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Trends in Usage-Based and Pragmatic Language Processing and Learning: A Bibliometric Analysis on Psycholinguistics and Second-Language Acquisition Studies

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Abstract

This chapter provides bibliometric analyses of novel trends in the research toward pragmatic aspects of language processing and learning in the studies of psycholinguistics and second-language acquisition. Growing interests in the relevant themes are shown with the analysis of the *co-occurrence of keywords* in a common literature and the *bibliographic coupling* between literatures. The emergence of novel experimental methodologies, including the application of neuroimaging and machine learning approaches to the psycholinguistic research, provides new opportunities of looking into the pragmatic aspects of language acquisition and invites new empirical research to validate the theories and extend the boundaries of second-language acquisition research in the real-world setting.

Keywords: usage-based, pragmatics, psycholinguistics, second-language learning, second-language acquisition, bibliometric analysis, systematic review

1. Introduction

Language is communicated with a purpose. As active users of language, we are intrigued in how lexical choices can be used to represent our minds and bodies; how our mother tongue can shape our learning processes; and how linguistic expressions benefit our social interactions with others. These questions naturally fall inside the issue of the processing and the acquisition of language in the real-world setting (or the usage-based and pragmatic processing and learning). On one hand, in the history of psycholinguistics, only a very small group of studies has these relevant focuses. The empirical evidence and theoretical frameworks for language use in *real-world* scenarios are scarce. Most asked questions regarding how linguistic expressions are processed [1, 2]. Few addressed issues regarding *who* uses these expressions, and *under what context* and *for what purpose* are these expressions chosen. On the other hand, a growing need is foreseen in the field of

second-language acquisition studies to combine the theories of L2 acquisition and psycholinguistic paradigm that is developed or adapted to examine the teaching and learning of a second language in the *real-world* scenarios and to give a higher emphasis to the study of acquisition of pragmatic knowledge in another language. This chapter takes an initiative to provide a quantitative bibliometric analysis on the latest trend in the theme of functional, usage-based, and pragmatic language processing and learning in psycholinguistics and second-language acquisition studies. These trends are partly formed by the successful validation of experimental paradigms and the rapid development of interdisciplinary methods to track the neurocognitive underpinnings related to one's language behavior and will contribute to a greater understanding of how the language is understood, produced, and picked up in the socio-communicative settings.

2. Bibliometric analysis

According to the principle of the bibliometric analysis, a co-occurrence analysis based on keywords shows the frequency of the keywords that emerge in one article at the same time and how strong the emergences are [3]. The core themes of a research field can be identified by analyzing the links between keywords and by pointing out the most frequently occurred keywords in the field. We aim to use the *co-occurrence* analysis based on keywords to understand the evolution of main research themes related to the functional and the usage-based language processing and learning in the field of psycholinguistics and second-language acquisition [4]. To explore the relationship between research contexts and knowledge structure underlying the publication, the bibliographic coupling analysis has been employed between related studies that share at least one bibliographic coupling of cited reference. The more citations two publications share, a stronger bibliographic coupling strength between two publications is indicated, suggesting a similarity between the topics and knowledge. The novelty of the bibliometric coupling is that it finds the related research works, groups them into clusters, and builds a bibliometric network based on strength they connect with each other. Here this method demonstrates the *core document* (strongly and frequently coupled documents) and the *core clusters* representing the connections to this core document, among the publications relevant to the pragmatic and usage-based language processing and learning.

The first purpose of this chapter is to address the bibliometric trend of psycholinguistic studies on pragmatic and usage-based language processing. Research articles were selected from the Web of Science Core Collection database with the search function $TS = ((\text{'psycholinguistics'} \text{ AND } \text{'usage'}) \text{ OR } (\text{'psycholinguistics'} \text{ AND } \text{'function'}) \text{ OR } (\text{'psycholinguistics'} \text{ AND } \text{'pragmatics'}))$. The search function resulted in 95 key articles that cover publication years from 2010 to 2019 (by September 14, 2020). The second purpose is to make a bibliometric analysis on the second-language (L2) language acquisition studies that focused on usage-based and pragmatic language acquisition. Searching within the same database with the search function $TS = ((\text{'second-language acquisition'} \text{ AND } \text{'usage'}) \text{ OR } (\text{'second-language acquisition'} \text{ AND } \text{'function'}) \text{ OR } (\text{'second-language acquisition'} \text{ AND } \text{'pragmatics'}) \text{ OR } (\text{'L2 acquisition'} \text{ AND } \text{'usage'}) \text{ OR } (\text{'L2 acquisition'} \text{ AND } \text{'function'}) \text{ OR } (\text{'L2 acquisition'} \text{ AND } \text{'pragmatics'}))$ revealed 601 key articles that cover publications within the 10 years (by January 11, 2020).

All articles were collected in the Science Citation Index Expanded (SCI-EXPANDED), the Social Sciences Citation Index (SSCI), and Arts & Humanities Citation Index (A & HCI) databases. All analyses were performed in BibExcel (Version 2016-02-20 [5]), and network results were visualized in VOSviewer (Version 1.6.13).

2.1 Frequency distribution

The number of publications regarding the topics that bridge psycholinguistics and pragmatics/function/usage has generally grown between 2014 and 2018. The articles were published in altogether 73 journals indexed in the Web of Science Core. The top five journals that have mostly accepted articles with the topic of pragmatics, and the functional and the usage-based language processing in the field of psycholinguistics during the 10 years are: *Frontiers in Psychology* (Psychology), *Journal of Pragmatics* (Linguistics), *Language* (Linguistics), *Cognition* (Psychology/Linguistics), *Slovo a Slovesnost* (Linguistics) following a decreasing order. Another eight journals received at least two publications are *Psychological Science* (Psychology), *PLoS One* (Comprehensive), *Language Sciences* (Linguistics), *Language Learning* (Linguistics), *Journal of English for Academic Purposes* (Linguistics), *Clinical Linguistics & Phonetics* (Linguistics), *Revista Signos* (Linguistics), and *Annual Review of Applied Linguistics* (Linguistics). These journals are mainly psychology or linguistics-specialized, or more comprehensive journals, highlighting the cross-disciplinary efforts in publishing articles related to the pragmatic and usage-based language processing. The topics that connect second-language acquisition and pragmatics/function/usage have grown since 2011. These articles were published in 198 different journals with a wide coverage of various focuses. The top five journals that accepted most articles (at least 20) are *Second Language Research*, *Journal of Pragmatics*, *Frontiers in Psychology*, *Modern Language Journal*, and *Language Learning* following a descending order. Journals that published at least 10 articles with this topic are *System*, *Applied Psycholinguistics*, *Lingua*, *Studies in Second Language Acquisition*, *Bilingualism: Language and Cognition*, *International Journal of Bilingualism*, *Foreign Language Annals*, *Linguistic Approaches to Bilingualism*, *IRAL: International Review of Applied Linguistics in Language Teaching*, and *International Journal of Bilingual Education and Bilingualism*. Journals that published between five and nine articles include *Applied Linguistics*, *Language Teaching Research*, *PLoS One*, *Hispania: A Journal Devoted to the Teaching of Spanish and Portuguese*, *Intercultural Pragmatics*, *Applied Linguistics Review*, *Annual Review of Applied Linguistics*, *Recall*, *Cognition*, *Journal of Neurolinguistics*, *Language Teaching*, *Computer Assisted Language Learning*, *Language Sciences*, *Canadian Modern Language Review: Revue Canadienne des Langues Vivantes*, *Journal of Psycholinguistic Research*, *Journal of Phonetics*, *Brain and Language*, *Topics in Cognitive Science*, and *Language Acquisition*. These journals are reputable sources that receive empirical studies or systematic reviews and specialize in psychology, second-language acquisition, bilingualism, language teaching and education, pragmatics, and even cognitive science/cognitive neuroscience, suggesting that the second-language acquisition studies on usage-based and pragmatic language processing/learning receive a strong interdisciplinary attention and impact.

Altogether 232 authors published articles relevant to the topic of psycholinguistics and the pragmatic/usage-based language processing. The top eight researchers authored at least two of the publications during the last 10 years. They are Professors Valerie L. Shalin (Psychology), Stefan Th. Gries (Linguistics), Matthew Haigh (Psychology), Edward Gibson (Brain and Cognitive Sciences), Lewis Bott (Psychology), Bruce Derwing (Linguistics), John M. Tomlinson, Jr. (Psychology), and Nick Ellis (Psychology). The authors were affiliated in institutions of 22 countries. The countries that mostly published these articles (at least five) as the first author were the United States (33), followed by Spain (9), England (8), Canada (7), France (6), Germany (6), and Italy (5), suggesting that North-American English, Spanish, French, German, and Italian were the mostly interested languages in these publications. Topics relevant to the second-language acquisition

and pragmatic/usage-based language learning were contributed by 1418 unique authors. The top contributors who authored at least four publications during the past 10 years are Professors Bardovi-Harlig Kathleen (Linguistics), Saito Kazuya (Linguistics), Roumyana Slabakova (Linguistics), Ellis Nick (Psychology), Emanuel Bylund (Psychology & Linguistics), Antonella Sorace (Linguistics), Jason Rothman (Psychology), Silvina Montrul (Linguistics), and Ping Li (Psychology & Linguistics). Authors from 48 countries contributed to the publication. The most productive countries (at least 10 articles) as the first author were the United States (211), England (45), China (34), Germany (33), Canada (33), Netherlands (20), Australia (19), France (19), Italy (15), Sweden (13), Belgium (12), Japan (12), and Korea (10), suggesting that the topics relevant to the pragmatic and usage-based language learning were interested by research groups with expertise in linguistics and/or psychology, and the languages of interest were more various. Besides the Indo-European languages such as English, German, French, and Italian, the East-Asian languages, in particular, Chinese, Japanese, and Korean, are the popular languages of research.

The keywords that appeared at least five times among target publications in the topic of psycholinguistics and pragmatic and usage-based language processing highlighted the following related themes [Language (17), Comprehension (11), Psycholinguistics (10), Speech (8), Speakers (7), Acquisition (6), Information (5), Context (5), and Perception (5)] and methodology [Eye-movements (5) and Children (5)]. In the topic of usage-based and pragmatic language learning, the keywords that occurred at least 10 times among target publications represented the themes highlighting Second Language Acquisition (76) and L2 Acquisition (15), Bilingualism (56), Language Acquisition (23), Spanish (20), Pragmatics (17), Study Abroad (15), Language, (14), Working Memory (14), Second Language (13), English (13), Vocabulary (13), Second Language Learning (12), German (10), Interlanguage Pragmatics (10), and fMRI (10). The comparison of the keywords between these two topics clearly indicates a distinct trend of research interest and methodology of use in the field psycholinguistics and the field of second-language acquisition studies. These trends can be summarized as follows: The former group of studies is interested in comprehension, speaking, and developmental aspects of language and predominantly relying on the online behavioral measurements. The latter group relies more on the neuroscientific methods and focuses on the learning aspects of language and bilingualism.

2.2 Co-occurrence analysis based on keywords

2.2.1 *Pragmatic and usage-based language processing*

The co-occurrence analysis conducted on psycholinguistic studies on pragmatic and usage-based language processing revealed nine clusters of 73 keywords (with minimum cluster size set as 5) in total that mutually appear in a pair of target articles over all records based on the search function (see **Figure 1**). The clusters were ranked in a descending order based on their size and strength of connections. These clusters reflect what readers may rely on to search for the interested articles in the field of psycholinguistic research toward the functional, usage-based and pragmatic language processing (see **Table 1** for the list of key words per cluster). The first cluster reflects the trend in examining the processing of patterns and formulaic language usages in L1 and L2 speakers. The second cluster reflects the trend in investigating the usage and representation of formulaic expressions in discourse and conversation and discusses the relevant capacity and cognitive process such as perspective-taking processes. The third cluster reflects the focus on syntactic processing and Broca's area, in sentence comprehension, the ambiguity

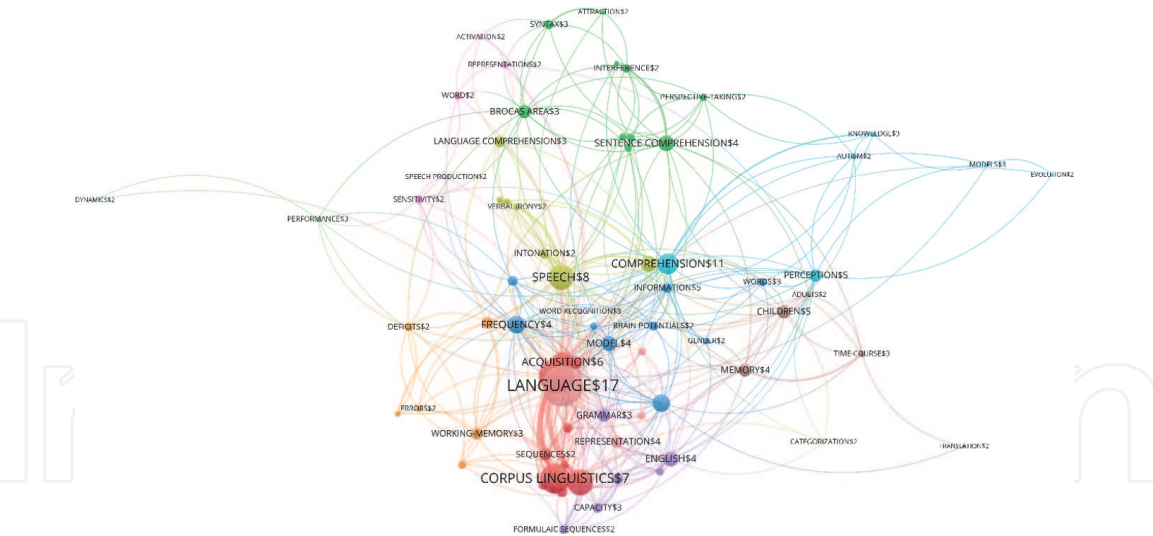


Figure 1.
Co-occurrence map of keywords ($n = 73$) over publications relevant to psycholinguistic studies on usage-based and pragmatic language processing. Nodes reflect keywords, and the size of the nodes represents their frequencies. Ties reflect the relationships between keywords, and the thicknesses represent the strengths of the relationships. Clusters of keywords are color coded and are shown in details in **Table 1**.

and interference during language production and their relation with fluid intelligence, interference, and perspective taking. The fourth cluster reflects the trend of using neurocognitive indices (brain potentials and eye-movements) and modeling approach in lexical decision and recognition paradigms. The fifth cluster suggests the trend of focusing on intonation and speech, highlighting indirect languages such as sarcasm and verbal irony and the contextual impact during comprehension. The sixth cluster shows the trends in speech production and the dynamics of activation of representations during the process. The seventh cluster highlights the trend of investigating the cognitive processes (such as categorization, access to the knowledge, perception, and comprehension) in autistic individuals. The eight cluster shows an independent trend of looking at idiom comprehension, the deficits of it, and its relation with working memory. The last cluster reflects some trend focusing on developmental psycholinguistic research.

2.2.2 Pragmatic and usage-based language learning

The co-occurrence analysis conducted on second-language acquisition studies on the pragmatic and usage-based language learning revealed 14 clusters of 296 keywords in total (with minimum cluster size set to 10) that mutually appear in at least a pair of target articles over a consecutive number of records (see **Figure 2** and **Table 2**). The first cluster reveals a strong trend represented by a group of empirical studies on speech and phonological learning with cognitive neuroscience approaches. These approaches included but were not limited to the functional neuroimaging, the eye-tracking, and the recording of other online linguistic behaviors. In this trend, multiple cognitive processes were tapped, and individuals with particular sensory deprivation (e.g., deaf), cognitive impairments (e.g., specific language impairment), or neurodevelopmental disorders (e.g., dyslexia) were included as target populations of testings. The second cluster shows a trend of examining the processing different linguistic aspects (such as morphosyntactic, lexical, gestural, pragmatic, referential, and so on). Under the usage-based framework in both adult and second-language acquisition. The third cluster uniquely represents the trend of investigating the second-language acquisition of various functional and discourse markers, for instance, the usage of definiteness and

Cluster number	Keywords	Cluster number	Keywords
1	2nd-language speakers	4	Model
1	Lexical bundles	4	Eye-movements
1	List	4	Information
1	Patterns	5	Intonation
1	Sequences	5	Sarcasm
1	Formulaic language	5	Speaker
1	Attention	5	Verbal irony
1	Acquisition	5	Language comprehension
1	Corpus linguistics	5	Word recognition
1	Speakers	5	Context
1	Psycholinguistics	5	Speech
2	Formulaic sequences	6	Activation
2	Capacity	6	Dynamics
2	Discourse	6	Representations
2	Grammar	6	Sensitivity
2	Perspective	6	Speech production
2	Usage	6	Word
2	Conversation	6	Performance
2	English	7	Autism
2	Representation	7	Categorization
2	Language	7	Evolution
3	Attraction	7	Knowledge
3	Cognitive control	7	Models
3	Fluid intelligence	7	Perception
3	Interference	7	Comprehension
3	Language production	8	Deficits
3	Perspective-taking	8	Errors
3	Working-memory capacity	8	Idiom comprehension
3	Brocas area	8	Mind
3	Syntax	8	Working-memory
3	Sentence comprehension	8	Individual-differences
4	Brain potentials	9	Adults
4	Gender	9	Translation
4	Lexical decision	9	Time-course
4	Recognition	9	Memory
4	Words	9	Children
4	Frequency		

Table 1.
Clusters and the list of keywords in the co-occurrence analysis of publications relevant to psycholinguistic studies on usage-based and pragmatic language processing. Clusters are visualized in the co-occurrence map in Figure 1.

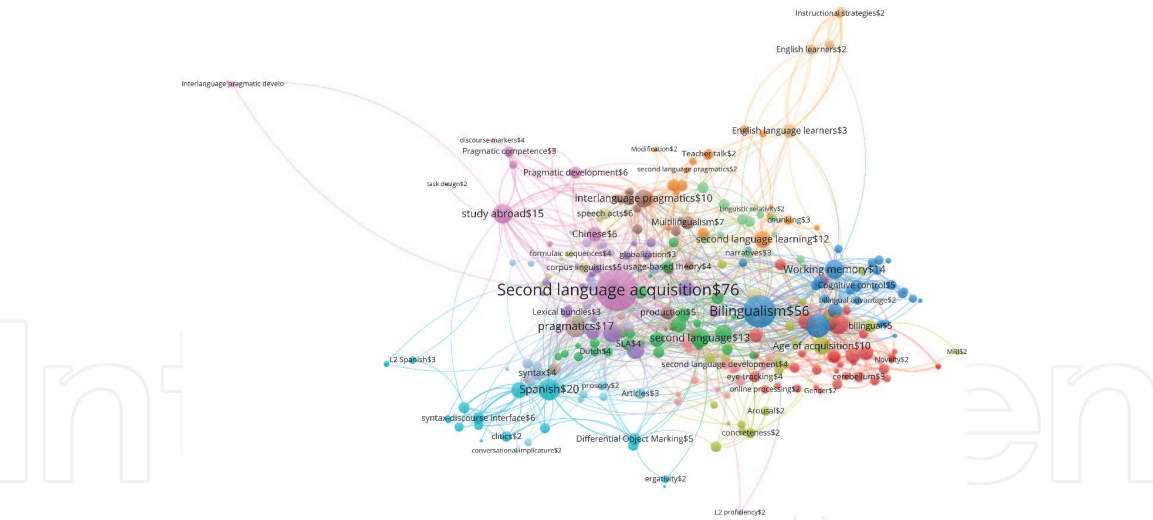


Figure 2.
Co-occurrence map of keywords (n = 298) over publications relevant to second-language acquisition studies on usage-based and pragmatic language learning. Nodes reflect keywords, and the size of the nodes represents their frequencies. Ties reflect the relationships between keywords, and the thicknesses represent the strengths of the relationships. Clusters of keywords are color coded and are shown in details in Table 2.

specificity, conversational and scalar implicature, functional words, and mood. The fourth cluster reveals a trend of examining the association of individual’s cognitive control or executive function abilities (including switching, inhibition, attentional monitoring, and working memory) and other related processes with second-language acquisition. The fifth cluster shows a trend of analyzing the role of instructional and learning strategies in second-language acquisition of pragmatic functions in educational and cultural settings. The sixth cluster reveals a latest trend of studying bilingual language processing and reading with functional and structural neuro-imaging techniques, focusing on cross-linguistic comparisons that involve Mandarin. The seventh cluster emphasizes the studies on the interface of syntax and pragmatics and the interface of syntax and discourse, with a target language Spanish and heritage languages. The eighth cluster represents a trend of determining the structure of pragmatic competence and characterizing the role of pragmatic capacities in social interaction and adaptation. The ninth cluster represents the studies on the pragmatic acquisition (e.g., speech act) with English as a second language as a testing case. The 10th cluster focuses on the dynamic interplay between the second language and the first language, emphasizing how the acquisition of a second language may interfere or cause the loss of the capacity of using the first language. The 11th cluster mainly deals with the visual language acquisition, including the sign language and the spatial language. The learning of other syntax-related functions is discussed under the usage-based language acquisition framework in the rest of the clusters (e.g., the topics of null subject, of formulaic sequences, and of word order).

2.3 Bibliographic coupling based on citing reference

2.3.1 Pragmatic and usage-based language processing

Among 95 articles relevant to the study of psycholinguistic studies on pragmatic and usage-based language processing between 2010 and 2019, 80 shared citing references. According to the shared citations, the articles were clustered into seven groups, with the minimum number of citations per cluster equals to five (see Figure 3 and Table 3). The first group of research focuses on the psycholinguistic experiments on pragmatic functions. The topics include irony, presupposition,

Cluster number	Keywords	Cluster number	Keywords
1	Anxiety	5	Lexical development
1	Attention	5	Literacy
1	Cerebellum	5	Methods
1	Children	5	Modification
1	Cochlear implants	5	Oral language
1	Cognitive processes	5	Requests
1	Consolidation	5	Role play
1	Deaf	5	Scaffolding
1	Declarative memory	5	Second-language learning
1	Development	5	Second-language pragmatics
1	Dyslexia	5	Situation-bound utterances
1	Eye-tracking	5	Sociocultural theory
1	Fast mapping	5	Teacher talk
1	fMRI	5	Usage-based models
1	Functional connectivity	6	Age of acquisition
1	Functional magnetic resonance imaging	6	Arousal
1	Gender	6	Bilingual
1	Gene expression	6	Classroom
1	Hemodynamic response	6	Cognitive processing
1	L2	6	Concreteness
1	Language	6	Convolutional neural networks
1	Language evolution	6	Cross-linguistic influence
1	Learning	6	Dominance
1	Memory	6	DTI
1	Methodology	6	EEG
1	Neuroimaging	6	Embodied cognition
1	Novelty	6	Emotion
1	Online processing	6	Eye movements
1	Phonological awareness	6	Familiarity
1	Procedural	6	Imageability
1	Procedural memory	6	Longitudinal study
1	Pronoun	6	Mandarin
1	SLI	6	MRI
1	Specific language impairment	6	Neuroplasticity
1	Speech perception	6	Reading
1	Speech production	6	Second-language processing
1	Word learning	6	Word association
1	Reaction time	6	Working memory capacity
2	Acquisition	7	Boundary tones

Cluster number	Keywords	Cluster number	Keywords
2	Adult L2 acquisition	7	Clitic left dislocation
2	Anaphora resolution	7	Clitics
2	Aspect	7	Differential Object Marking
2	Categorization	7	Dislocations
2	Child L2 acquisition	7	Ergativity
2	Cognates	7	Heritage speakers
2	Corpus	7	Incomplete acquisition
2	Critical period hypothesis	7	Information structure
2	Dummy auxiliaries	7	Interface hypothesis
2	Dutch	7	L2 learners
2	Exposure	7	L2 Spanish
2	Frequency	7	Language contact
2	German	7	Lexical semantics
2	Gesture	7	Polysemy
2	Grammar	7	Prosodic transfer
2	Input	7	Spanish
2	Interfaces	7	Syntax-discourse interface
2	Interlanguage	7	Syntax-semantics interface
2	Intonation	7	Topicalization
2	L1 transfer	8	Arabic
2	Language aptitude	8	Code-switching
2	Language control	8	Comprehension
2	Learner varieties	8	Hebrew
2	Lexicon	8	Interlanguage pragmatics
2	Linguistic input	8	L2 pragmatic competence
2	Morphosyntax	8	L2 pragmatics
2	Pragmatics	8	Lexical processing
2	Processing	8	Longitudinal research
2	Reference	8	Mixed methods
2	Second language	8	Multilingualism
2	SLA	8	Pragmatic awareness
2	Usage-based	8	Production
2	Usage-based theory	8	Recognition
2	Vocabulary	8	Social interaction
2	Written corrective feedback	8	Sociocultural adaptation
3	Articles	8	Vocabulary learning
3	Awareness	8	Pragmatic routines
3	Cognition	9	Chinese
3	Computer-assisted language learning (CALL)	9	Chinese learners of English

Cluster number	Keywords	Cluster number	Keywords
3	Conversational implicature	9	Conventional expressions
3	Definiteness	9	Discourse markers
3	Determiners	9	English as a foreign language
3	English	9	Interlanguage pragmatic development
3	English articles	9	L2 proficiency
3	Explicit instruction	9	Pragmatic competence
3	Focus	9	Pragmatic development
3	French	9	Request
3	Function words	9	Second-language acquisition
3	Globalization	9	Speech act
3	Identity	9	Study abroad
3	Individual differences	9	Task design
3	Irish English	10	Bilingual development
3	L2 acquisition	10	Construction Grammar
3	Lexical bundles	10	Corpus analysis
3	‘Like’	10	Cross-linguistic influence
3	Longitudinal	10	Dynamic systems
3	Prosody	10	dynamic systems theory
3	Scalar implicatures	10	L1 attrition
3	Second-language acquisition (SLA)	10	Language attrition
3	Second-language interaction	10	Language balance
3	Sociolinguistics	10	Late bilinguals
3	Spanish subjunctive	10	Second-language development
3	Specificity	10	Usage-based approach
3	Usage-based linguistics	10	Usage-based perspective
3	Variation	10	Language dominance
3	Phonology	11	Assessment
3	Pragmatic markers	11	Child second-language acquisition
3	Pronunciation	11	EFL
4	Artificial language	11	ESL
4	Attention network test	11	Japanese
4	Attentional monitoring	11	Language impairment
4	Basal ganglia	11	Linguistic relativity
4	Bilingual advantage	11	Motion events
4	Bilingualism	11	Narratives
4	Cognitive control	11	Path
4	Epilepsy	11	Sign language
4	Executive control	11	Spatial language

Cluster number	Keywords	Cluster number	Keywords
4	Executive function	12	Discourse
4	Executive functions	12	Foreign language instruction
4	Form-function mapping	12	Implicit learning
4	French liaison	12	Interface
4	Immersion	12	Morphology
4	Inhibition	12	Null subjects
4	Language acquisition	12	Sequential bilingualism
4	Language development	12	Statistical learning
4	Language proficiency	12	Syntax
4	Language switching	12	Syntax-pragmatics interface
4	Language usage	12	Universal grammar
4	Linguistics	13	Academic writing
4	Phonological short-term memory	13	Collocations
4	Recasts	13	Corpus linguistics
4	Second-language acquisition	13	Formulaic sequences
4	Switching	13	Grammatical development
4	Theory of mind	13	Interlanguage development
4	Verbal working memory	13	Noticing
4	Working memory	13	Phraseology
5	Materials	13	Proficiency
5	Chunking	13	Proficiency level
5	Classroom discourse	13	Speech acts
5	Conversation analysis	14	Acculturation
5	Corrective feedback	14	Biliteracy
5	English as a second language	14	Catalan
5	English language learners	14	Education
5	English learners	14	Estonian
5	Explicit knowledge	14	Language ideologies
5	Formulaic language	14	Language policy
5	Game-based learning	14	Morphological awareness
5	Instructional interaction	14	Transfer
5	Instructional strategies	14	Word order

Table 2.
Clusters and the list of keywords in the co-occurrence analysis of publications relevant to second-language acquisition studies on usage-based and pragmatic language learning. Clusters are visualized in the co-occurrence map in Figure 2.

speech acts, contextual effects, facial expressions, speech acts, communicative norms, discourse particles, indirect speech, and affective meanings. The second group of research concerns the pragmatics-syntax interface and the involvement of cognitive changes in pragmatic processing. The topics include counterfactual conditionals, indefiniteness, referential informativeness, morphological marking for

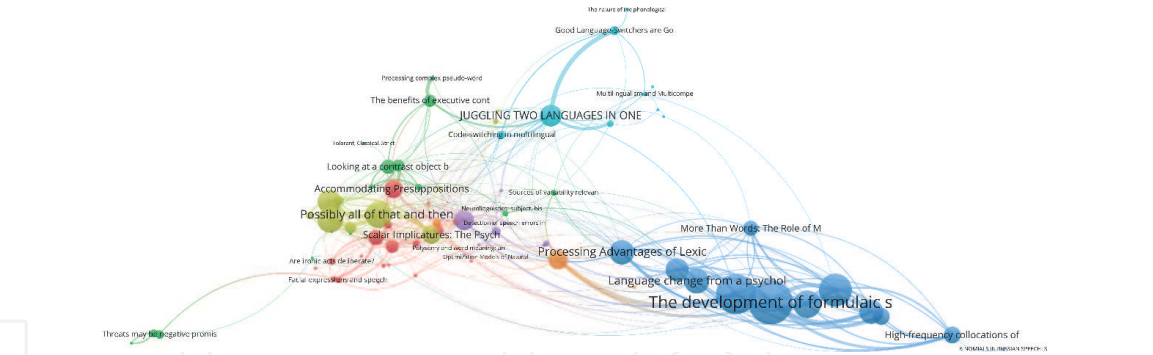


Figure 3. Bibliographic coupling network map for articles with shared citations ($n = 80$), relevant to the psycholinguistic literature on pragmatic and usage-based language processing. Nodes represent the title of the articles, and the size of the nodes represents the number of citations in that article that co-occur in another article. Ties reflect the relationships between keywords, and the thicknesses represent the number of the shared citations. Clusters of articles are color coded and are shown in details in Table 3.

pragmatics-syntax interface, autism, Parkinson’s disease, mild cognitive impairment, executive control training, selective attention, and theory-of-mind. The third group of research concerns conventional expressions and formulaic languages, which include the topics such as frequency of lexical use and second-language learning. The fourth group of research discusses the flexibility in pragmatic inferences and the relevant topics include the scalar inferences and counterfactual inferences. The fifth group of research concerns the individual differences in syntactic and pragmatic processing, such as the working memory constraints on syntactic islands and semantic comprehension, and pragmatic strategy in syntactic attachment. The sixth group of research focuses on bilingualism, which covers the topics including code-switching, cross-modal linguistic transfer, phonological processing, and the consequence of bilingualism. The last group of research discusses communicative and pragmatic function of lexical meanings. The topics include the noun-noun compounds, polysemy, sublexical constituents, and negation.

2.3.2 Pragmatic and usage-based language learning

Among 601 articles relevant to the study on second-language acquisition between 2010 and 2019, 571 shared citing references. According to the shared citations, the articles were clustered into eight groups, with the minimum number of citations per cluster sets to 10 (Figure 4 and Table 4). The first research group highlights the empirical studies on factors that affect different aspects of second-language acquisition in children or young adults, with many involving a comparison between the first-language and the second-language acquisition. The second group of research highlights the acquisition of lexical and grammatical aspects of language in L2, distinguishing the role of domain-general (e.g., the cognitive constraint on frequency learning) and domain-specific factors (e.g., the knowledge of linguistic register) in second-language acquisition. The third group concerns the effectiveness of various instructional strategies (e.g., virtual learning environment) and the perception of teaching strategies (e.g., corrective feedback) in the acquisition of pragmatic competencies. The fourth group concerns the development of pragmatic strategies in L2, for instance, the use of speech acts (such as apology request and refusal acts), prosodic strategies, conversational implicature, quotative marking, and conventional expressions. The fifth group concerns the syntax-pragmatics interface during second-language acquisition. Some special themes are discussed, which include the null and overt subject, wh-question, co-reference and anaphora, and left dislocation. The sixth group of research uniquely focuses on the cognitive

Cluster number	Title of the article
1	A strong link between verbal and emoji-based irony: How the brain processes ironic emojis during language comprehension
1	Accommodating presuppositions is inappropriate in implausible contexts
1	Ancient Greek awareness of child language acquisition
1	Are ironic acts deliberate?
1	Beyond mechanistic interaction: value-based constraints on meaning in language
1	Co(n)textual supports in the discursive use of phraseological units
1	Cognitive adequacy in a dialogic functional discourse grammar
1	Facial expressions and speech acts: experimental evidences on the role of the upper face as an illocutionary force indicating device in language comprehension
1	Identifying seekers and suppliers in social media communities to support crisis coordination
1	Misleading health consumers through violations of communicative norms: a case study of online diabetes education
1	Pragmatic choice in conversation
1	Procedural meaning and Spanish discourse particles: an experimental approach
1	Rationales for indirect speech: the theory of the strategic speaker
1	Robots that say no affective symbol grounding and the case of intent interpretations
1	Sentinels of breach: lexical choice as a measure of urgency in social media
1	Sources of history for a psychology of verbal communication
1	The impact of foreign accent on irony interpretation
2	Acoustic marking of prominence: how do preadolescent speakers with and without high-functioning autism mark contrast in an interactive task?
2	Approximation to the semantics of counterfactuals
2	Experimental investigations of weak definite and weak indefinite noun phrases
2	Looking at a contrast object before speaking boosts referential informativeness but is not essential
2	Pragmatic comprehension deficit in Parkinson's disease
2	Processing complex pseudo-words in mild cognitive impairment: the interaction of preserved morphological rule knowledge with compromised cognitive ability
2	Psychological essentialist reasoning and perspective taking during reading: a donkey is not a zebra, but a plate can be a clock
2	Seeking the -ational in derivational morphology
2	Sensitivity to speaker control in the online comprehension of conditional tips and promises: an eye-tracking study
2	Sources of variability relevant to the cognitive sociolinguist, and corpus—as well as psycholinguistic methods and notions to handle them
2	The benefits of executive control training and the implications for language processing
2	The communicative significance of primary and secondary accents
2	The director task: a test of theory-of-mind use or selective attention?
2	Threats may be negative promises (but warnings are more than negative tips)
2	Tolerant, classical, strict
3	Binomials in Russian speech: semantic types and objective and subjective frequency

Cluster number	Title of the article
3	Conventional expressions: investigating pragmatics and processing
3	Formulaic language and second language acquisition: zipf and the phrasal teddy bear
3	High-frequency collocations of nouns in research articles across eight disciplines
3	Investigating academic phraseology through combinations of very frequent words: a methodological exploration
3	Language change from a psycholinguistic perspective: the long-term effects of frequency on language processing
3	More than words: the role of multiword sequences in language learning and use
3	Processing advantages of lexical bundles: evidence from self-paced reading and sentence recall tasks
3	The development of formulaic sequences in first and second language writing Investigating effects of frequency, association, and native norm
3	The effectiveness of focused instruction of formulaic sequences in augmenting L2 learners' academic writing skills: a quantitative research study
3	Usage-based linguistics and the magic number four
3	What do we (think we) know about formulaic language? An evaluation of the current state of play
4	Authorship attribution, constructed languages, and the psycholinguistics of individual variation
4	Competition and symmetry in an artificial word learning task
4	Eye Movement Evidence for Context-Sensitive Derivation of Scalar Inferences
4	Free choice permission and the counterfactuals of pragmatics
4	Intonation and pragmatic enrichment: how intonation constrains ad hoc scalar inferences
4	Letter and symbol identification: no evidence for letter-specific crowding mechanisms
4	No delay for some inferences
4	Possibly all of that and then some: scalar implicatures are understood in two steps
4	Scalar implicatures: the psychological reality of scales
4	Two languages, two minds: flexible cognitive processing driven by language of operation
5	A test of the relation between working-memory capacity and syntactic island effects
5	Agreement processes in English and Spanish: a completion study
5	Attachment preference in auditory German sentences: individual differences and pragmatic strategy
5	Detection of speech errors in the speech of others: an ERP study
5	Neurolinguistics: subject, history, methods
5	Simulating cross-language priming with a dynamic computational model of the lexicon
5	Specific language impairment: markers into semantic and pragmatic areas in Spanish-speaking children
5	The effect of word predictability on reading time is logarithmic
5	Which noun phrases is the verb supposed to agree with? Object agreement in American English
5	Working memory predicts semantic comprehension in dichotic listening in older adults

Cluster number	Title of the article
6	Adaptation of the bilingual aphasia test (BAT) to Sardinian: clinical and social implications
6	Calling for interdisciplinary approaches to the study of Spanglish and its linguistic manifestations
6	Code-switching in multilinguals with dementia: patterns across speech contexts
6	Cross-modal bilingualism: language contact as evidence of linguistic transfer in sign bilingual education
6	Familiarity, comprehension and use of Indian English only L1 Indian English speakers' psycholinguistic judgments and interview responses
6	Good language-switchers are good task-switchers: evidence from Spanish-English and Mandarin-English bilinguals
6	Juggling two languages in one mind: what bilinguals tell us about language processing and its consequences for cognition
6	Morphosyntactic annotation of CHILDES transcripts
6	Multilingualism and multicompetence: a conceptual view
6	The nature of the phonological processing in French dyslexic children: evidence for the phonological syllable and linguistic features' role in silent reading and speech discrimination
7	Noun-noun compounds for fictive food products: experimenting in the borderzone of semantics and pragmatics
7	Optimization models of natural communication
7	Polysemy and word meaning: an account of lexical meaning for different kinds of content words
7	Statistical measures for usage-based linguistics
7	SyllabO plus: a new tool to study sublexical phenomena in spoken Quebec French
7	The good, the not good, and the not beautiful: on the non-obligatoriness of suppression following negation

Table 3.
Clusters and title of articles in the bibliographic coupling analysis on the psycholinguistic literature on pragmatic and usage-based language processing. Clusters are visualized in the bibliographic coupling network map in Figure 3.

advantage (especially in the executive function) and the neural consequences of bilingualism, with the aid of neuroimaging techniques. The seventh group aims to examine the factors that affect the second-language acquisition and the first-language attrition in the aspects of syntactic, prosodic, and pragmatic skills (e.g., the age of acquisition, the richness of language input, and the neurocognitive constraints). The last group is devoted to the research on the processing of discourse and pragmatic marker (e.g., the usage of article, scalar implicature, and presupposition) in second-language learner.

3. Summary and future direction

The bibliometric review shows a growing trend of research interest in the function, usage, and pragmatics of language in the field of psycholinguistics and in the field of second-language acquisition. These trends indicate that the existing

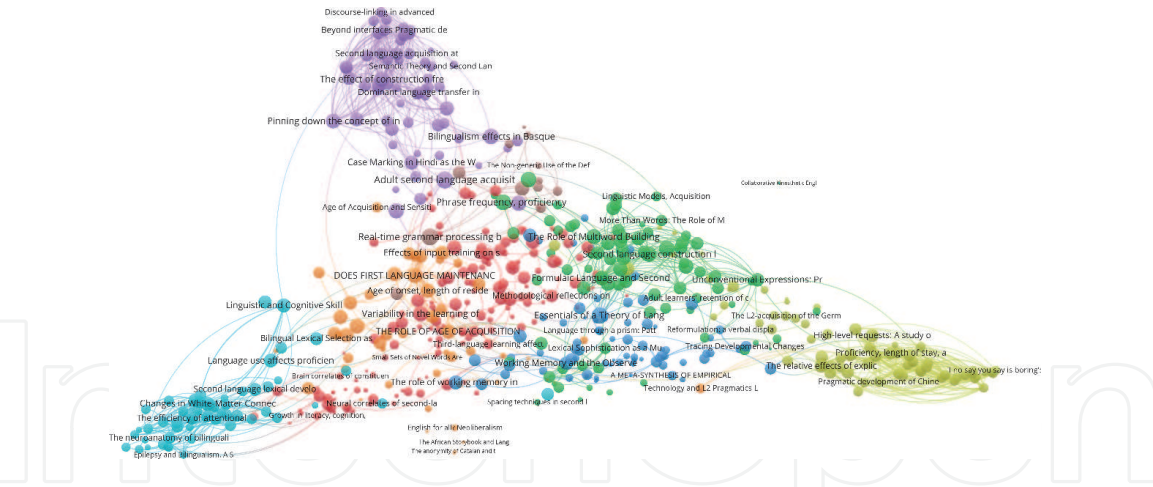


Figure 4. Bibliographic coupling network map for articles with shared citations ($n = 571$), relevant to the second-language acquisition literature on pragmatic and usage-based language learning. Clusters of articles are color coded and are shown in details in *Table 4*.

Cluster number	Title of the represented articles
1	Variability in the learning of complex morphophonology
1	Can L2-English influence L1-German? The case of post-vocalic /r/
1	A formalist perspective on language acquisition
1	Multicompetence and native speaker variation in clausal packaging in Japanese
1	Abstracting grammar from social-cognitive foundations: a developmental sketch of learning
1	Individual differences in child English second language acquisition: comparing child-internal and child-external factors
1	Asymmetrical interlingual influence in the production of Spanish and English laterals as a result of competing activation in bilingual language processing
1	Tracking learners' progress: adopting a dual 'corpus cum experimental data' approach
1	Learned attention effects in L2 temporal reference: the first hour and the next eight semesters
1	Effects of input properties, vocabulary size, and L1 on the development of third person singular -s in child L2 English
2	Phrase frequency, proficiency and grammaticality interact in non-native processing: Implications for theories of SLA
2	Second language construction learning: investigating domain-specific adaptation in advanced L2 production
2	A usage-based approach to preposition placement in English as a second language
2	Cognitive linguistics and the second language classroom
2	The role of multiword building blocks in explaining L1-L2 differences
2	L2 negation constructions at work
2	Formulaic language and second language acquisition: zipf and the phrasal teddy bear
2	Explicit knowledge and processes from a usage-based perspective: the developmental trajectory of an instructed L2 learner
2	Frequency of input and L2 collocational processing a comparison of congruent and incongruent collocations

Cluster number	Title of the represented articles
2	Frequency effects on first and second language compositional phrase comprehension and production
3	Essentials of a theory of language cognition
3	The role of working memory in processing L2 input: insights from eye-tracking
3	Working memory and the observed effectiveness of recasts on different L2 outcome measures
3	The relationship between L2 instruction, exposure, and the L2 acquisition of a syntax-discourse property in L2 Spanish
3	Experience effects on the development of late second language learners' oral proficiency
3	A corpus-driven study of second-person pronoun variation in L2 French synchronous computer-mediated communication
3	Corrective feedback and the role of implicit sequence-learning ability in L2 online performance
3	ERPs recorded during early second language exposure predict syntactic learning
3	Exploratory research on second language practice distribution: an aptitude x treatment interaction
3	Reinvestigating the noticing function of output
4	The relative effects of explicit and implicit form-focused instruction on the development of L2 pragmatic competence
4	Expanding the circle to learner English: investigating quotative marking in a German student community
4	High-level requests: a study of long residency L2 users of English and French and native speakers
4	Improving Chinese EFL teachers' English requests: does study abroad help?
4	Environmental influence on language acquisition: comparing second and foreign language acquisition of Swedish
4	News from the pragmatics classroom: contrasting the inductive and the deductive approach in the teaching of pragmatic competence
4	Testing of second language pragmatics: past and future
4	Proficiency, length of stay, and intensity of interaction, and the acquisition of conventional expressions in L2 pragmatics
4	Second language acquisition of Spanish service industry requests in an immersion context
4	The effectiveness of corrective feedback for the acquisition of L2 pragmatics: an eight month investigation
5	Adult second language acquisition A selective overview with a focus on the learner linguistic system
5	Bilingualism effects in Basque subject pronoun expression
5	The relevance of first language attrition to theories of bilingual development
5	Embedded wh-questions in L2 English in India inversion as a main clause phenomenon
5	The effect of construction frequency and native transfer on second language knowledge of the syntax-discourse interface
5	Pinning down the concept of interface in bilingualism
5	Left dislocation in near-native French
5	Case marking in Hindi as the weaker language

Cluster number	Title of the represented articles
5	Second language acquisition of pragmatic inferences: evidence from the French c'est-cleft
5	Transfer and proficiency effects in L2 processing of subject anaphora
6	Changes in white-matter connectivity in late second language learners: evidence from diffusion tensor imaging
6	Linguistic and cognitive skills in Sardinian-Italian bilingual children
6	Better early or late? Examining the influence of age of exposure and language proficiency on executive function in early and late bilinguals
6	Language use affects proficiency in Italian-Spanish bilinguals irrespective of age of second language acquisition
6	Language interference and inhibition in early and late successive bilingualism
6	Second language lexical development and cognitive control: a longitudinal fMRI study
6	Bilingual lexical selection as a dynamic process: evidence from Arabic-French bilinguals
6	Degree of multilingualism, code-switching and intensity of target language contact predict pragma-linguistic awareness in an English as a foreign language context
6	The efficiency of attentional networks in early and late bilinguals: the role of age of acquisition
6	Language exposure induced neuroplasticity in the bilingual brain: a follow-up fMRI study
7	Does first language maintenance hamper nativelikeness in a second language? A study of ultimate attainment in early bilinguals
7	Bidirectional lexical interaction in late immersed Mandarin-English bilinguals
7	The role of age of acquisition in late second language oral proficiency attainment
7	Age of onset, length of residence, language aptitude, and ultimate L2 attainment in three linguistic domains
7	Effects of input training on second language syntactic representation entrenchment
7	The storage and composition of inflected forms in adult-learned second language: a study of the influence of length of residence, age of arrival, sex, and other factors
7	Inflectional morphology in bilingual language processing: an age-of-acquisition study
7	Language use across international contexts: shaping the minds of L2 speakers
7	Proficiency and working memory based explanations for nonnative speakers' sensitivity to agreement in sentence processing
7	The critical period hypothesis in second language acquisition: a statistical critique and a reanalysis
8	Real-time grammar processing by native and non-native speakers: constructions unique to the second language
8	Definite discourse-new reference in L1 and L2: the case of L2 Mandarin
8	The role of presuppositionality in the second language acquisition of English articles
8	Processing of scalar inferences by Mandarin learners of English: an online measure
8	Definite discourse-new reference in L1 and L2: a study of bridging in Mandarin, Korean, and English
8	Identifiability and accessibility in learning definite article usages: a quasi-experimental study with Japanese learners of English
8	Teaching the English article system: definiteness and specificity in linguistically-informed instruction

Cluster number	Title of the represented articles
8	Revisiting fluctuations in L2 article choice in L1-Korean L2-English learners
8	How much do Cantonese ESL learners know about the English article system?
8	The non-generic use of the definite article the in writing by Turkish learners of English

Table 4.
Clusters and title of articles in the bibliographic coupling analysis on the second-language acquisition literature on pragmatic and usage-based language learning. Clusters are visualized in the bibliographic coupling network map for Figure 4. Given large numbers of article, only articles that weighed top 10 in each cluster were listed. The articles were ranked in a descending order according to their weights in a cluster.

investigation of language communication and acquisition in real world is still in its infancy and invites further empirical and theoretical contributions. The frequency distribution clearly shows the leading contributors and the journals most attracted to the relevant topic. The co-occurrence and the bibliometric coupling analysis demonstrate that researchers are most interested in the processing of various interpersonal and socio-pragmatic functions in L1 and L2 speakers in the field of psycholinguistics, as well as factors underlying L2 acquisition from children to adults, and the impact of the cognitive and neurodevelopmental impairments in the field of second-language acquisition.

One important direction is to combine the real-time neurophysiological recordings (such as eye-tracking, EEGs and fMRI) with the psycholinguistic paradigms for investigating the real-world language use to reveal the neurocognitive architecture underlying pragmatic language processing and those underlying language acquisition (e.g., [6, 7] for some reviews). The use of virtual reality to create naturalistic scenarios will be a good complementary approach to test the impact of real-world social interaction on one's language processing and learning [8]. Of special interests is the testing of linguistic phenomena that can be addressed by different categories of communicative functions, such as indirectness (e.g., [9]), presupposition (e.g., [10]), speech/communicative acts (e.g., [11, 12]), and politeness (e.g., [13–15]), among many others, on both well-represented, dominant languages and under-represented, marginalized languages (e.g., east-Asian languages such as Chinese, Japanese, and Korean and their dialects) and on one's own and unfamiliar languages [16–20]. These topics are seldomly addressed in psycholinguistic literatures, and the experimental paradigms adapted to address these topics are rare in the second-language acquisition literatures. New computational approaches such as machine learning and computational modeling will provide a solution to the classification of different types of communicative functions in L1 with higher accuracy. However, whether such approaches can reveal the novel feature in the classification of communicative functions in L2 is still an unaddressed question. The capacity of classifying communicative categories in one's second language with the model built in one's mother tongue, and the vice versa, is promising to reveal if the mental representation underlying pragmatic functions is shared or distinct between L1 and L2. Other fascinating lines of research are to enhance the understanding of the individual differences in the processing of pragmatic language that is endorsed by professional, political, or cultural background of the language users [21, 22], and the atypical processing that may be revealed by testing individuals with pragmatic impairments or variations (including but not limited to neurodevelopmental and neurodegenerative disordered individuals). With the aid of multimodal approaches to build intelligent recognition system, the profiling for one's pragmatic language ability is likely to provide a novel way to predict or diagnose individuals with special clinical status [23]. It is still unknown how learning a second language can affect

one's pragmatic language ability in those who suffer from certain clinical status. These new possibilities, combined with what has been indicated from the bibliometric review, will make significant contributions to reveal a new trend in developing new psycholinguistic paradigms for studying the mechanisms underlying the usage-based and pragmatic language processing.

Our bibliometric method may be limited in the coverage of literatures given that the literature search was only focused on the published articles in the databases of Web of Science where the journals of these publications are indexed. The nonjournal works such as books, dissertations, and conference papers can also contribute to the latest development in the shift towards pragmatic and usage-based language processing and learning in the relevant fields and could be incorporated for judging the impact of the research. The findings from the present analysis also await verifications from other citation tracking databases, such as Google Scholar, PubMed, and PsycInfo. Despite such limits, the bibliometric analysis provides evidence-based descriptions, comparisons, and visualizations of research output [24] and proposes a promising research avenue at the interface of psychological science, language science, and educational science. In particular, the network analysis and the visualization of the network structure for co-occurring keywords and for co-citing articles somehow serve as the tools to monitor the subject collaboration and to identify the cross-cluster research efforts of high performance and high impacts in the field of psycholinguistics and the field of second-language acquisitions (**Figures 1–4**). These emerging discoveries and trends invite more dedicated and interdisciplinary research outputs to address the arising issues of the functional, usage-based, and pragmatic language processing and learning in the field of psycholinguistics and second-language acquisition studies.

Acknowledgements

The author is supported by the grant of European Studies: An Interdisciplinary Approach to European Issues (World First-Class Discipline Construction Project of Tongji University).


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