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JCLR



Journal of Contemporary Language Research. 2023; 2(3): 167-170

DOI: 10.58803/jclr.v2i3.75

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Book Review



Research on the Syntax-Semantics Interface of Numerals by He Chuansheng, 2020, IX + 345 pp., ISBN: 9787572005688

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ARTICLE INFO

Article History:

Received: 03/08/2023

Revised: 28/08/2023

Accepted: 03/09/2023

Published: 25/09/2023



1. Introduction

Edited by Hu Jianhua, *Trends in Contemporary Linguistics* is published by Shanghai Educational Publishing House, with an attempt to build an academic platform to probe cutting-edge international linguistic topics and theories. As the first volume of the collection, the separate monograph *A Study on the Syntax-Semantics Interface of Numerals*, authored by He in 2021, is a comprehensive book, pioneering in-depth issues concerned with the interaction between the syntactic structure and compositional semantic interpretation of numerals under the framework of generative formal linguistics. With the purpose of putting forward a structure-interpretation mapping theory, supported by syntactic, semantic and morphophonological pieces of evidence mainly from Chinese Mandarin and more than 100 southern Chinese ethnic languages and some foreign languages as well, such a volume integrates a broad vision of linguistics, philosophy, anthropology, and mathematical history and shows profound theoretical and empirical significance.

This book consists of eight chapters, with each one focusing on a highly worth-discussing topic. Chapter one serves as a general introduction, which first briefs the background information in relation to *numeral* and *counting*, as well as the formation and development of the

numeral system in the linguistic field. Then, it clarifies and prescribes the specification of several basic concepts concerned, followed by a concise illustration of the main content and the purpose of this book.

Chapter two first contrasts the traditional constituent analysis and non-constituent analysis of complex numerals, with the former supported by packing strategy (Hurford, 1975) and the research on numerals modified by prepositions (Corver & Zwarts, 2006), and the latter evidenced by Ionin and Matushansky (2006), who claim that a numeral selects a nominal expression as its complement and projects a hierarchical noun phrase on the ground of some linguistic facts from Russian and other Slavic languages. He (2021) convincingly criticizes the non-constituent analysis by first analyzing the numeral and case features of simple and complex numerals in Hebrew (Danon, 2011), then presenting the counter-evidences from Russian and German, based on Meinunger (2015), who puts forward a grafting analysis for complex numerals, and finally providing proofs from the syntactic, semantic and morphophonological dilemma in Chinese Mandarin if following the non-constituent analysis.

Chapter three further testifies the validity of the constituent analysis for complex numerals through the

► Cite this paper as: Ning N. Research on the Syntax-Semantics Interface of Numerals by He Chuansheng, 2020, pages: ix-345, ISBN: 9787572005688. Journal of Contemporary Language Research. 2023; 2(3): 167-170. DOI: 10.58803/jclr.v2i3.75



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linguistic supports from over 130 Chinese ethnic languages, involving Sino-Tibetan, Altaic, Austronesian, and Austro-Asiatic families. In the aforementioned languages, two distinct conjunctions exist for complex numerals and nouns, and it is verified that the conjunction for numerals is not likely to be the allomorph of its nominal counterpart or to be a numeral *per se*. While some languages share a phonetically common conjunction for numerals and nouns, four different types of languages concerning the phenomenon of numeral coordination are distinguished, suggesting that some numeral conjunction may be derived from nominal conjunction or borrowed from Chinese Mandarin. With regard to the phenomenon of two numerals for one number in many languages, especially *one* and *two*, He (2021) demonstrates that one numeral is used for counting, while the other is used for qualifying, which also denotes that numerals belong to a system independent of nouns. An additional persuasive argument comes from some phonological pieces of evidence from Chinese ethnic languages, such as phonetic change, assimilation, tonal modification, synaeresis, and vowel harmonization in complex numerals. The linguistic materials concerning some certain phonological phenomena in complex numerals are powerful evidence to prove that complex numerals are actually complete constituents, which can be justified from the examples cited from He (2021). Take assimilation as an instance. According to He, in Monba language, one dialect of the Tibeto-Burman language, t̤ei 'ten', becomes t̤eiŋ when combined with nai 'two' and nis 'seven' to form complex numerals, and becomes t̤eiɸ when combined with pli 'four'. However, when t̤ei 'ten' is used individually to denote the number '10', no assimilation takes place. It is widely acknowledged that a gap between two phonemes will impede the process of assimilation, so it is obvious that there is nothing intervening between t̤ei 'ten' and nai 'two' when t̤eiŋ nai 'twelve' is formed, which is sufficient to prove that the complex numeral t̤eiŋ nai is a complete constituent, which can not split into smaller parts syntactically.

Chapter four is mainly devoted to the formal syntactic structure of complex numerals and its corresponding compositional meaning, exemplified by Chinese Mandarin, including multiplication, decimals, and fractions. He (2021) suggests that syntactically, numerals are not lexical items but phrases headed by places because they can license interrogation and anaphoric reference, while semantically, the compositional meaning of complex numerals is generated internally, with no need to be combined with nouns. He (2021) further puts forward that decimals, just like integers, also project hierarchical syntactic structures, with places being implied, and noun phrases containing decimals in average sentences refer neither to entity or quantity, and "average" is defined as $\lambda f \lambda X \lambda d \forall x [x \in X \rightarrow \exists y [\text{quantity}(y) \& \text{Map}(x, y) \& y = f \text{ means}(f) / |X| = d]]$ in such a sentence *every student has 3.5 maps (map here refers to anything that can be counted) on average*, which generally means that for all x , x is students, and there is y , which is a quantity, such that x have y maps in total, and y obeys to a function such that the average number

of maps that every student owns equals to the equation when y divides the number of all the students, and the result d is 3.5, which is the exact average maps that every student owns. In addition, He (2021) claims that as approximate number suffix, *duo* (over) adheres to a whole numeral phrase, evidenced by Chinese southern ethnic languages, and forms a compositional meaning with the whole phrase rather than the place before it, and *duo* semantically refers to $\lambda n [n + (10\% \times 10^{\text{MINexponent}(n)} \sim 50\% \times 10^{\text{MAXexponent}(n)})]$, with n referring to number or magnitude. Finally, *ban* (half) is analyzed as a numeral, classifier, or numeral-classifier suffix, with persuasive examples and arguments.

Chapter five emphasizes the syntactic and semantic interaction between numerals, classifiers, and nouns. He (2021) strongly opposes the non-constituent analysis of the Numeral-nominal Classifier-Noun (Num-Cl-N) structure supported by Zhang Ning (2011), who claims that Num-Cl-N projects a right-branching hierarchical structure, with Cl heading the whole phrase. He (2021) first convincingly refutes the five pieces of evidence given by Zhang Ning (2011), namely the modifier of the left branch, the syntactic dependency of modifiers, the order of adjectives, the identity of complement and predicate, and the mutual semantic selection between numerals, classifiers, and nouns. Then, He (2021) presents three positive arguments which verify the constituenthood of Num-Cl-N structures as the independence of numeral-classifier phrase, the adhesivity of approximate number suffix to a complete numeral-classifier phrase, and the license of logical movement of a numeral-classifier phrase. Regarding Numeral-verbal Classifier-Noun structure, He (2021) adopts an analogous approach to the aforementioned one. He (2021) also first persuasively generalizes five linguistic facts to counter hierarchical analysis, that is, the possibility of a unified analysis between nominal and verbal classifiers, the syntactic relation between NumeralP and verbal classifiers, the semantic selection between verbs and verbal classifiers, the VP ellipsis in Numeral-verbal Classifier-Noun structure, and the incapability of verbal classifiers to co-exist with non-perfective aspects. He (2021) further demonstrates that these facts do not back up non-constituent analysis and may give rise to opposite conclusions, mirrored in pronoun object rising and V-not-V structures. In addition, some noticeable syntactic and semantic problems may arise if following non-constituent analysis. Finally, He (2021) explores the compositional meaning of numerals, (verbal and nominal) classifiers, and nouns. It is demonstrated that the semantic type of classifiers is $\langle d, \langle e, t \rangle \rangle$, and its function is to transform type d into $\langle e, t \rangle$. So, the semantic representation of classifiers is generalized as $\lambda n \lambda X [|X| = n \wedge \forall x [x \in X \rightarrow A(x)]]$.

Chapter six digs further into the semantic reference of numerals from the perspective of ontology. Based on the previous discussions, He (2021) supposes that numerals refer straightforwardly to numbers, which actually involves a significant issue in the philosophy of language and mathematics. Regarding the debate on the existence of number represented by realism or platonism, it has been

proved that although number is an abstract thing, it is a true existence which is objective and eternal. To put it differently, it is independent of time, space, human mind, and nominalism, which proposes that number only exists in the form of signs on the paper or the concept in human's brain. Given the discussions of Snyder (2017), Dummet (1995), and He (2021) argues that pure numerals in natural languages refer directly to numbers with evidence from linguistic facts and mathematical discoveries, taking "seven" in "seven is a prime number" and the transcendental number π and e as an example. Moreover, there exist few numerals referring to sets, mainly incorporated from pure numerals and classifiers, such as *liǎ* (two+classifier) and *sā* (three +classifier) in Mandarin Chinese, and some other phenomena of numeral-classifier incorporation in Chinese southern ethnic languages, like *dzĩ*³⁵ (one+classifier) in Shixing language.

Chapter seven adds some supplementary descriptions about the special morphological and syntactic structure of the numeral system in Chinese southern ethnic languages. It enriches the descriptive achievements on numeral research around the world and provides precious empirical and theoretical enlightenment for the studies of numeral system in natural language. Additionally, it makes great sense for the development of anthropology and the history of mathematics. He (2021) finds that there are diverse morphological and syntactic means to differentiate the category of numerals. These numerals function similarly to nouns, adjectives, or even verbs, demonstrating a state of continuum. Specifically, the pattern indicates that smaller numerals tend to exhibit more adjectival characteristics, whereas larger numerals tend to lean more toward nominal characteristics (Corbett, 1978). There are plenty of examples from southern Chinese ethnic languages. Jiarong and Geman are examples of languages in which the numerals have the prefixes *kə-* and *kəu-*, respectively, which are used before adjectives. The linguistic facts from Tibeto-Burman Dong-Tai languages also support the numerals continuum hypothesis. Furthermore, there is a wide range of phenomena of place ellipsis across Chinese ethnic languages, by which a place, immediately lower than a previous one, is deleted after a number. For example, *yi qian yi* (one thousand one) means one thousand one hundred. Here, a place means a base, such as hundred, thousand, million. In addition, what is quite worth mentioning is partition-counting in numerals smaller than 20 in Kelao, Va language (a dialect of Chinese southern ethnic languages) and over-counting in Yugu and Turkic, which is of high research value because it is a rarely seen phenomenon nowadays and the majority of languages today in the world are using under-counting.

Chapter eight briefly summarizes the book, which provides an overview of the main content of this volume. It is demonstrated that the syntax-semantics interface study of natural language numeral system is of great academic value to linguistics and other interdisciplinary research like anthropology and the history of mathematics. It is also significant to reveal its universality, typological meaning

and the interaction between language and cognitive systems. In addition, it would provide certain enlightenment to some important philosophical issues like referencing numerals.

As a subsystem of natural language, the numeral system has always been a hot topic of language ontology study and the focus of interdisciplinary research because of its morphological richness, syntactic uniqueness, and semantic completeness. This volume has made several contributions to reveal the very nature of the numeral system. Above all, it is more than just a book descriptive of the prominent characteristics of numerals, which also fully achieves the standards of observational and explanatory adequacy for human language. Additionally, it is the first volume to systematically study the numeral system of a series of language families in a certain area, which presents a whole picture of the evolution and development of numerals in those languages via clear, authentic, and sufficient linguistic material. Furthermore, this book is conducive to identifying the internal linguistic pedigree of specific languages and facilitating the application of artificial intelligence, which is of significant theoretical and practical value. Therefore, this volume is highly recommended to researchers and scholars who are interested in the formal study of numerals.

That being the case, some issues are not elaborated on sufficiently in this book.

This volume mainly focuses on the linguistic materials of numerals from Chinese Mandarin or ethnic languages, which is doubtful that whether it can represent the universal characteristics of all natural languages in the world. Thus it is suggestive to compare more typical languages of other language families like Indo-Euro languages and Semito-Hamitic languages. In addition, based on He (2021), this book may contribute to the understanding of the nature of numerals, which would facilitate its application to artificial intelligence (AI), but the question that how can it be applied to AI may need further evidence.

Declarations

Competing interest

The author declares that she has no known competing financial interests or personal relationships that could appear to influence the worked reported in this paper.

Funding

This paper is funded by Hunan University of Science and Technology, whose funding code is 20YBA117 and 21YBA119, and it is also funded by China Scholarship Council, whose funding code is 638709.

Authors' contribution

The author is responsible for all procedures to finish this paper, which includes the design of the book review, data collection and analysis, literature review, manuscript

writing, correction and response to the editors, etc.

Availability of data and materials

Data used in this paper are available at <https://cir.nii.ac.jp/crid/1130855721504083981>, with access permissions and download links provided upon request. Moreover, essential materials used for this research, including their names, models, and suppliers, are detailed in the references. We are committed to promoting transparency and collaboration in scientific research and welcome inquiries from other researchers for access to data and materials.

Acknowledgments

I would like to thank Hunan University of Science and Technology, Guangdong University of Foreign Studies, the University of Edinburgh and China Scholarship Council for their support and guidance throughout this research. I also express my gratitude to my doctoral supervisor, Professor Han Jingquan, my master supervisor, Professor He Chuansheng, my admirable teachers, professor Yang Jiang and Tang Qing, my Senior fellow apprentice, Song Jianyong

and my classmate, Zhao Banghua, for their invaluable insights and assistance in various stages of the project.

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