes are in part shaped around the image of the body that they manipulate. Thus, the reality experienced by the mind reflects the nature of the body.
that moves through it\cite{14}. Neuroscientific studies using fMRI have shown that the cortical systems for language and actions are reciprocally connected with each other. Information about language and actions interacts in overlapping distributed neuronal assemblies\cite{15}. Comprehension of action words that are semantically related to different parts of the body (e.g., ‘lick’, ‘pick’, and ‘kick’) activates automatically and specifically the motor system in a somatotopic manner\cite{15,16}. Hence, our experience is structured by the forms that our bodies have and the movements that they make. Cognition is therefore embodied in the sense that it is, in fine, a compilation of experiences made through the body, and also that it cannot be disconnected from the body map that makes those experiences what they are\cite{16}.

4. Summary and Future Perspectives

Understanding and producing language are crucial and complex human behaviors that underpin almost all our social interactions. Linguistic knowledge involves not just knowledge of language per se, but also knowledge of the world as mediated by language\cite{2}. How language is constructed and represented in the brain/mind and how language affects the way speakers conceptualize the world have long been core themes of research in the interdisciplinary study of language and cognition.

Technological advances in neuroscience and computation offer ever more sophisticated methods to study processes that were inaccessible only a decade ago. This has helped restructure theory by shedding new light on traditional models in cognitive linguistics and neuroscience\cite{17}. From a neural plasticity perspective, language development dynamically shapes and reshapes functional architecture, rather than giving rise to an incremental but fixed neural structure across the lifespan. Functionally distinct components of language processing and control appear recruit overlapping brain regions. And thus, the study of language itself contributes to our understanding of the oldest questions in cognitive science, i.e., whether cognitive operations are modular or distributed across domains\cite{18}. This section in JEST is a notable effort to contribute to this fascinating field that thrives on interdisciplinary research.

Thus, the guest editors of this special section would like to express their sincere thanks to the authors from China and Australia for their contributions. We also express their profound gratitude to all reviewers and supporters of this work. Finally, we would like—also on behalf of the authors—to express our gratitude to the editorial team for their wonderful effort and their everlasting support throughout the process.

References

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Jie-Hui Hu was born in Hebei Province, China in 1979. He is now a professor with the School of Foreign Languages, University of Electronic Science and Technology of China (UESTC), Chengdu. He received the B.A. in English language, the M.A. degree in linguistics and applied linguistics, and the Ph.D. degree in biomedical engineering from UESTC in 2001, 2004, and 2015, respectively. He worked as an academic visitor with the School of Psychology, Bangor University, UK from Jan. 2015 to Jan. 2016. He is currently working on the cognitive processes of language learning and interactions of language and cognition from both psychological, pedagogical, and neuroscientific perspectives, using various methodologies including fMRI and ERPs.

Prof. Guillaume Thierry’s photograph and biography are shown in Guest Editors’ introduction.

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Wen-Kun Feng is a professor in language and literature at the School of Foreign Languages, UESTC. He is currently the Director of Sichuan Association of Cognitive Linguistics, and he has authored 6 books and published more than 50 articles in CSSCI/SSCI journals in a number of fields related to English literature and language: Literary study, translation studies, theory of meaning, and philosophy of language. He is currently focused on the study of meaning emergence, cognitive relation of language and meaning, the existential structure of poetics, and the ontological language and thought of Meilleau-Ponty.

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Bill Thompson is a professor in psychology with the Department of Psychology, Macquarie University, and the chief investigator of the ARC Centre of Excellence in Cognition and Its Disorders. Bill Thompson is the Director of the Music, Sound and Performance Lab. He was the President of the Society for Music Perception and Cognition (Jan. 2007 to Jan. 2009). He is also the editor of the journal Empirical Musicology Review and the associate editor of the journal Music Perception. He is the author of the book “Music, Thought and Feeling: Understanding the Psychology of Music” (Oxford University Press) and numerous referred articles.

Hui Zhang is a professor in linguistics with the School of Foreign Languages and Cultures, Nanjing Normal University, and the Director of Electrophysiology Lab, Nanjing Normal University. He is the editor-in-chief of Language and Cognitive Science, and a peer-reviewed international journal published in UK. His research interests are in cognitive linguistics and neurolinguistics. He is the author of Idiom Representation and Processing: A Neurocognitive Approach (2016), Idioms and Their Comprehension: A Cognitive Semantic Approach (2003), co-author of Cognitive Metonymy (2010), and published more than 50 papers in CSSCI journals and SSCI journals.

Introduction to Cognitive Neurolinguistics Research Group, UESTC: The Cognitive Neurolinguistics Lab in School of Foreign Languages, University of Electronic Science and Technology of China, consists of an interdisciplinary research group, interested in how language and the brain are related. They investigate the first and second language (e.g., phonetic and semantic) processing in the brain and interactions of language with other cognitive processes (e.g., thought and emotion), using diversified methodologies of experimental psychology and cognitive neuroscience including eye-tracking, event-related potentials, neuroimaging (functional magnetic resonance imaging and functional near-infrared spectroscopy), transcranial magnetic stimulation, and neuropharmacology. They primarily aim to provide mechanistic support for educational, social, and clinical applications of language research.

Since the lab was established, this research team has gained external recognition home and abroad. They have published over 30 peer-reviewed papers in both international journals, such as Proceedings of the National Academy of Sciences of the United States of America (PNAS), Journal of Neuroscience, and Human Brain Mapping, and Chinese journals including Modern Foreign Languages, Foreign Languages in China, Foreign Language Teaching, etc. They also take part in editorial and reviewing activities for international and Chinese journals. All members in this group have overseas experience and international collaborations. The lab is the base for Sichuan Association of Cognitive Linguistics, with Prof. Wen-Kun Feng as the founding chairman.

The lab members would like to express their appreciation for the authors’, reviewers’, and editors’ contribution for this special section. They will prompt the academic communications in cognitive neurolinguistics together with JEST. And the lab sincerely welcome all talents who are interested in this field to join them!