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ORIGINAL ARTICLE

Twenty years of experimental philosophy research

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Abstract

This paper reports the first study in the literature that adopts a bibliometric approach to systematically explore the scholarship in the young and fast-growing research field of experimental philosophy. Based on a corpus of 1,248 publications in experimental philosophy from the past two decades retrieved from the PhilPapers website, the study examined the publication trend, the influential experimental philosophers, the impactful works, the popular publication venues, and the major research themes in this subarea of philosophy. It found, first, an overall growing trend in publications in experimental philosophy, encompassing four developmental stages. Second, it found that significant changes in topics of interest have taken place, with some gaining increasing attention, others seemingly going out of fashion, and still others remaining popular constantly. Third, the study identified lists of leading philosophers, frequently cited publications, and popular journals helpful for researchers and newcomers to get a quick start in learning about the field.

KEYWORDS

bibliometric analysis, experimental philosophers, experimental philosophy, publication trend, publication venues, research themes, sustainable development

1 | INTRODUCTION

Experimental philosophy (abbreviated as x-phi) emerged as a new paradigm of philosophical inquiry around the turn of the twenty-first century. It utilizes empirical research ideas and methods typically found in studies in cognitive science (including psychology, linguistics, cognitive neuroscience, behavioral economics, computer science, and so on) to cast light on issues of philosophical significance (Knobe 2007a, 81). If we consider the publication of "Normativity and Epistemic Intuitions" (Weinberg, Nichols, and Stich 2001) as the herald of this movement, then the year 2020 marked the twentieth anniversary of x-phi. During the past two decades, this movement has witnessed explosive growth, rendering it an influential and important force in contemporary philosophy. Thus far, fruitful research has been conducted in areas as diverse as philosophy of language, philosophy of mind, philosophy of action, philosophy of science, philosophy of religion, epistemology, ethics, metaphysics, logic and reasoning, and the rest (Sytsma and Buckwalter 2016). The findings of these empirical

investigations, surprising and sometimes controversial, have offered valuable insights into various philosophical phenomena and sparked heated debates on a number of philosophical as well as meta-philosophical topics.

Notwithstanding the expanding body of literature on x-phi, systematic review of this exciting field has been quite rare. To the best of our knowledge, several edited volumes on x-phi are available, such as Horvath and Grundmann 2012, Knobe 2012, Nado and Beebe 2016, Sytsma and Buckwalter 2016, and Fischer and Curtis 2019. These works, while quite comprehensive in scope and informative on specific issues, have not provided an explicit meta-analysis-like account of the trends and changes in x-phi research. For instance, it is not yet crystal-clear, at least to newcomers to the field of philosophy and those in the neighboring subjects, which topics have been most frequently explored in x-phi, which philosophers have been most productive, which publications have been most influential, which academic venues have been most popular, or whether there have been significant changes in these aspects over the past twenty-plus years.

2 | BIBLIOMETRIC ANALYSIS

One way to address the abovementioned questions is to map the research outputs in the domain of x-phi by following the bibliometric approach developed in the field of library and information science. It is worth pointing out that "bibliometrics," alternatively known as "informetrics" or "scientometrics," typically involves the systematic employment of mathematical and statistical methods to measure, quantify, and analyze scientific works like books and journal articles (Pritchard 1969, 438; Bar-Ilan 2008; De Bellis 2009) in terms of their characteristic parameters, such as author information, dates and places of publication, citations and referencing patterns, and so on. Through bibliometric analyses of the literature within a specific field, one may easily gain knowledge of individual researchers, including their productivity and impact, their institutions, and areas of interest. More important, the research trends and changes in a particular domain can be automatically discovered when the bibliometric methods are combined with other techniques of analyzing the abstract, keywords, and body of the text in publications (for example, natural language processing and corpus linguistic techniques). Therefore, it is not an exaggeration to claim that such a quantitative approach to investigating the research literature "could provide far more information than could be obtained from purely qualitative review" (Knobe 2015, 2) and could also avoid the tendency of cherry-picking particular strands of studies or findings. Such studies are of significance not only to librarians, institutional administrators, and funding agencies but also (and perhaps more important) to students and researchers, enabling them to obtain an accurate overview of their fields of interest.

In recent years, bibliometrics has been widely applied in different disciplines, such as computer science, the life sciences, the physical sciences, and applied science (Ellegaard and Wallin 2015), as well as in the humanities and social sciences like education (Chang et al. 2020) and linguistics (Lei and Liu 2019; Zhang 2020; Hyland and Jiang 2021). But only a handful of bibliometric studies can be found in philosophy (see Khelfaoui et al. 2021 for a quick survey), and there is as yet not one in the burgeoning subfield of x-phi.

Notably, Knobe (2015) collected a set of data on published works in philosophy of mind from two different periods (1960–1999 and 2009–2013) to see if contemporary philosophers are dealing with different topics using methods different from those of their predecessors in the twentieth century. It was observed that, different from the twentieth-century sample that relies heavily on pure *a priori* methods, only a small proportion of the contemporary works appeal to the conventional armchair method of philosophizing. Most of the works in the past decade make use of empirical data, and a sizable number of them also document original experiments. Regarding research topics, philosophers nowadays have shifted their attention away from traditional philosophical topics like metaphysical questions of mind and place heavier emphasis on the more specific aspects of mind and cognition, such as the cognitive processes underlying people's judgments about philosophically interesting issues

like morality, knowledge, causation, and so on. These findings led Knobe to conclude that philosophy of mind has become part of the interdisciplinary field of cognitive science, and philosophers are no longer following in their predecessors' footsteps.

Also focusing on methods in philosophy, Bonino, Maffezioli, and Tripodi (2021) offered a quantitative analysis of a corpus of papers from five leading journals in analytic philosophy published during the years 1941 to 2010. The results showed that logic is actually absent in almost three-quarters of the corpus, and papers with logic as an instrument have increased significantly over time, whereas works in which logic is not instrumental have decreased constantly. Further, as time went by, logic in analytic philosophy seems to have become more technically sophisticated, though the publications with a high level of sophistication are relatively low in number. Bonino and colleagues thus took these findings to cast doubt on the "prevailing view" among analytic philosophers that logic is a widely applied and increasingly sophisticated method of analytic philosophy.

Similarly, Fletcher et al. (2021) inquired whether there has been a change in the use of formal methods in philosophy over time. But differing from Bonino, Maffezioli, and Tripodi (2021), who centered on logical methods only, they also looked at the use of nonlogical methods. Specifically, they collected two samples of philosophy papers published in *Philosophical Studies*, from the latter half of the 2000s and from the latter half of the 2010s, and coded these papers for whether they used logical methods or other formal methods like probability theory, decision theory, game theory, statistics, causal modeling, and so forth. It was found that the use of logical methods remained relatively constant, while the use of probabilistic methods increased dramatically. Further analyses vindicated the pervasiveness of the change, with a dramatic increase in the use of various nonlogical methods at different levels (fundamental, intermediate, or advanced) and in diverse subdisciplines (philosophy of mind, action theory, value theory, epistemology, and so on).

Apart from these bibliometric(-like) studies on philosophical methods, there are two relevant studies in the subfield of philosophy of science. For instance, to see what philosophers of science do, Malaterre, Chartier, and Pulizzotto (2019) sampled all the full articles published in the major journal *Philosophy of Science* from 1934, the year it started, up to 2015 and ran topic-modeling algorithms on this self-built corpus. They identified 126 key research topics spanning eighty-two years and also traced the evolution of the topics over time. What they observed through the quantitative analyses is consistent with the notable changes and milestones in the development of philosophy of science, such as the vicissitude of logical empiricism during the 1930s and 1970s, the emergence of philosophy of biology in the 1980s, the various epistemological issues concerning scientific knowledge, and so on. More recently, Khelfaoui et al. (2021) conducted an investigation of the visibility of philosophy of science in the sciences at the level of disciplines, journals, and authors. Through detailed examination of the publications and citations of papers published in seventeen major philosophy of science journals between 1980 and 2018, this study offered a comprehensive portrait of the relationships between philosophy of science and other fields of the natural sciences, technology, engineering, mathematics, and the social sciences, as well as the humanities. This revelation of the growing visibility and openness of philosophy of science in other scientific fields indicates that philosophy of science as a specialized field is by no means an insular and closed research territory.

In a word, the studies mentioned above have initiated a growing trend to probe into questions of philosophy via quantitative methods. In particular, the combination of the bibliometric approach and other natural language processing techniques offers a new and promising avenue for probing the field of philosophy and its subareas. But to the best of our knowledge, so far no such work has been conducted on the scholarship within the burgeoning field of x-phi. The present study aims to take up this underexplored issue through a detailed bibliometric analysis of the relevant works published in x-phi from 2001 to 2020. Specifically, we set out to investigate the following questions:

1) What is the overall publication trend in x-phi?
2) What are the popular venues for works in x-phi?
3) Which philosophers and documents in x-phi have been most influential?
4) What have been the most frequently explored research topics in x-phi?

We proceed as follows. Section 2 introduces the research methodology, including the selection of the database, the types of data collected, and the data processing procedures and techniques. Section 3 presents the major findings and detailed statistical analyses regarding the publication trend, productivity and impact of researchers, impactful works, and thematic changes. Section 4 is a general discussion of the present study, including a summary of the major findings, its limitations, and implications for future research in x-phi.

3 | METHODOLOGY

For present purposes, the key term "experimental philosophy" is defined with a fuzzy boundary. We include in our database both quantitative studies that have reported experimental investigations on philosophically interesting issues and qualitative studies that discuss theoretical or empirical issues related to such empirical inquiries. Below we describe the selections for and creation of the database as well as the preprocessing procedures used for the raw data.

3.1 | Database: The experimental philosophy corpus

In bibliometric studies, the widely used online databases include Web of Science (WoS), Google Scholar, and Scopus. For instance, most of the prior bibliometric studies in philosophy (Khelfaoui et al. 2021) and neighboring disciplines like linguistics have used WoS (e.g., Lei and Liu 2019; Zhang 2020; Hyland and Jiang 2021). These databases all contain rich and useful bibliographic information of works in different disciplines, presented in different forms. But because of the broad coverage of resources, it is difficult to obtain from these sources an ideal set of the most relevant academic literature in a particularly interdisciplinary field like x-phi. In our present study, multiple attempts to search for x-phi research on WoS with queries like "experimental philosophy" and different refining constraints returned thousands of results that include a large body of materials that are actually irrelevant to x-phi, which renders the retrieved pool of research literature less accurate, less representative, and less manageable. In addition, some studies clearly belonging to the realm of x-phi, like Devitt and Porot 2018 and Li et al. 2018, were not found through the search because they do not contain the key term "experimental philosophy" in search fields like title, abstract, and keywords.

Consequently, we opted for the philosophy-discipline-specific and readily available online database PhilPapers (https://philpapers.org/) in the present study. As introduced on the homepage, PhilPapers represents the most comprehensive and authoritative index of the research literature in philosophy. Different sources of online contents in philosophy are automatically monitored on this web portal, including journals, books, open access archives, and personal pages. Currently, more than 2.6 million research books and articles are being indexed in this database, structurally organized into more than 5,800 topics at different levels of generality. The categorization of the bibliography is maintained by a combination of automatic classification, crowdsourcing, and curation work done by approximately six hundred appointed academics (category editors), rendering it a highly reliable and well-organized database of philosophical literature.

On January 20, 2021, when the PhilPapers website was accessed, there were 1,943 records in total listed under eleven subcategories of x-phi (that is, experimental aesthetics, x-phi of action, x-phi of language, x-phi of mind, x-phi of religion, x-phi of science, ethics, epistemology, metaphysics, foundations of x-phi, and a miscellaneous category). All the bibliometric information of these records available on the website, including title, author information, publication venue and date, abstract, keywords, category label(s), and citation count, was collected, which formed the x-phi corpus.

3.2 | Data Preprocessing

Several steps were taken to preprocess the raw data. To begin with, duplicates, unpublished manuscripts, and nonacademic resources like mass media reports were removed. Also removed were those

entries written in languages other than English and those whose publication venues are unknown (mostly manuscripts and preprints shared by authors online). This initial step of data cleansing left 1,473 records in the database. Among these records, we included only full-length journal articles, book chapters, and books published between the years 2001 and 2020 (including 2020).[1] In so doing, we excluded from the bibliometric analysis book reviews, editorial introductions, correction notes, interviews, dissertations and theses, encyclopedia entries, commentary notes, critical notices, and so forth, that are available on PhilPapers under the category of x-phi.[2] Consequently, after this second round of data cleansing, we have 1,248 records in our final database, including 972 journal articles, 51 books, and 225 book chapters.

4 | RESULTS AND ANALYSIS

Below we report the major findings of the current bibliometric study, including (1) the number of publications in x-phi across categories and over the past twenty years, (2) the most productive experimental philosophers, (3) the major publication venues of works in x-phi, and (4) the main research themes and the changes in x-phi over the past two decades.

4.1 | Number of publications in experimental philosophy across years and categories

Figure 1 displays the number of works published in x-phi in the past two decades. Overall, the number of publications has been on the rise since the beginning of this century. While there were just fewer than ten annual publications in the first few years, the number has increased about tenfold during the second half of the time span we investigated (2001–2020, inclusive), with the year 2014 seeing the largest number of publications: 116 works. Also noticeable from Figure 1 are two spikes that appeared between 2008 and 2010 and between 2012 and 2014. The results of a polynomial regression model ($F(2, 18) = 50.32$, $p = 4.26e-08$) show that the number of publications has indeed increased significantly over the past twenty years, evidencing that x-phi has gradually become a popular area of interest despite the small ups and downs between 2010 and 2020.

The upward trend can also be seen clearly when we divide the past twenty years into four time periods, shown in Figure 2. As the figure indicates, there have been roughly four developmental stages of x-phi in the past two decades. The first stage, from 2000 to 2005, is the initiation period, which witnessed the emergence of seminal works on epistemic intuitions (Weinberg, Nichols, and Stich 2001), intentional action and side-effect effect (Knobe 2003a, 2003b, 2004a, 2004b; Adams and Steadman 2004), reference of proper names (Machery et al. 2004), free will and moral responsibility (Nahmias et al. 2005), and so forth. The second stage, from 2006 to 2010, is the development stage, which experienced the fastest growth of x-phi research, with works in areas of ethics, epistemology, metaphysics, philosophy of action, philosophy of mind, and philosophy of language appearing in large numbers. Next comes the expansion period, between 2011 and 2015, which has seen the extension of research topics as researchers have become seemingly more cautious about ways of doing x-phi and thus have given careful consideration to issues like reliability of folk intuitions and various potentially confounding factors in prior as well as future experimental research projects, such as the wording effects of particular tasks/cases, the order of presentation, and individual factors like ethnicity and gender, perspective-taking strategies, and so on.[3] Finally, during the last five years, from 2016 to 2020, x-phi seems to have reached a plateau,

[1] We did not include works published in 2021 in our corpus, because it usually takes time for fresh publications to be cited.

[2] These pieces of writings are excluded because they typically do not have an abstract or keywords.

[3] See Williamson 2011; Buckwalter and Schaffer 2015; Schwitzgebel and Cushman 2012; Tobia, Buckwalter, and Stich 2013; Schulz, Cokely, and Feltz 2011; Nagel, Juan, and Mar 2013; Buckwalter and Stich 2013; Sytsma and Livengood 2011; Sytsma et al. 2015.

with discussion on some of the hotly debated questions in the two prior stages receiving relatively less attention or emerging at a slower pace. Overall, it is apparent that throughout the past two decades, there has been not only the rapid development of the field of x-phi but also the gradual deepening of our understanding of many critical issues in this area as well as in philosophy more broadly.

We also investigated the trend of publishing experimental works within each of the eleven subject subcategories over the past twenty years. As shown in Figure 3, ethics is the area that has received the most attention from experimental philosophers, with the number of publications reaching three hundred. What follow next are epistemology and philosophy of mind, both of which have witnessed the publication of about two hundred articles. Areas like philosophy of religion, aesthetics, and philosophy of science are not as popular as the abovementioned fields among experimental philosophers, totaling only about twenty published works. It seems that not only the popularity of research field but also the disciplinary nature of the field (that is, whether it is interdisciplinary or not) bear a direct relation to the number of published works in x-phi.

Figure 4 indicates the growth of publications within each subcategory placed under the umbrella term "x-phi." We see that the output in most of the subcategories (such as ethics, epistemology,

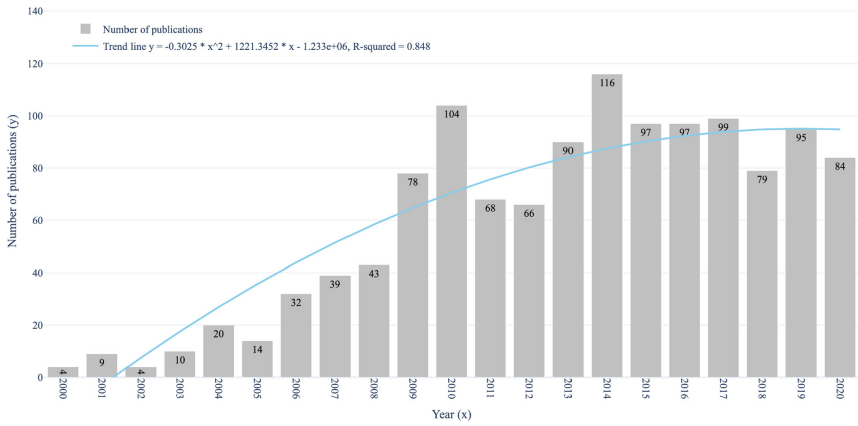

FIGURE 1 Annual number of publications in x-phi in all categories (2000–2020).

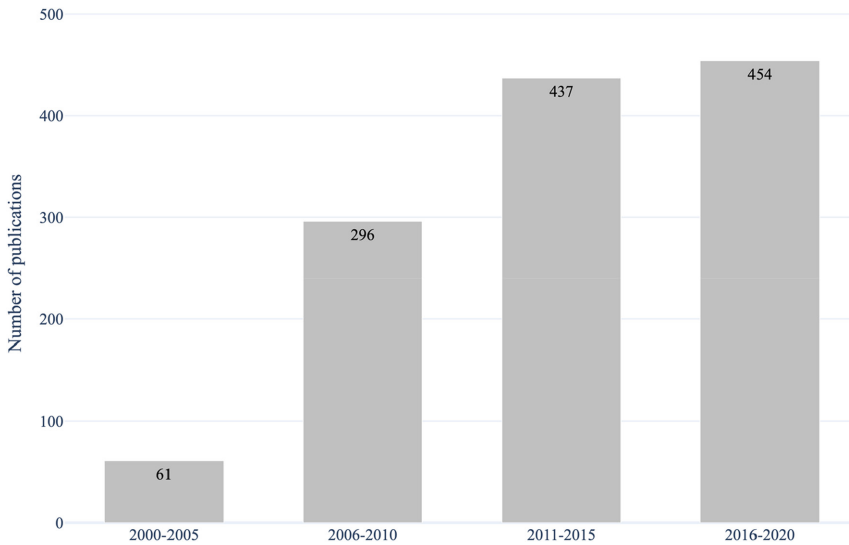

FIGURE 2 Number of publications in x-phi over the four time periods.

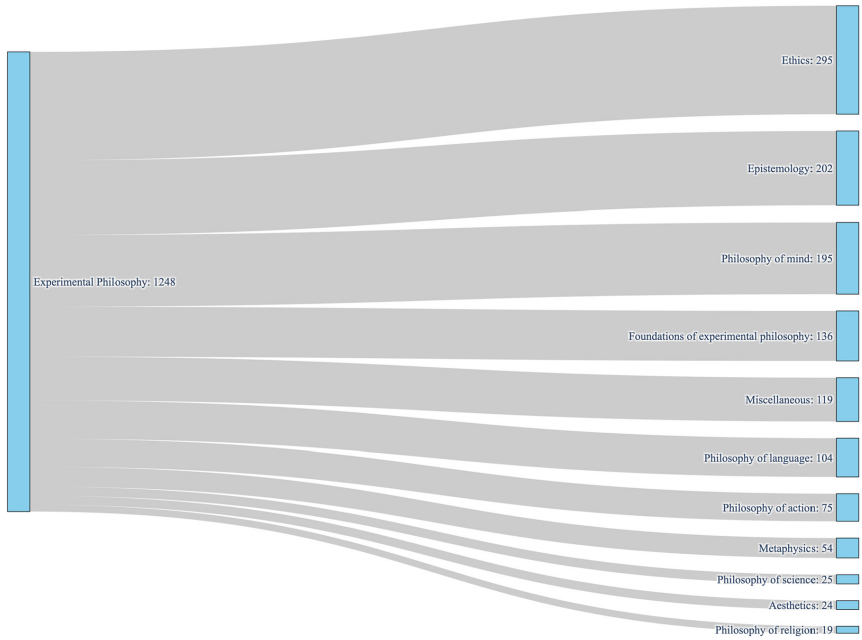

FIGURE 3 Number of experimental works in each subcategory published in the period 2000 to 2020.

philosophy of mind, and philosophy of language) has followed roughly the same upward developmental trajectory as the whole field of x-phi, in spite of their respective rises and falls along the way. The publications in many of the research areas (like ethics, philosophy of mind, and philosophy of action) first peaked around 2010 and subsequently reached a new high around 2014, witnessing heated debates on the key issues in x-phi, such as intuitions, free will, intentional action, the Knobe effect, moral judgments, and so forth during these periods. But for areas like aesthetics, philosophy of religion, and philosophy of science, the peak did not occur until 2018, suggesting that these areas have only recently begun to attract increasing attention from experimental philosophers.

4.2 | Productive authors

Table 1 displays the twenty most productive experimental philosophers in the past two decades. Joshua Knobe topped the list with seventy-six publications on metaphilosophical discussions of x-phi and on specific philosophical and psychological issues of moral cognition, intentional action, causation, free will, consciousness, and so on. In a much-cited article, "Intentional Action and Side Effects in Ordinary Language," Knobe (2003a) first reported the puzzling side-effect effect, which later became widely known as the "Knobe effect" and has since sparked strong interest and hot debates among philosophers and psychologists alike. Subsequently, in an introductory article, "Experimental Philosophy Manifesto," Knobe and Nichols (2008) offered a fresh perspective on understanding the role of experimentation in philosophical research and called on researchers to get rid of methodological concerns and engage actively with the exciting and illuminating findings in x-phi. Shaun Nichols, John Turri, David Rose, Wesley Buckwalter, Edouard Machery, Justin Sytsma, Thomas Nadelhoffer, Adam Feltz, Jonathan Weinberg, James R. Beebe, Florian Cova, and Stephen Stich are all among the most prolific experimental philosophers, each of whom has written or cowritten more than twenty works on general metaphilosophical questions and specific issues relevant to x-phi. Researchers like Eddy Nahmias, Eugen Fischer, James Andow, Mark Phelan, Nat Hansen, Fiery Cushman, and Jonathan Phillips have also all contributed substantially to the x-phi literature, each with a publication record of more than ten.

FIGURE 4 Annual number of publications in each subcategory of x-phi.

In total, the publications of these twenty most productive philosophers account for about 45 percent (562 out of 1,248) of the overall output in x-phi. These philosophers form the leading forces of the x-phi movement, with their works significantly shaping and influencing the development of this burgeoning field. It should be noted, however, that the list in Table 1 is by no means exhaustive. Philosophers like Jonathan Livengood, Andrew J. Latham, Ángel Pinillos, Bryce Huebner, Daniel Cohnitz, Jennifer Nado, Joshua Alexander, and others have all made valuable contributions to the x-phi movement. It is possible that some researchers are productive and influential but their works somehow had not yet been indexed by PhilPapers when we accessed the website and hence are not on the list.

4.3 | Major publication venues

What are the most popular venues for works in x-phi? In the database we created, we found that around 78 percent (972 out of 1,248) of the entries are journal articles, suggesting that journals are the predominant publication venue of works in x-phi. Table 2 presents a list of the top twenty journals that have published the most articles in x-phi over the past two decades (with the last four journals tying

TABLE 1 The twenty most productive authors

Rank	Author Names	No. of Publications
1	Joshua Knobe	76
2	Shaun Nichols	59
3	John Turri	52
4	David Rose	47
5	Wesley Buckwalter	37
6	Edouard Machery	29
7	Justin Sytsma	26
8	Thomas Nadelhoffer	24
9	Adam Feltz	22
10	Jonathan Weinberg	22
11	James R. Beebe	21
12	Florian Cova	21
13	Stephen Stich	20
14	Eddy Nahmias	19
15	Eugen Fischer	17
16	James Andow	15
17	Mark Phelan	15
18	Nat Hansen	14
19	Fiery Cushman	13
20	Jonathan Phillips	13

for twentieth place). These journals have collectively contributed 46 percent of the total number of publications (578 out of 1,248) in the field. Specifically, *Philosophical Psychology* is by far the most popular journal among experimental philosophers, which well matches the aims and scope of the journal as introduced on its homepage: "an international journal devoted to developing and strengthening the links between philosophy and the psychological sciences." Other interdisciplinary journals like *Review of Philosophy and Psychology*, *Mind and Language*, and *Cognition* are also popular homes for studies in x-phi that address issues at the intersection of philosophy, psychology, and cognition. Finally, journals like *Frontiers in Psychology*, *Neuroethics*, *PLoS ONE*, *Midwest Studies in Philosophy*, *The Monist*, and so on, have also published multiple works in x-phi. Interestingly, twelve of the top twenty journals are prestigious interdisciplinary ones, with the rest being established discipline-specific journals of philosophy (e.g., *Synthese*, *Philosophical Studies*, *Philosophy Compass*, *Analysis*, *Inquiry*, *Episteme*, *Erkenntnis, Noûs*, *Metaphilosophy*, and so forth). Also noticeable from our database is that the traditionally prestigious philosophy journals like *Philosophical Quarterly*, *Philosopher's Imprint*, *Ergo*, *Mind*, *Topoi*, and the like, respectively contain fewer than five articles in experimental philosophy published during 2000–2021. Taken together, these findings indicate that interdisciplinary journals are more friendly to x-phi than the conventional philosophy-specific journals.

4.4 | Impactful articles

In bibliometric studies, citation statistics represent a reliable evaluative criterion for a publication's impact in the field, as such data are typically devoid of researchers' subjective judgments. Raw citation counts are useful, but because of the time effect of publishing, this type of data needs to be normal-

TABLE 2 Top twenty journals publishing x-phi research

Rank	Journal	No. of Publications
1	*Philosophical Psychology*	84
2	*Review of Philosophy and Psychology*	66
3	*Mind and Language*	50
4	*Cognition*	43
5	*Synthese*	42
6	*Philosophical Studies*	36
7	*Cognitive Science*	26
8	*Journal of Business Ethics*	24
9	*Journal of Cognition and Culture*	20
10	*Philosophy Compass*	19
11	*Philosophy and Phenomenological Research*	18
12	*Consciousness and Cognition*	17
13	*Analysis*	16
14	*Inquiry: An Interdisciplinary Journal of Philosophy*	15
15	*Behavioral and Brain Sciences*	14
16	*Episteme*	13
17	*Metaphilosophy*	13
18	*Journal of Consciousness Studies*	11
19	*Journal of Theoretical and Philosophical Psychology*	11
20	*Australasian Journal of Philosophy*	10
20	*Erkenntnis*	10
20	*Journal of Experimental Social Psychology*	10
20	*Noûs*	10

ized. In Table 3, we list the thirty most influential articles in terms of relative citation rate (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 refers to the raw citation counts of a given paper, whereas ECC represents the expected citations of any article in the year it was published. For example, the year 2008 saw the publication of forty-three articles in x-phi in our database, which got cited 9,007 times in total; then for any paper published in that year the expected citation count is 209. Thus, if a paper published in 2008 has actually been cited 418 times thus far, then the relative citation rate of this paper will be 2. By controlling for the effect of the number of years an article has been published, this normalized citation rate can be used to compare the impact of articles across the time span we investigated.

As shown in Table 3, among the thirty most influential publications, there are only four books and one book chapter, with the vast majority being journal articles, again suggesting that academic journals are the major homes of impactful scholarly works. Regarding the age of these influential publications, seven of them appeared before 2010, twenty came out during 2011 to 2019, and three were first published in 2020, reflecting the prime of the x-phi movement and the impact of these recent works. Crucially, when it comes to the categories of these publications, around one-third of them deal with issues in ethics (e.g., Strohminger and Nichols 2014; Railton 2014; Sarkissian et al. 2011; Cushman, Young, and Hauser 2006; Prinz 2007) and approximately one-fifth belong to epistemology (e.g., Rose

TABLE 3 The thirty most influential publications

	Title	Author(s)	Document Type	Year	Source	Google Citations	RCR
1	The Essential Moral Self	Nina Strohminger and Shaun Nichols	Journal article	2014	*Cognition*	491	23.38
2	The Affective Dog and Its Rational Tale: Intuition and Attunement	Peter Railton	Journal article	2014	*Ethics*	243	11.57
3	*Philosophy Within Its Proper Bounds*	Edouard Machery	Book	2017	Oxford University Press	254	11.55
4	The True Self: A Psychological Concept Distinct from the Self	Nina Strohminger, Joshua Knobe, and George Newman	Journal article	2017	*Perspectives on Psychological Science*	240	10.91
5	Folk Moral Relativism	Hagop Sarkissian, John J. Park, David Tien, Jennifer Wright, and Joshua Knobe	Journal article	2011	*Mind and Language*	222	10.57
6	Atheists and Agnostics Are More Reflective Than Religious Believers: Four Empirical Studies and a Meta-Analysis	Gordon Pennycook, Robert M. Ross, Derek J. Koehler, and Jonathan A. Fugelsang	Journal article	2016	*PLoS ONE*	214	9.30
7	Estimating the Reproducibility of Experimental Philosophy	Florian Cova, Brent Strickland, Angela Abatista, Aurélien Allard, et al.	Journal article	2021	*Review of Philosophy and Psychology*	120	9.23
8	Expertise in Moral Reasoning? Order Effects on Moral Judgment in Professional Philosophers and Non-Philosophers	Eric Schwitzgebel and Fiery Cushman	Journal article	2012	*Mind and Language*	428	9.11
9	Nothing at Stake in Knowledge	David Rose, Edouard Machery, Stephen Stich, Mario Alai, Adriano Angelucci, et al.	Journal article	2019	*Noûs*	76	8.44
10	The Role of Conscious Reasoning and Intuition in Moral Judgment	Fiery Cushman, Liane Young, and Marc Hauser	Journal article	2006	*Psychological Science*	1370	7.83
11	Religious Credence Is Not Factual Belief	Neil Van Leeuwen	Journal article	2014	*Cognition*	160	7.62
12	The Free Will Inventory: Measuring Beliefs About Agency and Responsibility	Thomas Nadelhoffer, Jason Shepard, Eddy Nahmias, Chandra Sripada, and Lisa Thomson Ross	Journal article	2014	*Consciousness and Cognition*	159	7.57

(Continues)

TABLE 3 (Continued)

	Title	Author(s)	Document Type	Year	Source	Google Citations	RCR
13	Epistemic Intuitions in Fake-Barn Thought Experiments	David Colaço, Wesley Buckwalter, Stephen Stich, and Edouard Machery	Journal article	2014	*Episteme*	158	7.52
14	Disgust Sensitivity Predicts Intuitive Disapproval of Gays	Yoel Inbar, David A. Pizarro, Joshua Knobe, and Paul Bloom	Journal article	2009	*Emotion*	662	6.90
15	The Essence of Essentialism	George E. Newman and Joshua Knobe	Journal article	2019	*Mind and Language*	62	6.89
16	Causes and Consequences of Mind Perception	Adam Waytz, Kurt Gray, Nicholas Epley, and Daniel M. Wegner	Journal article	2010	*Trends in Cognitive Sciences*	551	6.56
17	Explaining Away Incompatibilist Intuitions	Dylan Murray and Eddy Nahmias	Journal article	2014	*Philosophy and Phenomenological Research*	136	6.48
18	The Neural and Cognitive Mechanisms of Knowledge Attribution: An EEG Study	Adam Michael Bricker	Journal article	2020	*Cognition*	32	6.40
19	Consistent Belief in a Good True Self in Misanthropes and Three Interdependent Cultures	Julian De Freitas, Hagop Sarkissian, George E. Newman, Igor Grossmann, Felipe De Brigard, Andres Luco, and Joshua Knobe	Journal article	2018	*Cognitive Science*	82	6.31
20	Cognitive Load Selectively Interferes with Utilitarian Moral Judgment	Joshua D. Greene, Sylvia A. Morelli, Kelly Lowenberg, Leigh E. Nystrom, and Jonathan D. Cohen	Journal article	2008	*Cognition*	1296	6.20
21	*Sentimental Rules: On the Natural Foundations of Moral Judgment*	Shaun Nichols	Book	2004	Oxford University Press	1102	5.77
22	Children's and Adults' Understanding of Punishment and the Criminal Justice System	James Dunlea and Larisa Heiphetz	Journal article	2020	*Journal of Experimental Social Psychology*	28	5.60
23	Public Views on Policies Involving Nudges	William Hagman, David Andersson, Daniel Västfjäll, and Gustav Tinghög	Journal article	2015	*Review of Philosophy and Psychology*	206	5.57

TABLE 3 (Continued)

	Title	Author(s)	Document Type	Year	Source	Google Citations	RCR
24	*On Folk Epistemology: How We Think and Talk About Knowledge*	Mikkel Gerken	Book	2017	Oxford University Press	122	5.55
25	*The Emotional Construction of Morals*	Jesse Prinz	Book	2007	Oxford University Press	1746	5.49
26	Teleological Essentialism	David Rose and Shaun Nichols	Journal article	2019	*Cognitive Science*	49	5.44
27	Normality: Part Descriptive, Part Prescriptive	Adam Bear and Joshua Knobe	Journal article	2017	*Cognition*	117	5.32
28	Water Is and Is Not H_2O	Kevin P. Tobia, George E. Newman, and Joshua Knobe	Journal article	2020	*Mind and Language*	26	5.20
29	The Role of Emotion in Moral Psychology	Bryce Huebner, Susan Dwyer, and Marc Hauser	Journal article	2009	*Trends in Cognitive Sciences*	489	5.09
30	Gender and Philosophical Intuition	Wesley Buckwalter and Stephen Stich	Book chapter	2013	*Experimental Philosophy, Vol.2.*	214	4.98

et al. 2019; Colaço et al. 2014; Van Leeuwen 2014; Bricker 2020; Gerken 2017). Others addressed issues related to person identity (Nichols 2004; Strohminger, Knobe, and Newman 2017), free will (Murray and Nahmias 2014; Nadelhoffer et al. 2014), and metaphilosophical issues (Machery 2017; Cova et al. 2021). A few others focused on issues in philosophy of mind like reference and normality (e.g., Tobia, Newman, and Knobe 2020; Bear and Knobe 2017).

A caveat is needed here. There are substantial and inherent differences between different areas of (experimental) philosophy in the sense that some subfields are more interdisciplinary and hence have a larger research community than others. For instance, while folk morality is a topic that interests both moral psychologists and philosophers among researchers from other related areas, semantic issues like reference might appeal most to only a small group of philosophers and linguists. Therefore, publications on folk morality are more likely to have a greater readership and citation counts than those on reference issues. That may explain why the seminal work in x-phi of language by Machery et al. (2004), while very influential and frequently cited (709 raw citations), did not appear in the top thirty impactful publication list (it actually ranked sixty-ninth in the database). Finally, what is also noticeable is that Joshua Knobe has written or cowritten seven papers in this list of impactful works, and Edouard Machery, Shaun Nichols, Fiery Cushman, Stephen Stich, Wesley Buckwalter, and others have all appeared more than once in the author list, which, again, is a testament to the leading position of these researchers in the field.

4.5 | Research topics

To detect the common research topics and the thematic changes of x-phi research over the past twenty years, we examined the keywords supplied by authors and the wording of the abstracts. It is necessary to combine these two sources of information together, for while some journal articles simply do not have keywords provided by authors, others contain only a few keywords that might not include all the key topics discussed in the publication. Thus, automatically generating the highly frequent words and

phrases directly from the wording of the abstracts using natural language processing techniques could potentially remedy the limitations of the author-supplied keywords.

Specifically, we first calculated the frequency of the author-supplied keywords in the database, which we analyze below. To generate key research topics from the abstracts, we took the following steps. Initially, all the words in the abstracts were lemmatized using the SpaCy package (https://spacy.io/). Then, self-made Python programs were run to extract the n-grams (n = 1, 2, 3) that contain a single word or a continuous string of two to three words in the corpus. Through using a list of stop words from SpaCy, all the n-grams containing function words except prepositions were removed. The rationale behind this step is that whereas the majority of the function words typically do not form meaningful research topics, prepositions do appear in research topics like "philosophy of mind," "theory of reference," and so on.

The immediate question, then, is which terms represent the most important research topics. This is indeed a tricky question, which involves setting the threshold frequency of the terms. If the threshold is set too high, some crucial terms might be excluded; but if it is set too low, then there might be too many topics to deal with, among which some less important and trivial issues might be included. Based on initial observations of our database and in reference to prior works like Lin and Lei 2020, we decided that the author-supplied keywords (abbreviated as AU) and the keywords automatically generated from the abstract (abbreviated as AB) should occur at least twenty times in the database in order to be counted as important research themes. Quite a number of these highly frequent words and phrases, however, were too broad to be treated as significant research topics (e.g., "study," "research," "philosophy," "methodology," and the like) and thus were discarded.[4] Another caveat should be made here. For keywords in the AB list, multiple occurrences of a keyword in one publication are counted as just one occurrence. Thus, a keyword with a frequency of fifty means that it has appeared in fifty publications. Also, key terms that have been provided by authors as keywords will not be listed in the AB list, to avoid repetition in the final keywords list on the one hand and, more important, to avoid the "inflation" of frequency of certain words on the other hand.[5] After this procedure, we obtained a list of twenty-five keywords supplied by authors and thirty-nine meaningful n-grams retrieved from the abstracts as keywords. In addition, to see the diachronic changes and evolution of the research topics in the past two decades, we calculated the frequency of the candidate keywords in the four time periods 2000–2005, 2006–2010, 2011–2015, and 2016–2020 separately. Presented in Figure 5 is the distribution of twenty-one research topics whose overall frequency is above forty over the four periods. "Experimental philosophy" and "intuition" are by far the most popular topics, especially in the last three periods.

While the lengths of the bars with differing tones to the left in Figure 5 give us an intuitive sense of how frequently each of them has been used in the research literature, it nonetheless cannot guarantee direct comparisons between different periods, because the number of publications that bears direct relation to the frequency of the research topics varies considerably across these time windows, and hence cannot accurately show the diachronic changes of the research topics. As a result, we took a further step to normalize the raw frequency of the keywords during each period based on the following formula:

$$\text{Normalized frequency (NF)} = \frac{\text{Raw frequency (RF)}}{\text{Total number of publications in the specific period}} * 1,248$$

Finally, a one-way chi-square test was conducted to see whether the changes of the candidate research topics across the four periods were statistically significant. Since the first period has very few publications, the frequency of a number of the identified keywords is zero (as evidenced in

[4]In the process of identifying the potential research themes for this paper, we first worked separately following the same procedures and criteria, then thoroughly discussed the candidacy of each term we had identified, and finally reached agreement on the ultimate list of keywords.

[5]For instance, the frequency of the word "knowledge" is 59 in the AU list, meaning that it has been treated as a keyword in fifty-nine publications. But the frequency of this word in the AB list is 158, which we think is highly inflated. The reason is that besides its use in epistemology-related issues like "knowledge attribution" and "a case of knowledge," it could be frequently used in common expressions like "political knowledge" and "task-specific knowledge," which are less likely to represent the major topics being discussed in publications centered on x-phi.

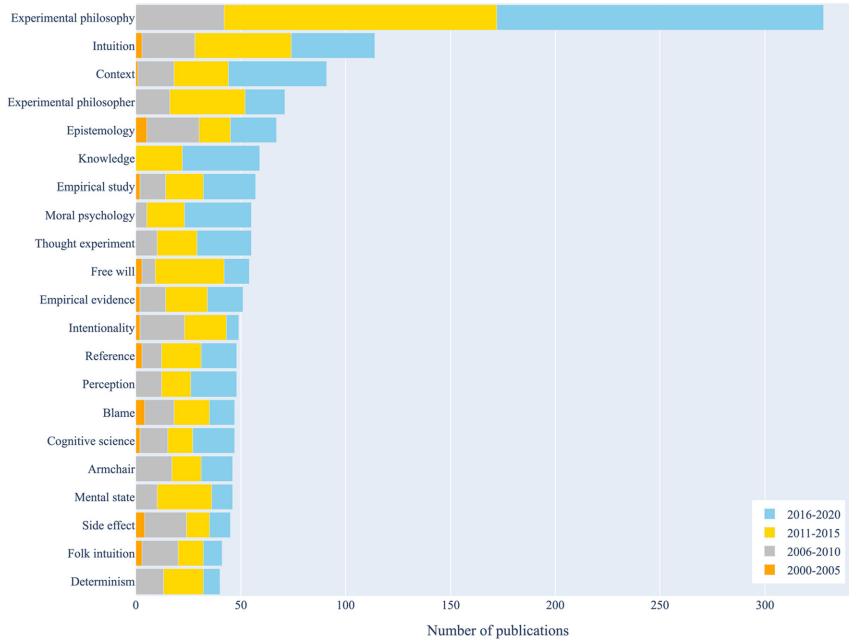

FIGURE 5 Distribution of the research topics with the total frequency above forty.

Figure 5), which renders most of the p-values smaller than 0.001. Consequently, we also performed the one-way chi-square test on only the last three periods to better capture the evolutionary trajectory of the research topics over the last three periods. The raw frequency, the normalized frequency of the research topics, and the chi-square test results are all presented in Table 4.

The first category includes eighteen research topics that have gained increasing attention in the last three periods, with half of them being provided by authors. Top on the list is the term "experimental philosophy," which made its formal debut in the second period in the title of the work "Experimental Philosophy and Folk Concepts: Methodological Considerations" by Knobe and Burra (2006) and also as an author-supplied keyword in "Folk Intuitions on Free Will" by Nichols (2006). Since then, it has been frequently referred to as a novel and controversial subject, and thus intensively discussed in the research literature, leading to the influential x-phi movement. For example, in the year 2007 alone, we saw the publication of several important works in x-phi, such as Kauppinen's "The Rise and Fall of Experimental Philosophy" (2007), Knobe's "Experimental Philosophy" (2007a) and "Experimental Philosophy and Philosophical Significance" (2007b), and Nadelhoffer and Nahmias's "The Past and Future of Experimental Philosophy" (2007), which together form a testament to the coming of the new era of x-phi in contemporary philosophy. Other keywords in this category include classical philosophical topics like *epistemology*, *knowledge*, *knowledge attribution*, *belief*, *truth*, and *identity*, and some cross-disciplinary topics like *assertion*, *context*, *contextualism*, and *moral psychology* that are also studied in linguistics and psychology. In addition, some topics related to research methods have become increasingly popular, like critical discussions of *philosophical methodology* in *metaphilosophy*, which often involve (re-)considerations of the role of *thought experiments* and philosopher's *expertise*. Along the way, more and more *experimental studies* are being carried out to test classical philosophical theories or to validate certain research methods, through which significant *cross-cultural* and *intra-cultural* variations are observed. Quite often, such empirical findings are widely cited to cast doubt on existing theories and methods.

The second category of research topics are those that have undergone significant decrease in frequency. The eighteen topics in this category were very popular during the years 2006–2010 but declined in popularity in the last decade. For instance, philosophical traditions like *analytic philoso-*

TABLE 4 Statistics of the key research topics (2000–2020)

	Source	Keywords	Raw Frequency					Normalized Frequency					
			Total Freq,	2000-2005	2006-2010	2011-2015	2016-2020	2000-2005	2006-2010	2011-2015	2016-2020	Chi-square	p-value
Significantly Increased	AU	experimental philosophy	328	0	42	130	156	0.00	83.92	389.06	445.51	111.64	0.00
	AU	epistemology	67	5	25	15	22	5.76	9.47	44.89	62.83	30.70	0.00
	AU	knowledge	59	0	0	22	37	0.00	0.00	65.84	105.67	99.62	0.00
	AU	moral psychology	55	0	5	18	32	0.00	21.89	53.87	91.39	43.43	0.00
	AU	philosophical methodology	34	0	4	11	19	0.00	17.52	32.92	54.26	19.51	0.00
	AU	metaphilosophy	33	0	4	8	21	0.00	17.52	23.94	59.97	30.98	0.00
	AU	belief	25	0	0	11	14	0.00	0.00	32.92	39.98	37.48	0.00
	AU	contextualism	24	0	1	9	14	0.00	4.38	26.94	39.98	27.30	0.00
	AU	truth	21	0	0	6	15	0.00	0.00	17.96	42.84	45.67	0.00
	AB	context	91	1	17	26	47	21.15	74.44	77.81	134.22	23.62	0.00
	AB	thought experiment	55	0	10	19	26	0.00	43.79	56.86	74.25	8.01	0.02
	AB	cross cultural	37	1	5	11	20	21.15	21.89	32.92	57.12	17.40	0.00
	AB	experimental study	36	2	5	8	21	42.31	21.89	23.94	59.97	26.01	0.00
	AB	knowledge attribution	27	0	2	10	15	0.00	8.76	29.93	42.84	21.79	0.00
	AB	assertion	26	0	2	8	16	0.00	8.76	23.94	45.69	26.38	0.00
	AB	empirical research	23	0	3	7	13	0.00	13.14	20.95	37.13	12.61	0.00
	AB	identity	23	0	2	6	15	0.00	8.76	17.96	42.84	26.82	0.00
	AB	expertise	22	0	2	10	10	0.00	8.76	29.93	28.56	12.52	0.00
Significantly Decreased	AU	philosophy of mind	36	1	21	12	2	21.15	91.96	35.91	5.71	86.03	0.00
	AU	ethics	35	3	12	11	9	63.46	52.55	32.92	25.70	10.42	0.01
	AU	philosophy of science	31	0	19	6	6	0.00	83.20	17.96	17.14	72.89	0.00
	AU	contemporary philosophy	27	0	10	16	1	0.00	43.79	47.88	2.86	39.35	0.00
	AU	moral judgment	23	0	9	10	4	0.00	39.41	29.93	11.42	15.05	0.00
	AU	intentional action	23	3	9	6	5	63.46	39.41	17.96	14.28	15.43	0.00
	AU	conceptual analysis	20	1	9	5	5	21.15	39.41	14.96	14.28	17.91	0.00

TABLE 4 (Continued)

	Source	Keywords	Raw Frequency					Normalized Frequency					
			Total Freq,	2000-2005	2006-2010	2011-2015	2016-2020	2000-2005	2006-2010	2011-2015	2016-2020	Chi-square	p-value
	AU	analytic philosophy	20	0	10	10	0	0.00	43.79	29.93	0.00	40.77	0.00
	AB	intentionality	49	2	21	20	6	42.31	91.96	59.86	17.14	50.04	0.00
	AB	blame	47	4	14	17	12	84.61	61.31	50.88	34.27	7.62	0.02
	AB	armchair	46	0	17	14	15	0.00	74.44	41.90	42.84	12.93	0.00
	AB	side effect	45	4	20	11	10	84.61	87.58	32.92	28.56	43.54	0.00
	AB	folk intuition	41	3	17	12	9	63.46	74.44	35.91	25.70	29.14	0.00
	AB	determinism	40	0	13	19	8	0.00	56.93	56.86	22.85	16.97	0.00
	AB	Joshua Knobe	33	5	18	7	3	5.76	78.82	20.95	8.57	77.89	0.00
	AB	causation	30	1	11	12	6	21.15	48.17	35.91	17.14	14.48	0.00
	AB	consciousness	30	0	14	11	5	0.00	61.31	32.92	14.28	31.01	0.00
	AB	moral consideration	29	6	16	6	1	26.92	70.06	17.96	2.86	82.09	0.00
Rise and Fall	AU	free will	54	3	6	33	12	63.46	26.27	98.76	34.27	59.49	0.00
	AU	moral responsibility	29	1	5	17	6	21.15	21.89	50.88	17.14	22.26	0.00
	AB	experimental philosopher	71	0	16	36	19	0.00	70.06	107.74	54.26	19.52	0.00
	AB	mental state	46	0	10	26	10	0.00	43.79	77.81	28.56	25.41	0.00
	AB	ordinary people	31	1	7	15	8	21.15	30.65	44.89	22.85	7.62	0.02
	AB	experimental result	28	2	6	15	5	42.31	26.27	44.89	14.28	16.71	0.00
	AB	compatibilist	25	1	6	13	5	21.15	26.27	38.91	14.28	11.45	0.00
	AB	incompatibilist	21	0	6	13	2	0.00	26.27	38.91	5.71	23.76	0.00
Fall and Rise	AU	social cognition	21	0	4	4	13	0.00	17.52	11.97	37.13	15.73	0.00
	AB	folk concept	31	7	14	3	7	48.07	61.31	8.98	19.99	50.58	0.00
Remain Unchanged	AU	intuition	114	3	25	46	40	63.46	9.47	137.67	114.23	3.78	0.15
	AU	folk psychology	28	5	6	8	9	5.76	26.27	23.94	25.70	0.12	0.94
	AU	morality	26	1	5	11	9	21.15	21.89	32.92	25.70	2.34	0.31

(Continues)

TABLE 4 (Continued)

Source	Keywords	Raw Frequency					Normalized Frequency					
		Total Freq,	2000-2005	2006-2010	2011-2015	2016-2020	2000-2005	2006-2010	2011-2015	2016-2020	Chi-square	p-value
AU	Knobe effect	24	0	5	10	9	0.00	21.89	29.93	25.70	1.25	0.54
AU	theory of mind	20	0	4	6	10	0.00	17.52	17.96	28.56	3.66	0.16
AB	empirical study	57	2	12	18	25	42.31	52.55	53.87	71.40	3.74	0.15
AB	empirical evidence	51	2	12	20	17	42.31	52.55	59.86	48.55	1.23	0.54
AB	reference	48	3	9	19	17	63.46	39.41	56.86	48.55	3.16	0.21
AB	perception	48	0	12	14	22	0.00	52.55	41.90	62.83	4.18	0.12
AB	cognitive science	47	2	13	12	20	42.31	56.93	35.91	57.12	5.94	0.05
AB	intention	31	4	6	13	8	84.61	26.27	38.91	22.85	4.88	0.09
AB	empirical work	28	3	6	7	12	63.46	26.27	20.95	34.27	3.31	0.19
AB	ordinary language	27	3	5	7	12	63.46	21.89	20.95	34.27	4.30	0.12
AB	skepticism	24	2	5	7	10	42.31	21.89	20.95	28.56	1.45	0.49
AB	experimental method	23	0	4	9	9	0.00	17.52	26.94	25.70	2.24	0.33
AB	empirical datum	23	2	5	6	10	42.31	21.89	17.96	28.56	2.52	0.28
AB	experimental work	21	1	5	7	8	21.15	21.89	20.95	22.85	0.08	0.96
AB	moral intuition	21	0	6	8	7	0.00	26.27	23.94	19.99	0.86	0.65
AB	experimental evidence	21	2	4	6	9	42.31	17.52	17.96	25.70	2.08	0.35

phy and *conceptual analysis* in *contemporary philosophy*, the subdisciplines like *philosophy of mind*, *ethics*, and *philosophy of science*, and specific philosophical issues like *intentional action*, *intentionality*, *causation*, and *consciousness* all gradually received less mention. Notably, according to the statistics, the famous *side-effect effect* in judgments of *intentionality* commonly attributed to Joshua Knobe (2003a) as well as pertinent issues like *blame*, *moral considerations*, and *moral judgments* seem to have gone out of fashion. It is also worth pointing out that the use of terms like *armchair* and *folk intuition* underwent a sharp decline from the second period to the last two periods. This probably happened because during the later stages of the development of x-phi attention was diverted from earlier critiques of the conventional armchair theorizing methodology and the irrelevance of folk intuitions to the more open attitudes toward *empirical* or *experimental research*, which witnessed significant increase in popularity when introduced in the first category.

Next, there are ten keywords that have gone through dramatic changes during the past fifteen years, but in different directions. For instance, while research topics like *free will*, *moral responsibility*, *mental state*, *compatibilist*, and *incompatibilist* received the most attention during the years 2010 to 2015, terms like *social cognition* and *folk concept* received the least attention during this same period, exhibiting an inverted V-shape and a V-shape distribution in their respective frequencies.

Finally, there are eighteen topics that have largely remained stable in their popularity over the past two decades. "Intuition," being a keyword that has almost served as a companion to the term "experimental philosophy," especially in the earlier stages, retained quite a high currency throughout the time span. This trend conforms to the reality that from the early "intuition-driven" romanticism (that is., conventional armchair philosophy) to the late "survey-driven" romanticism (that is, x-phi) (Cullen 2010), intuitions have been both the target and the trigger of heated philosophical debates, with skepticism about the old and new approaches to philosophizing from the opposing camps being the catalyst. *Folk psychology* and *cognitive science* are also topics that are frequently mentioned in experimental studies of *ethics*, *knowledge*, *belief*, *identify*, *free will*, *blame*, *causation*, and the like, which have undergone significant changes, and of *reference*, *morality*, *perception*, and *theory of mind* that have been popular throughout the past twenty years. What also keep being in focus are topics related to research methods like *empirical study*, *empirical/experimental evidence*, *experimental work*, *data*, and so on, which have helped maintain the momentum of the x-phi movement.

5 | GENERAL DISCUSSION

In this study, through taking a bibliometric approach aided by natural language processing techniques, we have traced the developmental pathways of x-phi as a young and burgeoning research field during the past two decades. Detailed analyses have been performed on the number, source, author, keywords, and abstracts of more than a thousand publications sampled on the PhilPapers website and have produced three major findings.

5.1 | Major findings

First, x-phi has undergone roughly four developmental stages over the past two decades, namely, the *initiation* period (2000–2005), the *development* period (2006–2010), the *expansion* period (2011–2015), and the *plateau* period (2016–2020). Although works in the first period had paved the way for later development of this experimental approach to philosophical inquiries, the key umbrella term "experimental philosophy" did not come into widespread use until 2006. Since then, it has remained at the center of heated discussion. Over the next fifteen years or so, x-phi evolved from negative research programs with the slogan of "burning the armchair" to the more positive and interdisciplinary projects that embrace more armchairs, becoming a fascinating part of the broad enterprise of cognitive science. This characteristic change of x-phi is showcased in part by the wide array of

research topics covered in this area and in part by the diverse academic journals that host the scholarly output on these topics.

Second, during the past twenty years, some topics like *intuition*, *morality*, *folk psychology*, *reference (of names)*, *theory of mind*, and *cognitive science*, and empirical-research-method-related issues like *experimental data*, *experimental evidence*, and so forth, have retained constant interest and attention among experimental philosophers. Others have witnessed significant increase in popularity, such as *knowledge*, *knowledge attribution*, *belief*, *truth*, *assertion*, *context*, and *contextualism*, and metaphilosophical concepts like *experimental philosophy* per se, *thought experiments*, *expertise*, and so on; but still others have undergone significant decrease in popularity, such as *ethics*, *intentionality*, *intentional action*, *causation*, *consciousness*, and so forth. Combining these thematic changes and variations in the number of publications in each subcategory of x-phi, we predict that issues in particular areas like epistemology, moral psychology, philosophy of language, and metaphilosophy will continue to attract even greater attention from researchers in the areas of philosophy, psychology, and linguistics. This, however, does not mean that experimental investigations into other research areas in philosophy will stagnate. Instead, we are quite optimistic about their future development, given the productivity and impact of the extant research.

Third, the current analyses identify a list of influential philosophers, impactful publications, and popular journals that are helpful for researchers and newcomers to get a quick start in learning about the field. Joshua Knobe, Shaun Nichols, David Rose, and Edouard Machery, together with several other productive researchers, are the leading forces in the x-phi movement. Some of their papers, such as "Intentional Action and Side Effects in Ordinary Language" (Knobe 2003a), "Semantics, Cross-Cultural Style" (Machery et al. 2004), "An Experimental Philosophy Manifesto" (Knobe and Nichols 2008), "The Essential Moral Self" (Strohminger and Nichols 2014), and "Nothing at Stake in Knowledge" (Rose et al. 2019), and books like *Sentimental Rules: On the Natural Foundations of Moral Judgment* (Nichols 2004), *Philosophy Within Its Proper Bounds* (Machery 2017), and so on, are among the frequently cited works in x-phi, each exerting considerable influence on the subsequent research in the relevant subfields. Reputable interdisciplinary and philosophy-specific academic journals like *Philosophical Psychology*, *Review of Philosophy and Psychology*, *Mind and Language*, *Cognition*, *Cognitive Science*, *Synthese*, and *Philosophical Studies*, among others, are the most popular venues for works in x-phi.

5.2 | Limitations

While the present study has offered a fresh and comprehensive overview of the research field of x-phi, it nonetheless has two major limitations that to some extent restrain our interpretation of the results. On the one hand, the works included in the current database are all sampled from the PhilPapers website, which might not have indexed all the relevant literature in x-phi. And because the full texts of the publications are not available, the textual analysis is entirely based on titles, abstracts, and keywords, which might be skewed in one way or another. Further, the lack of reference information in the present research renders the analysis of the impact of individual researchers and works less ideal. Otherwise, the detailed citation metrics of the publications could provide a fuller picture of the most frequently cited works, the most influential authors/researchers, and the research networks in the domain.

On the other hand, a certain degree of subjectivity is involved in the present bibliometric analysis, particularly in determining which n-grams to include for discovering research themes and how to account for the changes of these grams. Even though we first worked independently in identifying major research topics from the long list of keywords and n-grams and then had thorough discussions on the candidacy of each key term, the inclusion or exclusion of certain words like "identity," "context," and "ordinary people" as potential themes turned out to be a difficult decision, toward which we opted for greater leniency. When subsequently explaining thematic changes, we found that

while the evolutionary trajectory of most of the terms was quite clear and straightforward, that of some others was rather difficult to delineate. This problem arises from the fact that there might be several synonymous expressions for the same research topic, which are nonetheless organized into different categories based on the statistics in Table 4. This is the case for the "Knobe effect" and "side-effect effect," as well as for method-related terms such as "experimental study" and "empirical study," "experimental result," and "experimental data," and the like. In these cases, our analyses and interpretations of the results are formed on the basis of the overall distribution of the pertinent terms together with our knowledge of the field. More efforts are needed to probe the use of the different terms to see whether there are genuine thematic changes or merely terminological differences.

5.3 | Implications for future studies

The findings mentioned above carry significant implications for the future development of x-phi. In particular, to move out of the plateau stage and make further progress in a sustainable manner, experimental philosophers need to expand their research territory and upgrade their tool kits. Not only the central issues in traditional *core* areas such as epistemology, metaphysics, and related fields like philosophy of language and philosophy of mind are worthy objects of philosophical inquiries; questions in *periphery* areas like ethics and aesthetics, and in pertinent disciplines like linguistics, psychology, cognition, and so forth, are equally valuable research topics (Kitcher 2011; Eklund 2013). For one thing, investigations into the peripheral issues could potentially help deepen our understanding of the central ones; for another, philosophical questions are not timeless questions but are constantly evolving, and those on the outer edge might be within even closer epistemic reach (Kitcher 2011, 252; Machery 2017, 16). That means in future x-phi studies researchers should not just blindly follow the hot research trends and narrowly focus on testing various philosophical theories against folk judgments in experimental settings. Rather, they need to delve further into the mechanisms underlying people's views on the many philosophically interesting issues.

Meanwhile, experimental philosophers may have to develop novel techniques, in addition to the conventional "method of cases," to approach the diversified contemporary philosophical questions. For decades, thought experiments have been employed as a central device in traditional philosophical inquiry, and they are now attracting even greater attention in x-phi, as evidenced by the significant surge in frequency presented in Table 4. Nonetheless, despite the centrality and popularity of thought experiments, echoing the criticism of method of cases like moderate restrictionism (Alexander and Weinberg 2007; Alexander 2012) or even radical restrictionism (Machery 2017), we think that future studies will need to adopt new experimental paradigms and develop novel test probes, and be very careful with employing classical thought experiments. The reason is that adapting classical thought experiments into study vignettes often turns out to be problematic in one way or another. For instance, in the case of the reference of proper names, most of the extant empirical studies are conducted based on the Gödel thought experiment, which has hitherto been found to be beset with wording issues and with complications and incoherence in plots (Li et al. 2018; Devitt and Porot 2018; Li 2022), ambiguity in semantic reference and speaker's reference (Ludwig 2007; Heck 2018), and ambiguity in epistemic perspectives (Sytsma and Livengood 2011; Li 2021), among others. In a word, we think restrictions on employing thought experiments in x-phi studies are necessary, probably moderately at first and radically in its later, mature stage—just as Machery (2017) has observed that the more naturalistic the research area, the less frequently thought experiments are used. X-phi, with its close connection to naturalism, has the potential to thrive on carrying out fresh experimental investigations rather than simple simulations of classic thought experiments in armchair philosophy.

Relatedly, future studies in x-phi should not just aim at gathering and testing folk intuitions in various philosophical cases against philosophical proposals through surveys or questionnaires. On the one hand, efforts should be made to deepen our understanding of philosophical intuitions. In experimental studies, researchers first need to figure out what intuition is, what the thing that is being tested is, whether it can be legitimately used as evidence for philosophical theories, and if yes, how good such

evidence is. On the other hand, it would be beneficial to amass evidence for theories from multiple perspectives, such as intuitions, considered judgments, usage, corpus data, and so on (Devitt 2012). In this regard, we think that besides adopting research methods commonly used in psychology and cognitive science to pump out intuitions from ordinary people or philosophers, researchers could turn their attention to various linguistic corpora that are readily available and to the employment of techniques in corpus linguistics as well as advanced natural language processing techniques in computer science, as these methods have great potential to generate evidence for various philosophical arguments and claims and to facilitate studies of philosophical concepts across time and cultures (Chartrand 2022). Certainly, whatever research design experimental philosophers adopt, greater efforts should be made to improve the reliability and validity of their experimental endeavors, including both the experimental designs and the statistical analyses.

In addition, the current exploration of the research literature in x-phi demonstrates that the scientific review methodology of bibliometric analysis is very helpful in gaining a panoramic view of the research field. In light of the achievements and inadequacies of the present attempt, future studies using this method could focus on other databases like WoS, Google Scholar, JSTOR, and the like, and retrieve all the available bibliometric information, including the cited references in each publication. Last but not least, researchers could also conduct surveys on expert philosophers, especially the leading forces in the x-phi movement, for their views on the status quo and the trends of future developments in this field in particular and in philosophy in general, so as to supplement the bibliometric observations with multi-perspective insights.

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