REVIEW ARTICLE

A bibliometric study of the research field of experimental philosophy of language

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Abstract: The past eighteen years witnessed the rapid development of experimental philosophy of language. Adopting a bibliometric approach, this study examines the research trends and status quo of this burgeoning field based on a corpus of 237 publications retrieved from PhilPapers. It is observed that experimental philosophy of language has undergone three stages, the initiation stage, the development stage, and the extension stage, across which there is a clear upward trend in the annual number of publications. Michael Devitt, Edouard Machery, John Turri, Nat Hansen, et al., are found to be the most productive philosophers, testifying their leading positions in this field. Journals, instead of books, are the major homes of works in this area. The analysis also yields a list of influential works, including the seminal work "Semantics, Cross-cultural Style" and other significant publications on the semantics of various types of expressions. Relatedly, the major research themes are found to include not only intuitions about the reference of proper names, but also a wide array of philosophically and linguistically interesting issues like the meaning of color adjectives, epistemic modals, and predicates of personal taste, the norms of assertions and the essence of lies, etc. These findings showcase that experimental philosophy of language has broadened the research territory and offered deep insights into central issues of philosophy of language that are beyond the reach of the conventional armchair methodology.

Keywords: experimental philosophy of language; bibliometric analysis; research trend; research themes

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1. Introduction

Experimental philosophy of language, also interchangeably referred to as experimental semantics, is a newly emerged area in philosophy. Experimental philosophers of language typically adopt research methods commonly used in psychology and cognitive science to address philosophically

interesting issues related to language, such as meaning and reference of various linguistic expressions. If we take the publication of the short paper "Semantics, cross-cultural style" by Machery et al. (2004) as the herald of experimental philosophy of language movement, then this year 2022 marks the 18th year of its development. Young though it is, it has attracted increasing attention among philosophers, linguists and psycholinguists interested in language, and has matured into an influential and indispensable way of doing semantics and philosophy.

While the field of experimental philosophy of language is ever expanding, producing a growing body of scholarly output, there have been few studies that systematically review this burgeoning area. Hansen (2015) and Machery (2021) have each provided a survey of the studies in experimental philosophy of language, but they have nonetheless failed to offer a panoramic view of the whole field, primarily due to their narrow focus on the empirical investigations into the issue of reference of names, which in reality represents just one strand of the experimental research. As a result, it is still unclear, at least to those who are not familiar with this field, what the most commonly explored research topics are in experimental philosophy of language, who have been the most productive and influential researchers, which have been the most important works, and what the major venues for works in experimental philosophy of language are. It is also unknown whether there are changes in these aspects.

To better answer these questions, we turn our attention to bibliometrics, an approach that is originally developed and commonly used in library and information science. A bibliometric analysis is in essence a quantitative analysis that applies "mathematics and statistical methods to the analysis of academic publications" (Pritchard, 1969: 348). It can be employed to uncover research trends and publication patterns, and thus give researchers a broad overview of a certain academic field, such as the number of publications within a certain time period, the productivity of individual authors and institutions, the publishing capacity of academic publishers and journals, and the influence of researchers and published works (de Bellis, 2009). When used in combination with machine learning and natural language processing techniques, bibliometrics can further offer deeper insights into the major research themes and their evolution over a specified time window, and hence delineate the boundary and the developmental trajectory of the whole field in an objective manner. Over the years, bibliometrics has been widely used in different disciplines, such as computer science (Xie and Willett, 2013), business management (Liu et al., 2015), education (Chang et al., 2020), and linguistics (Lei and Liu, 2019; Zhang, 2020; Hyland and Jiang, 2021, etc.). But, to the best of our knowledge, there have been no such studies even in the broad field of philosophy, let alone its sub-field experimental philosophy of language.

There are several studies in philosophy that have a savor of bibliometric analysis, which might be considered as primitive form of bibliometric studies in this field. For instance, Andow (2015) investigated the explosion of the word "intuition" and its cognates based on articles retrieved from JSTOR database. It was observed that the intuition talk has been prevalent since the 1900s and this phenomenon is not confined to the field of philosophy. Other academic areas of finance, marketing, linguistics, economics, etc., have all witnessed the surge of intuition talks. But philosophers in particular seemed to have enjoyed using intuitions in their works the most. In this way, Andow (2015) provided evidence of the widespread use of intuitions in academic research and hence laid ground for further studies on the conventional armchair theorizing methodology. However, with a focus on the use of intuitions, the study cannot inform us of the other hot research topics in philosophy in the

examined time span.

Another case in point is Knobe (2015), in which around 400 influential publications in philosophy of mind from 20 reputable philosophy journals in the periods of 1960–1999 and 2009–2013 were examined to see what contemporary philosophers are actually doing. Knobe found that works in these time frames are quite different in terms of both research topics and methods. While the studies in the 20th century mostly adopted the pure a priori armchair-based method, the latest contemporary works have widely appealed to empirical approaches. With this shift in methodology, there is also a shift of attention from broad metaphysical questions of mind to more specific and cognition-related aspects of mind. Knobe thus concluded that philosophers nowadays are doing things substantially different from their predecessors and philosophy has evolved to be an interdisciplinary research area. Still another empirical bibliometric-like study is Knobe (2016). In this study, Knobe offered a quantitative analysis of 379 papers documenting 453 experimental studies indexed under the category "experimental philosophy" in the PhilPapers Database. Through manual examination and categorization, Knobe found that a vast majority of these studies (88%) do not belong to either the positive or negative research program in experimental philosophy. Instead, they are best construed as falling into the broad area of cognitive science. This finding has led Knobe to claim that experimental philosophy is part of cognitive science. These two quantitative studies conducted by Knobe (2015, 2016) provided valuable data on two subfields of contemporary research in philosophy. But owing to constraints in scope and methods, these studies have not provided a comprehensive review of the relevant areas.

Thus, this present study aims to fill the niche by carrying out a bibliometric analysis of the research outputs in the specific area of experimental philosophy of language. The questions guiding this project include the following:

1) What is the overall publication trend in experimental philosophy of language?

2) What are the popular venues for works in experimental philosophy of language?

3) Which philosophers and documents in experimental philosophy of language have been most influential?

4) What have been the major research topics in experimental philosophy of language?

In the rest of this paper, we will first introduce the research methods in detail, including the process of data collection and data cleansing in Section 2. In Section 3 we will show the major findings, with statistical analysis and brief discussions of the results, structured according to the research questions listed above. Section 4 concludes the study with predictions and implications for future bibliometric research in experimental philosophy of language.

2. Methodology

2.1. Corpus: Experimental philosophy of language

The first step of the bibliometric analysis is to create a corpus of the research outputs in experimental philosophy of language. But how do we delimit experimental philosophy of language? For the current purpose, we roughly follow the definition offered by Hansen (2015: 1):

Experimental philosophy of language applies experimental methods used in the cognitive sciences (experimental psychology, psycholinguistics) to topics of interest to philosophers of language, such as the meaning of particular kinds of expressions (names, determiners, natural kind terms, adjectives, and so on), pragmatic phenomena (implicature, presupposition, metaphor, the semantics-pragmatics boundary, for example), and methodological issues (the reliability of informal versus formal experimental methods, the reliability of expert judgments versus the judgments of ordinary speakers, for example).

However, we exclude from the current study the empirical research on pragmatic phenomena (implicature, presupposition, metaphor, the semantics-pragmatics boundary, etc.), as these phenomena are typically described as being the core part of "experimental pragmatics" (Noveck, 2018) and are mostly investigated by researchers in the field of linguistics. Here, it is also worthwhile to point out that in experimental studies on the semantics-pragmatics boundary/interface issue, researchers also use the term "experimental semantics" as a coordinate of "experimental pragmatics" (see the book titles *Experimental Pragmatics/Semantics* by Meibauer and Steinbach, and *The Oxford Handbook of Experimental Semantics and Pragmatics* by Cummins and Katsos. However, there is an anthropological difference to be noted here. The studies to this type of experimental semantics differs from what we focus on in the current research, in that while these studies are mostly carried out by linguists or psycholinguists, what we are concerned about are principally done by philosophers.

Having set the boundary, we next sampled the scholarly works indexed on the PhilPapers website (https://philpapers.org/). We targeted this resource pool instead of the commonly used databases like Google Scholar and Web of Science, because thus far it has been the largest and the most comprehensive database of philosophy maintained by professional philosophers. Further, the works indexed are all categorized under different categories and subcategories based on the central topics. For instance, experimental philosophy is placed under philosophical methods section, which is under metaphilosophy. To obtain the relevant literature, we located the subcategory of "experimental philosophy of language" that is among the 13 subcategories of experimental philosophy. As of May 16, 2022, there are 209 entries in this category. We retrieved the bibliometric data of these works, including title, author, publication year, document type, source, abstract, keywords (if there are) and citation numbers.

2.2. Data pre-processing

We next pre-processed the data for further bibliometric analysis. As a first step, duplicate entries, book reviews, book introductions, conference presentations, short commentaries and those that were published before 2004 were manually removed. In the meanwhile, we also added some scholarly works that in our opinion clearly belong to experimental philosophy of language but are nonetheless missing in the index. This resulted in a total number of 237 publications in our corpus spanning the period of 2004–2021. Among these works, there are 9 books, 35 book chapters, 193 journal articles, suggesting journals are the most popular medium of disseminating knowledge in experimental philosophy of language.

In addition, while conducting manual check of these works, we supplemented the core bibliometric information such as publication year, abstract and keywords for works that do contain such data but were somehow incomplete as indexed on the PhilPapers website. We also corrected the citation counts based on Google Scholar (as of May 15, 2022), which is up-to-date and comparatively

speaking more accurate. In addition, the author names were re-coded in case the same researcher's name is listed differently (e.g., Devitt, M, Michael Devitt, J. Knobe and Joshua Knobe, Nathaniel Hansen, Nat Hansen, Hansen, N.) in the literature. The journal titles that were abbreviated in some works were also changed into the full title for easy referencing and analysis.

3. Results and analysis

In this section, we report the results and analysis of our bibliometric study, which includes: 1) the number of publications in experimental philosophy of philosophy across the past 18 years, divided into three 6-year periods, 2) the most productive researchers in experimental philosophy of language, 3) the major publication venues of works in experimental philosophy of language, 4) the main research themes in experimental philosophy of language over the last two decades.

3.1. Number of publications over the past 18 years

What is the developmental trajectory of experimental philosophy of language like? **Figure 1** below presents the annual number of publications over the years. It is evident that despite several falls, the number of publications in general has kept rising over the last two decades, rendering experimental philosophy of language a burgeoning field. In particular, since 2015, the average number of yearly research outputs has stayed around 22, which is almost triple of the average annual number of publications (i.e.,7.5) in the previous 11 years.

When we divide the past 18 years into three 6-year periods, the increasing trend across the three periods is easily observable. As shown in **Figure 2**, in the first period there are only 15 publications, while in the last period the number has risen to 133. This sharp increase in the number of publications suggests that experimental philosophy of language as a young and developing sub-discipline has attracted greater and greater attention over the examined time span.

3.2. Most productive philosophers of language

In the field of experimental philosophy of language, who have been the leading and driving forces? To answer this question, we looked at the productivity of researchers in this area. As shown in **Table 1**, Michael Devitt, Edouard Machery, John Turri and Nat Hansen are the top five most prolific philosophers of language who have authored or co-authored more than 10 works in the last two
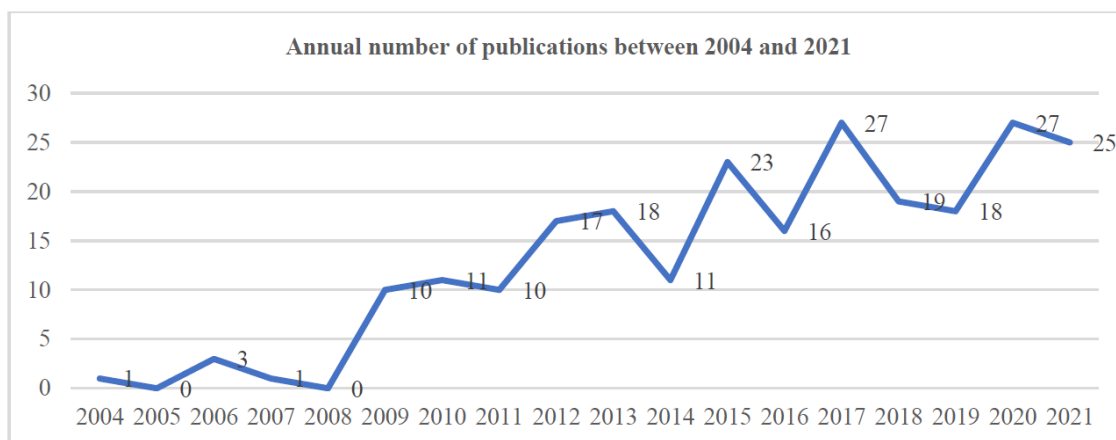
Figure 1. Annual number of publications in experimental philosophy of language between 2004 and 2021.
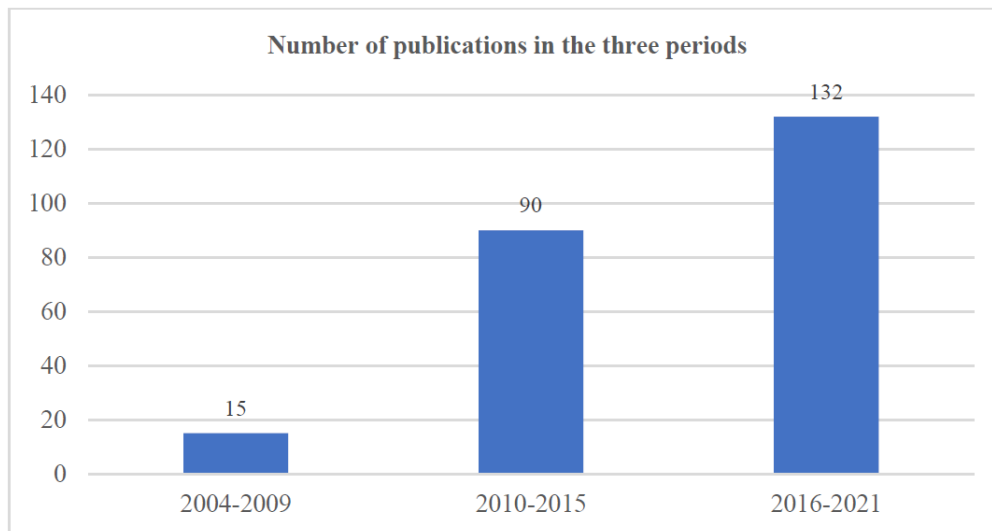
Number of publications in the three periods

Figure 2. Number of publications in experimental philosophy of language in the three periods.

Table 1. The top 10 productive philosophers of language

	As sole author or co-author	Total number of publications
Michael Devitt	13	13
Edouard Machery	11	12
John Turri	9	14
Nat Hansen	9	12
Eugen Fischer	7	7
Genoveva Marti	6	6
Emmanuel Chemla	5	9
Justin Khoo	5	5
Markus Kneer	5	5
Daniel Cohnitz	4	4
Jeffrey Maynes	4	4

decades. In particular, Michael Devitt has published 13 works as the sole author or the first author on topics of linguistic intuitions and their evidential value, issues in experimental semantics, testing theories of reference of names (including proper names and natural kind terms), etc. Edouard Machery, one of the leading figures in experimental philosophy movement, produced 12 works in philosophy of language, with a special focus on the reference of proper names. His work "Semantics, Cross-Cultural Style" (2004), has remained the most influential and provocative study, replications and criticism of which have not ceased to appear. It is also this research that initiated the experimental turn of philosophy of language (Li and Liu, 2015). Intriguingly, over the years, we have seen heated debates on testing reference of proper names between Edouard Machery, Michael Devitt and Genoveva Marti, which has no doubt facilitated the development of experimental philosophy of language.

In the last decade, Nat Hansen has reviewed the experimental philosophy of language movement,

conducted experiments on contextualism and also examined issues and claims in ordinary language philosophy. John Turri's research mostly touches the norms of assertion, moral judgements, lying, etc. More recently, Eugen Fischer has published works concerning topics like intuitions and inferences, conceptual engineering, and more generally, ways of doing experimental philosophy (of language). Also in recent years, Markus Kneer has conducted several studies on belief ascriptions, predicate of personal tastes, epistemic modals, assertions, debates between contextualism and relativism. Similarly, Justin Khoo explored the issues concerning modal disagreements, epistemic modals, indexicals, moral semantics, etc. Emmanuel Chemla differs from the above philosophers in that her works on presuppositions and scalar implicatures, the interface between semantics and pragmatics, etc., are most often discussed and cited in the linguistic field. Nonetheless, these topics also have a philosophical ring in themselves, which is why they were indexed in the experimental philosophy of language category in PhilPapers.

3.3. Major publication venues

People who are interested in the experimental philosophy of language movement may be eager to know what the popular venues that host the emerging works in the field are. In our database, the 237 works includes 9 books, 35 book chapters and 193 journal articles, indicating journals are the major homes of scholarly works in experimental philosophy of language. Among these publications, the books are mostly quite young, which mostly appeared after the year 2015. These new books include *Advances in Experimental Philosophy of Language* (Haukioja, 2015), *Puzzles of Reference* (Cappelen and Dever, 2018), *The Oxford Handbook of Experimental Semantics and Pragmatics* (Cummins and Katsos, 2019), *Experimental Philosophy: A Critical Study* (Mukerji, 2019), *Linguistic Intuitions: Evidence and Method* (Schindler et al., 2020), and *The Routledge Handbook of Linguistic Reference* (Biggs and Geirsson, 2021). Similarly, most of the book chapters also came out in the last ten years. Their sources, besides the above-mentioned edited book volumes, include *Current Controversies in Experimental Philosophy* (O'Neill and Machery, 2014), *On Reference* (Bianchi, 2015), *Advances in Experimental Philosophy and Philosophical Methodology* (Nado, 2016), *A Companion to Experimental Philosophy* (Sytsma and Buckwalter, 2016), *Methodological Advances in Experimental Philosophy* (Fischer and Curtis, 2019), and *Language and Reality from a Naturalistic Perspective* (Bianchi, 2020). These recent books and book chapters, though small in number, present the status quo and the advances of experimental philosophy of language in a rather systematic and coherent manner, making important contributions to the filed.

Different from the recent books and book chapters, journal articles started to appear early in around the beginning of this century, presenting the most recent research of the time. What are the major journals that host these articles? **Table 2** presents the top 15 venues that have published research in experimental philosophy of language. Most notably, *Synthese*, *Cognition*, *Review of Philosophy and Psychology*, *Mind and Language*, *Philosophical Psychology* have been the most popular venues, probably because these journals enjoy a wider readership among philosophers, linguists, and psychologists as well. Indeed, the rest of the journals in the list such as *Cognitive Science*, *Philosophy and Phenomenological Research*, and *Philosophy Compass* are also interdisciplinary to varying degree, rather than being confined to a narrow and specific discipline. It seems natural that these journals form the logical homes of works in experimental philosophy of language, primarily due to their interdisciplinary nature, i.e., employing methods commonly used in psychology and cognitive science to address issues in philosophy of language that are of interest to philosophers,

Table 2. The most popular venues of works of experimental philosophy of language

No.	Journal title	No. of publications
1	*Synthese*	15
2	*Cognition*	14
3	*Review of Philosophy and Psychology*	13
4	*Mind and Language*	12
5	*Philosophical Psychology*	9
6	*Philosophy and Phenomenological Research*	7
7	*Philosophy Compass*	7
8	*Journal of Semantics*	6
9	*Australasian Journal of Philosophy*	5
10	*Erkenntnis*	5
11	*Inquiry*	5
12	*Semantics and Pragmatics*	5
13	*Cognitive Science*	4
14	*Philosophical Studies*	4
15	*Analysis*	4

linguists and psychologists.

3.4. Influential works

How to gauge the impact of individual academic research output? Citation counts are always employed as a crucial means to measure the significance of a publication. However, while raw citation numbers are intuitive, they are less informative and meaningful when we compare works that appear in different time periods. For instance, a paper published in the last two years is less likely to have as high a citation count as those appeared fifteen years ago. But the relatively low count of the latest work does not mean it is not important. In bibliometric studies, a common strategy is to retrieve all the references cited in the works being included in the corpora and normalize the frequency of each of them based on their raw frequencies and the total number of publications during the time span under investigation. On the basis of these data, researchers can also compare the highly cited work in any period of interest in the development of the field, which may help reveal the diachronic changes over the years. In the current study, however, we failed to retrieve the references in each of the works included in our database from the PhilPapers website. As a remedy, in order to control for the time effect, we compared the citations (retrieved from Google Scholar) of works of similar age, namely those that came out during the same time period. We divided the past eighteen years roughly into five windows, namely 2004–2007, 2009–2011, 2012–2014, 2015–2017, 2018–2021, because there are only 6 publications in the first period (and there is none in the year 2008), and then normalized the frequencies within each time window. Below we present the list of the top 20 most influential works in experimental philosophy of language in terms of their relative citation rate (shortened as RCR), which is computed according to the following formula proposed by Li and Lei (2019):

$$\text{Relative citation rate (RCR)} = \frac{\text{Observed citation counts (OCC)}}{\text{Expected citation counts (ECC)}}$$

Here, OCC is the raw citation counts of a given research output, whereas ECC is the expected citations of any research output in the time period it was published. For example, the years between 2009 and 2011 have seen the publication of 32 pieces of works which were cited 2,345 times in total, then for any paper published in this period the expected citation count is approximately 73. Thus, if a paper published in 2010 has actually been cited 182 times thus far, then the relative citation rate of this paper will be 2.48. We think this normalized citation rate can be used as a rough measure to compare the impact of works across the time span we investigated, while controlling for the effect of the number of years an article has been published. Nonetheless, the list below in **Table 3** should not be read as an absolute rank of the influence of the publications.

Several interesting observations can be made from the table. First, among the 20 impactful publications, only one of them is a book chapter, while the rest are all journal articles, suggesting journal articles are the primary sources of references in experimental studies in philosophy of language. Second, judging from the publication years, half of the influential works appeared during the latest period of 2018–2021. This makes sense as with the advances of experimental philosophy of language the recent works may offer a better review of the prior literature and deeper insights into the issues under consideration. Third, the influential studies center on several hot topics in experimental philosophy of language. For instance, on the reference of proper names, the influential publications include the seminal work "Semantics, cross-cultural style" by Machery et al. (2004) and those in the response literature like "Reference in the land of the rising sun: A cross-cultural study on the reference of proper names" (Sytsma et al., 2015), and "Speaker's reference and cross-cultural semantics" (Machery et al., 2015), and more recently, Devitt and Porot's work "The reference of proper names: Testing usage and intuitions" (2018).

Some studies focus on concepts, normality and assertions, such as "Dual character concepts" (Reuter, 2019), "Moral disagreement and moral semantics" (Khoo and Knobe, 2016), "Normality: Part descriptive, part prescriptive" (Bear and Knobe, 2017), "Dual character concepts and the normative dimension of conceptual representation" (Knobe et al., 2013), and "The norm of assertion: Empirical data" (Kneer, 2018). Others deal with general problems in experimental philosophy (of language), like "Remarks on the experimental turn in the study of scalar implicature, Part 1" (Chemla and Singh, 2014), "Experimental ordinary language philosophy: A cross-linguistic study of defeasible default inferences" (Fischer et al., 2019), and "Carnapian explications, experimental philosophy, and fruitful concepts" (Koch, 2019). There are also significant studies on the semantics of particular types of expressions like epistemic modals, quantifiers, adjectives, and appositives, such as "Modal disagreements" (Khoo, 2015), "Must, knowledge, and (in)directness" (Lassiter, 2016), "Might do better: Flexible relativism and the QUD" (Beddor and Egan, 2018), "The semantics of many, much, few, and little" (Rett, 2018), "Evaluational adjectives" (Silk, 2021), and "Experimental evidence for the truth conditional contribution and shifting information status of appositives" (Syrett and Koev, 2015). Finally, it is notable that some philosophers like Edouard Machery, Joshua Knobe have appeared several times in the influential works, showcasing their leading position in the experimental philosophy movement.

3.5. Major research themes

What are the major research themes in experimental philosophy of language? In this section,

Table 3. Top 20 influential works in experimental philosophy of language

Title	Author	Year	Source	OCC	RCR
Normality: Part descriptive, part prescriptive	Bear and Knobe	2017	*Cognition*	127	6.38
The semantics of many, much, few, and little	Rett	2018	*Language and Linguistics Compass*	38	6.18
David Lewis in the lab: Experimental results on the emergence of meaning	Bruner et al.	2018	*Synthese*	35	5.70
The reference of proper names: Testing usage and intuitions	Devitt and Porot	2018	*Cognitive Science*	30	4.88
Experimental evidence for the truth conditional contribution and shifting information status of appositives	Syrett and Koev	2015	*Journal of Semantics*	95	4.77
Remarks on the experimental turn in the study of scalar implicature, Part I	Chemla and Singh	2014	*Language and Linguistics Compass*	95	4.77
Are false implicatures lies? An empirical investigation	Weissman and Terkourafi	2019	*Mind and Language*	28	4.56
Moral disagreement and moral semantics	Khoo and Knobe	2016	*Noûs*	87	4.37
Semantics, cross-cultural style	Machery et al.	2004	*Cognition*	723	4.33
Dual character concepts	Reuter	2019	*Philosophy Compass*	26	4.23
Must, knowledge, and (in)directness	Lassiter	2016	*Natural Language Semantics*	83	4.17
The norm of assertion: Empirical data	Kneer	2018	*Cognition*	25	4.07
Carnapian explications, experimental philosophy, and fruitful concepts	Koch	2019	*Inquiry*	22	3.58
Speaker's reference and cross-cultural semantics	Machery et al.	2015	In: Bianchi A (ed.) *On Reference*	63	3.16
Might do better: Flexible relativism and the QUD	Beddor and Egan	2018	*Semantics and Pragmatics*	18	2.93
Modal disagreements	Khoo	2015	*Inquiry*	57	2.86
Experimental ordinary language philosophy: A cross-linguistic study of defeasible default inferences	Fischer et al.	2019	*Synthese*	17	2.77
Dual character concepts and the normative dimension of conceptual representation	Knobe et al.	2013	*Cognition*	133	2.69
Reference in the land of the rising sun: A cross-cultural study on the reference of proper names	Sytsma et al.	2015	*Review of Philosophy and Psychology*	53	2.66
Evaluational adjectives	Silk	2021	*Philosophy and Phenomenological Research*	16	2.60

we first analyzed the keywords provided by authors in some of the works. Since some articles published in journals like *Review of Philosophy and Psychology*, *Analysis*, *Philosophy Compass*, and *Mind and Language*, do not contain keywords, we also analyzed the texts of all the abstracts of the journal articles and book chapters as well as book introductions with the help of natural language

Figure 3. Word cloud based on the keywords provided by authors.

processing techniques. Specifically, we first cleaned the keywords list and the texts of abstract using the programming language Python script. They were then lemmatized[1] via spaCy, which is an open-source library designed to help build natural language processing applications. In the next step, we calculated the frequency of the lemmatized keywords and ranked them in order. Manual checks were then conducted to consolidate the different key terms that in essence denote the same concept. For example, we manually changed all instances of "causal-historical", "causal historical", "causal view of reference", "causal theory of reference" into the oft-used label "causal-historical theory of reference". Similarly, all tokens of "descriptivism", "description theory of names" and "descriptivist theory of names" were modified into "descriptivist theory of names"; and "cultural difference", "(cross) cultural variation" were changed into "cross-cultural differences". After applying these procedures, a list of 384 keywords were produced, a word cloud representation of which is displayed above in **Figure 3**.

With regard to the abstracts, we extracted the n-grams in the lemmatized texts, which includes monograms, 2-grams, 3-grams, and 4-grams. For mono grams, only nouns and adjectives were studied while all the other words were removed from the 1-gram list because they are unlikely to be used as research themes. Also included in the procedures was a step to remove all the functional words like propositions, articles, and auxiliary verbs, using a stop word list as these words rarely

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[1.] Lemmatization is a commonly used pre-processing technique in natural language processing that can change any form of a word into its base form. For example, forms like "goes", "going", "went" can all be reduced to the base "go" for further analysis and computation through a simple lemmatization process.

occur in keywords. Subsequently, to get an insight from the data about the hot research themes in experimental philosophy of language, we contemplated the frequency of the n-grams and nouns chunks for them to be counted as meaningful topics. Initially, the words and word strings that occur more than 10 times were selected, which resulted in a list of 505 words and phrases. However, quite a number of these strings, though very frequent, were either not meaningful topics (like *proper*, *paper presents*, *reference proper*, *intuition reference proper*) or just too broad (like *study*, *philosophy*, *language*, *theory*, and *case*) and hence were manually removed. This procedure yielded a list of 60 meaningful concepts (see Appendix for the full list).

In **Table 4**, we list the top 20 research themes from both the author-supplied keyword list and the n-grams extracted from the abstracts, which also feature prominently in the word cloud in Figure 3. It is evident in Table 4 that the umbrella terms "experimental philosophy" and "experimental semantics" are most often used in the literature, as these are the central concepts that researchers cannot possibly eschew when they are introducing the research background, discussing their own empirical findings, and drawing implications for the development of the field. What is also easily noticeable from both columns of themes in the table is that "intuition" and "reference" are among the most popularly discussed topics in experimental philosophy of language. Also present in the list are terms like "cross-cultural difference", "descriptivist", "causal-historical theory", "theory of reference" as

Table 4. The top 20 research themes based on the n-grams and the keywords supplied by authors

Keywords		N-grams	
Theme	Frequency	Theme	Frequency
experimental philosophy	51	intuition	251
intuition	20	reference	193
reference	18	experiment	172
experimental semantics	13	participant	111
contextualism	12	truth	92
assertion	11	judgment	81
knowledge	10	Machery	74
Kripke	10	descriptivist	74
relativism	9	context	71
truth	9	assertion	65
concept	8	theory (of) reference	60
cross-cultural differences	8	knowledge	59
descriptivist theory	8	adjective	49
proper names	8	epistemic	48
causal-historical theory	7	Kripke	48
belief	6	experimental study	39
context sensitivity	5	cross-cultural difference	35
epistemic modals	5	epistemic modal	34
folk psychology	5	predicate	34
generics	5	presupposition	34
meaning	5	causal-historical theory	34

well as person proper names like Kripke and Machery.

The presence of these words as major research themes come as no surprise, given the fact that the whole movement of experimental philosophy of language was first initiated by the seminal work "Semantics, cross-cultural style" of Machery et al. (2004) which targeted the armchair theorizing methodology that Saul Kripke appealed to in advancing his causal-historical view of reference of names, and has subsequently been propelled by the growing body of response literature that center around the issues in the original study of Machery et al. (2004). In this expanding pool of literature on the reference of proper names, methodological issues are also widely discussed, hence besides words like "experiment", "participants" that are unavoidable in experimental studies, key terms like "truth", "judgment" are also very frequent as they may have occurred in expressions like "truth-value judgment" and "intuitive judgment"[2].

Besides the groups of works on the reference of proper names, studies in experimental philosophy of language also paid much attention to debates on contextualism and other opposing camps like relativism. For instance, in the last decade, a growing number of experiments have been conducted on epistemic modals, color adjectives, and predicates of personal taste, etc. Notably, Hansen and Chemla (2013) critically discussed the design of *the context shifting experiment* which has been employed as the central method of amassing evidence for contextualism. Based on their revised and improved experimental design, Hansen and Chemla (2013) tested a series of scenarios concerning knowledge ascriptions and color adjectives, providing insights into the impact of changing contexts on the evaluation of sentences containing the philosophically interesting terms like "know" and "green" and the critical features of the design and implementation of philosophical thought experiments and quantitative questionnaires. In several other works, based on experimental results, Hansen and Chemla (2017) as well as Adams and Hansen (2020) furthered our understanding of the nature and essence of color adjectives as well as the debates on context sensitivity. In addition to works on color adjectives, recent years have also seen the publication of research on epistemic modals. Just as mentioned in the list of influential works in Table 3, Beddor and Egan (2018) reported a set of experimental findings on epistemic modals that better support the flexible forms of relativism than contextualism. Knobe and Yalcin (2014) and Khoo and Phillips (2019) have also documented empirical results on epistemic modals that help adjudicate on the disputes surrounding contextualism. In more recent years, Markus Kneer also joined the heated debates between contextualism and relativism. Specifically, Kneer (2021a, 2022) provided large sets of data on perspectival claims including epistemic modals and predicate of personal taste, adding evidence in favor of the contextualist claims rather than relativism.

What is also attracting increasing attention lately is the issue of the norms of assertions. In particular, John Turri, one of the most productive experimental philosophers of language, has produced a series of empirical studies on the proper conditions under which assertions can be legitimately made. For example, Turri (2013) presented experimental evidence from six studies supporting the factive norms of assertion, and subsequently Turri (2016a, 2016b, 2016c, 2017, 2021) offered ample empirical data in favor of the knowledge account of assertions and compared the respective impact of knowledge and certainty on assertability. Reuter and Brössel (2019), however, challenged the knowledge account by presenting a set of evidence showing that the norm of assertion is justified

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[2.] The word "judgement" could also be used alone the in experimental studies as a synonym to "response" or "answer".

belief, with truth or even knowledge not being required in making assertions. Marsili and Wiegmann (2021) posed further challenges on the factive norms of assertion by questioning the common assumptions that participants' judgements about what an agent "should say" are evidence of their intuitions about assertability. Marsili and Wiegmann (2021) developed versions of stimuli that are more likely to be interpreted as intended by researchers, then experimentally tested the validity of these new measures, and offered evidence for the non-factive accounts of assertion. Differing from these above findings, Kneer (2018) reported data that indicate that knowledge cannot predict assertability reliably and the factive constraints seem unwarranted either. More recently, in a large-scale cross-cultural study in the United States, Germany, and Japan, Kneer (2021b) found that the speakers are expected to carry the epistemic responsibility of the speakers in asserting certain claims.

Closely related to assertions, lies which are regarded as dishonest assertions have also gained much attention in experimental philosophy of language in recent years. Turri and Turri (2016) assessed the common view that to tell a lie is to make false assertion in order to deceive others in a series of behavioral experiments. What they found is that attributions of lies are subjected to the influence of audience uptake and are based on attributions of assertion rather than attribution of deceptive intentions. Similarly, Marsili (2016) and Reins and Wiegmann (2021) have both critically discussed the traditional definitions of lies and tested their proposals against ordinary speakers' intuitions, thus offered alternative accounts of lies. Undoubtedly, these above-mentioned empirical studies in experimental philosophy of language have greatly advanced our knowledge and understanding of the various linguistic phenomena concerned.

4. General discussions

This bibliometric study of the movement of experimental philosophy of language has produced several crucial findings that carry important implications for future research. First, it is observed that there is an overall growing trend of publications in this burgeoning field over the past 18 years. A close look at the yearly productivity suggests that the developmental pathway of experimental philosophy of language can be characterized as consisting of three stages: the *initiation* period, the *development* period and the *extension* period. Secondly, this bibliometric research produces lists of the most productive researchers, the most popular publication venues and the most impactful works in experimental philosophy of language, which, we believe, are instrumental in promoting the movement and facilitating the advancement of the field. Thirdly, we find that the territory of experimental philosophy is fast expanding, with more and more philosophically and linguistically interesting phenomena being investigated empirically.

At its early stage, experimental philosophy of language is mostly concerned with the reference of proper names, or more specifically, the cross-cultural differences in folks' intuitions about the reference of proper names. During the development stage, while studies on reference of proper names and theories of reference kept coming out, research outputs on color adjectives, epistemic modals, predicates of personal taste, etc., begin to sprout up. And lately in the extension period, while these issues incur even more heated debates, the normative issue of assertions and lies also grabs a lot of attention. It thus becomes evident that there is a gradual shift away from the narrow focus on reference of proper names and intuitions as well as the meta-philosophical discussions of them. For this reason, the research projects in experimental philosophy of language can no longer be simply

judged as negative programs in experimental philosophy. Instead, they form a very active part of the positive programs and are even being broadened into the grand enterprise of cognitive science. Given the productivity and the impact of the research in experimental philosophy of language, we are optimistic that there is absolutely more to come in this booming area.

These having said, informative and illuminating as it is, the current study is also constrained in terms of the corpus and the analytic techniques. In particular, due to the small size of the database and the availability of certain types of bibliometric data (e.g., the references in each of the works in the database), we did not perform statistical analysis on the datasets, nor were we able to compare the data diachronically across the three time periods. Hence, the results and the conclusions might be compromised to some extent. Future studies should try to amass a larger body of bibliometric data of studies in experimental philosophy of language and carry out rigorous statical analysis to better delineate the development and the status quo of this exciting and rapidly developing research field.

Conflict of interest

No conflict of interest was declared by the authors.

Acknowledgements

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Appendix

Table 5. The 60 n-grams with the frequency above 10

N-gram	Count	N-gram	Count
intuition	251	natural kind	18
reference	193	truth value	18
experiment	172	contextualist	17
participant	111	slur	16
truth	92	experimental philosopher	16
judgment	81	semantic intuition	16
Machery	74	semantic pragmatic	16
descriptivist	74	armchair	15
context	71	cultural difference	15
assertion	65	aesthetic	14
theory reference	60	pluralism	14
knowledge	59	westerner	14
adjective	49	empirical evidence	14
epistemic	48	semantic reference	14
Kipke	48	Devitt	13
experimental study	39	dual character concept	12
cross-cultural difference)	35	ordinary language philosophy	12
epistemic modal	34	experimental semantics	12
predicate	34	logical form	12
presupposition	34	norm assertion	12
causal historical theory	34	referential intuition	12
ambiguity	31	Chinese	11
experimental philosophy	30	Japanese	11
competence	30	metalinguistic	11
intuition reference	28	colour adjective	11
contextualism	25	quasi-indexical	11
relativism	25	stereotypical inference	11
Gödel	23	acceptability	10
linguistic intuition	22	ordinary speaker	10
implicature	21	definite description	10