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Measuring the isolation of research topics in philosophy

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Abstract
Various authors have recently argued that certain parts of academic philosophy are highly isolated from other fields of academic research. The central aim of this paper is to go beyond philosophical arguments, and empirically test whether this is indeed the case. More specifically, we investigate whether LEMM (Philosophy of Language, Epistemology, Mind and Metaphysics) is more isolated than Philosophy of Science and Philosophy of Value Theory. To do this, we collected 2369 Web of Science indexed papers divided into 17 PhilPapers topics from these three subfields of philosophy, and used 10 indicators to measure their isolation. The results showed that the topics from LEMM were more isolated from other fields of science than the topics from Value Theory and Philosophy of Science. Within philosophy, however, the topics from LEMM generally seemed as well-connected as Philosophy of Science and Value Theory.

Keywords LEMM · Philosophy of science · Value theory · Academic isolation · Citation impact · Scholarly collaboration

Introduction

Various academic philosophers have recently expressed worries about the societal value of some of the current work in their field (e.g. Chalmers, 2015; Dietrich, 2011; Higgins & Dyschkant, 2014; Kitcher, 2011). One major source of these worries is the seeming lack of progress philosophy has made. Philosophers have been engaged in investigating the same 'big questions' for well over two millennia, but have not come close to a consensus for most of them. Questions about the nature of knowledge, truth, morality and the life worth living are as much a philosophical battleground today as they were in Ancient Greece (Chalmers, 2015; Dietrich, 2011; Frodeman & Briggle, 2016).

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One might respond to this that philosophy's failure to answer the big questions does not imply that it has not made any progress. Even if philosophers have failed to agree on what, for example, knowledge is, they have developed a wide range of competing sophisticated theories on the subject. Rescher (1985, p. 207; cited in Plant, 2012) calls this progress in "philosophical technology": Even if philosophers never reach consensus about the questions they try to answer, they do add ever more positions, arguments, counterarguments, distinctions and counterexamples to the debates about these questions.

However, the fact that philosophy primarily makes progress in philosophical technology might strengthen worries about the value of philosophy rather than assuaging them. This is because, according to some critics, such philosophical technology often has little societal purpose and no audience outside of the small group of philosophers working on those technicalities. Philip Kitcher, quoting Dewey (2004, p. 315), worries that philosophy is becoming a "sentimental indulgence of the few". In a similar vein, Daniel Dennett (2006, p. 39) writes that "many projects in contemporary philosophy are artifactual puzzles of no abiding significance". Colorfully building on Dennett's worries, Boghossian and Lindsey (2017, p. 64) write that research in the field "twiddles away and seriously entertains the hyper-esoteric and inconsequential" generally "buttressed by the tendency of philosophers to engage in a game of intellectual peekaboo with ideas that do not merit serious considerations". "To attend a philosophy conference", they write, "is to marvel at the obscurity and irrelevance of what's become of the discipline" (p. 64–65).

The problem these authors are pointing to is that some philosophical research is isolated from society.[1] This worry about the isolation of philosophy has more than just intellectual import. The American Philosophical Association—the largest professional organization in Philosophy—had almost 5000 employed members in 2018.[2] In addition, many new Bachelors, Masters and Doctores in philosophy graduate each year (in the United States, for example, respectively 7398, 957 and 454 in 2014).[3] Even without including philosophers and students outside the US in these numbers, it is clear that a large amount of state funding and educational effort is invested in philosophy. If large parts of philosophy indeed have no relevance at all for the public that ultimately provides the funding, these funds and educational efforts may be misdirected.[4]

One might argue in response that it is the nature of academic research to focus on highly specialized, seemingly esoteric subjects. And typically, such research clusters in 'topics' with a closely intertwined literature and highly research community. In philosophy, examples of such topics could be 'Truthmakers', 'Biological Species', or 'Moral Status of Animals'. Such clustering in highly specialized topics need not imply that these topics are really disconnected from society: as long as these topics are connected to other research that, in turn, has societal impact, they have indirect societal relevance. This seems particularly likely for a field like philosophy, which often deals with highly abstract questions.

[1] We follow Higgins and Dyschkant in using the term 'isolation' for this. Others have used 'insular' (e.g. Frodeman, 2013), 'esoteric' (e.g. Boghossian & Lindsey, 2017), 'self-involved' (Pigliucci, 2017) and 'intradisciplinary siloing' (e.g. Wilson, 2017) to discuss the same problem.

[2] https://www.apaonline.org/page/demographics

[3] https://www.apaonline.org/page/data

[4] We say 'may be misdirected' as broad relevance (and lack of isolation) is just one way in which philosophical research can be valuable. Some would argue that even philosophy that is highly isolated can be highly valuable in other ways, and we do not mean to argue against this here.

The question then is whether these specialized research topics are also isolated within academia, and more narrowly, the field of philosophy. At least Boghossian and Lindsey believe they are. They remark (p. 65) that "it's almost as if philosophers have forgotten how to speak to people not just outside their field, but also outside their niche". Similarly, Ladyman (2017), complains that much work in contemporary metaphysics on a subject like time completely disregards physicists' work on this topic. Finally, Higgins and Dyschkant (2014, p. 376) remark in the context of case study of analytic metaphysics that "each discussion becomes increasingly specialized, the resulting theories, conceptual frameworks, and common knowledge become increasingly alien to other academics".

Of course, philosophy is a broad and varied academic field, and it seems unlikely that all topics in this field are highly isolated. Indeed, many of the critics we cited above target specific parts of philosophy. Most prominently, Philip Kitcher makes a broad distinction between what is generally known as 'LEMM' (Philosophy of Language, Epistemology, Mind and Metaphysics) and the rest of philosophy. According to Kitcher, topics in LEMM (which he refers to as 'core philosophy') are particularly isolated. In the rest of philosophy, he broadly distinguishes between two subfields of philosophy that tend to be less isolated than LEMM. First, some philosophy takes other academic fields as its subject, and often engages extensively with those fields. For example, philosophy of physics typically engages closely with physics. Second, some philosophical work focuses on questions about values and societal issues, and often engages with other research relevant to these issues. For example, philosophers thinking about the permissibility of abortion are often engaged with medical work on abortion. We will call the former 'Philosophy of Science' (PoS) and the latter 'Value Theory' (VT).[5]

Many others follow Kitcher's claims, and argue that topics in some subfields of philosophy engage frequently with other fields of science, or with policy makers (Cherry, 2017; Higgins & Dyschkant, 2014; Ladyman, 2017). Thus, just like there is widespread belief that some parts of philosophy are self-involved and isolated, there is widespread belief that this is not equally the case for all subfields of philosophy. In particular, topics in PoS and VT are often assumed to be less isolated than LEMM. If true, this has far-reaching implications. LEMM currently dominates academic philosophy, while PoS and VT are what Kitcher (2011) calls 'peripheral' areas. These peripheral areas draw less funding, fewer students, and take up fewer faculty positions and a less prominent position in philosophy degrees. If the hypothesis of Kitcher and others is true, there would be good reasons to turn philosophy 'inside out' (Kitcher, 2011), and move the peripheral areas (PoS and VT) into a more prominent position at the expense of LEMM.

Baumann (2013) points out that claims concerning the isolation of different areas of philosophy are *empirical*, and thus require empirical support instead of philosophical arguments. There are multiple bibliometric studies that indirectly provide such support. First, some studies show that particular areas of philosophy are isolated. Higgins and Dyschkant (2014) present evidence that works in analytic metaphysics tend to only cite each other, and Higgins and Smith (2013) show that philosophical research on ontology is isolated. Similarly, Kreuzman (2001) shows that philosophy of science is isolated from epistemology, even though their subject areas overlap extensively. Petrovich and Buonomo (2018) show, by means of a series of

[5] Note that Kitcher particularly seems to refer to philosophy of special sciences and philosophy of scientific practice as less isolated than LEMM. As we will see below, this study confirms there are good reasons to distinguish between more 'general' and more 'applied' PoS: parts of what is known as Philosophy of Science seem to be as isolated as LEMM.

maps of analytic philosophy based on co-citation, that research topics in analytic philosophy have become more isolated since 2005.

Second, a small number of studies show that at least PoS is well-connected to the sciences. McLevey et al. (2018) analyse the disciplinary boundaries between PoS and the sciences by looking at citation patterns, and find that philosophers of science regularly publish in and get cited by science journals. Philosophers of science also reported extensive collaboration and interaction with scientists, and even that it is an obligation for PoS to impact science (Plaisance et al., 2019). However, a survey among LEMM-philosophers reported similarly strong and widespread support for interdisciplinary approaches to philosophy (Tiberius, 2017).

While these studies suggest that it is plausible that research in LEMM is more isolated than research in PoS and VT, they are far from conclusively showing this. This is because these studies focus on one particular debate or area of philosophy, and do not allow for comparisons between different areas. The aim of this paper is to fill this gap and investigate whether, and to what extent, topics in PoS and VT are more or less isolated than LEMM. To do this, we selected topics from these three subfields, and used bibliometric methods to investigate the extent to which these are isolated from other parts of academic research.

Before we turn to a description of our methods, further clarification of the notion of isolation is in place. We already highlighted the distinction between a topic's isolation from society and from other parts of academia. Because claims about the latter are more controversial than claims about the former (and because we deal with direct isolation from society in another paper), we focus on isolation from academia in this paper. Two further distinctions are important here. First, research may be isolated with respect to the research they take into account, and it may be isolated with respect to the research it subsequently influences. In other words, there are two 'directions' of isolation: a lack of influence *from* other topics, and a lack of influence *on* other topics. We will call these 'backward-looking' and 'forward-looking' isolation respectively. Second, there are at least two relevant subsets of academic research from which a philosophical research topic may be isolated: a philosophical topic can be isolated from other topics within philosophy; and a philosophical research topic can be isolated from research topics in different fields of academia. We will call these 'disciplinary isolation' and 'interdisciplinary isolation' respectively.

These different dimensions of isolation are logically independent: it is conceivable that a research topic has great impact in different academic fields, but does not build on work from those fields (i.e. high backward-looking isolation, low forward-looking isolation). Similarly, it is conceivable that a research topic is isolated from other fields, but not from other topics within philosophy (low internal isolation, high external isolation). For example, some work in philosophy of biology may deal with abstract questions about evolutionary theory that are not relevant to practicing biologists (high interdisciplinary forward-looking isolation). This need not mean that this work is isolated in all respects: it may well take into account the latest state of the art from evolutionary biology (low backwards-looking interdisciplinary isolation) and inform new philosophical work in cultural evolution (low forward-looking disciplinary isolation). Thus, measuring the isolation of philosophical reseatch requires tracking these different dimensions.

Methodology

On the basis of Kitcher's (2011) and the literature discussed above, we expect the following hypotheses to hold:

(A) *POS is less isolated than LEMM:* it should be expected that, on average, research topics in PoS are less isolated in all dimensions than research topics in LEMM.
(B) *VT is less isolated than LEMM*: it should be expected that research topics in VT are, on average, less isolated in all dimensions than research topics in LEMM.

To test these hypotheses, we select various research topics from each of the three subfields of philosophy, and compare them with respect to the two dimensions of isolation.

Selection of research topics

We follow Klavans and Boyack's suggestion to define 'research topics' as collections of documents produced by communities of researchers "with a common focused intellectual interest, such as work on a specific research problem" (Klavans & Boyack, 2017a, p. 1159). Such research topics are often identified using citation data or co-authorship data (Klavans & Boyack, 2017b). As we will already use these data to evaluate the isolation of the research topics, we instead use the publicly available classification scheme designed by PhilPapers.org to categorize the philosophical documents it lists.

PhilPapers is a comprehensive index of the research literature in philosophy, with the largest structured bibliography in the field. Its bibliography counts 5581 categories managed by 814 volunteer editors.[6] As this classification is actively curated by experts, its categories are unlikely to contain many spurious documents. These categories contain over two million published items in a five-level classification scheme ranging from five main 'Clusters' to 'Subtopics' which typically consist of 15 – 100 documents. Inspection of the classification made it clear that only categories at the leaf-level (i.e. Subtopic) approximate the intellectual homogeneity by which we defined research topics. We therefore operationalize the notion of research topic as the collection of documents collected in a leaf category of the PhilPapers classification scheme.

Among these 5581 topics we selected 17. To enable investigation of the differences between PoS, VT and LEMM, the topics were distributed evenly between these three subfields of philosophy. Topics for VT were chosen from 'Value Theory', topics for PoS were chosen from 'Science, Logic, and Mathematics', and topics for LEMM were chosen from 'Metaphysics and Epistemology'.[7] Because we suspect that both PoS and VT contain general, abstract topics akin to those in LEMM as well as more practically relevant topics, we relied on the Area-level of the PhilPapers classification to select two 'general' and four 'applied' topics in PoS and VT. In PoS, general topics were selected from 'General Philosophy of Science', and applied topics from 'Philosophy of Biology' and 'Philosophy of Physics'. In VT, general topics were selected from 'Meta-ethics' and 'Normative ethics', and applied topics from 'Applied ethics', 'Philosophy of race, gender, sexuality', and 'Social and Political Philosophy'.[8]

Within those broad categories, we excluded miscellaneous leaf-categories, leaf-categories that are part of more than one subfield, and leaf categories without an active editor.

[6] https://PhilPapers.org/browse/all, accessed on 19, June, 2020.

[7] Of course, the borders between these subfields are often unclear, and many papers could be part of more than one of them. For the purpose of this study, however, we ignore this problem.

[8] We did not include any topics from the category 'Continental Philosophy' because work from this subfield is not well covered in Web of Science and PhilPapers. Thus, the results of this study apply only to 'analytic' philosophy.

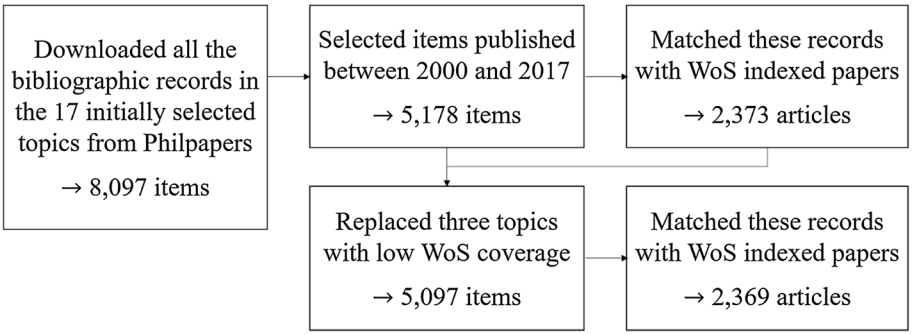

Fig. 1 Data process of sample selection

The topics used for analysis were then selected on the basis the number of documents and overlap with other topics. The full list of criteria and the order in which these were applied can be found in Appendix A.

Data sources and data processing

In the first step we downloaded the bibliographic records of all 8097 items in the 17 selected topics from PhilPapers in October 2019. From these we selected all 5,178 items published between 2000 and 2017, including 3976 journal articles, 310 books, 677 chapters in collections, 72 PhD theses and 143 unpublished works. We then matched these records to Web of Science Core Collection (WoS) indexed papers to obtain their citation and reference data. With 2373 articles out of 5178 items indexed in both databases, the overall WoS coverage was 46%. To ensure that the coverage of each topic was sufficiently high, we replaced three topics with low WoS coverage.[9] In total, then, we collected 5097 PhilPapers items published between 2000 and 2017, and then performed bibliometric analysis on the 2369 papers of these that are indexed in WoS. The process is illustrated in Fig. 1. The numbers of papers and index ratio of all topics included in the analysis are listed in Table 1. For the transparency and reproduction of our data set, the bibliographic records of the whole sampled papers are stored at https://doi.org/10.5281/zenodo.5521228.

The WoS matching algorithm used to map Philpaper items to WoS items was based on an algorithm developed by ECOOM[10] and specifically modified for the field of philosophy. The algorithm applies regular expression and N-grams matches to the downloaded bibliographic records and then uses the following five criteria to ensure the correctness of matches with WoS data: (1) identical unique identifier, i.e. DOI; or (2) identical source title, volume, issue and begin page; or (3) identical entire article title which is more than

[9] 'Biodiversity' (42.2%) was replaced by ' Species' (48.9%); 'Incommensurability in science' (32.5%) was replaced by 'Theory change' (46.2%); 'Immigration' (25.3%) was replaced by 'Animal rights' (30.7%). Because coverage was generally lower in topics from VT, not all topics selected from that field to replace topics with low coverage actually had higher coverage. In those cases, we kept the original topics.

[10] Over the course of 7 years, the ECOOM algorithm has automatically matched several hundred-thousands of references to WoS records with a 85%-90% rate of correct matching. The algorithm further suggests appropriate matches for the remaining 10–15% of false negative matches, which were manually validated to be 70% correct.

Table 1 Numbers of publications and indexed ratios of final 17 topics in three subfields of philosophy

Topic		All years	2000–2017		
		No. items	No. items	No. WoS articles	WoS coverage (%)
Philosophy of Science					
General PoS	Theory change	353	143	66	46.2
	The nature of models	447	312	138	44.2
	Subtotal	800	455	204	44.8
Applied PoS	Functions	383	188	91	48.4
	Mathematical structure of quantum mechanics	445	213	148	69.5
	Species	629	321	157	48.9
	Symmetry in physics	485	255	147	57.7
	Subtotal	1942	977	543	55.6
Total		2742	1432	747	52.2
Philosophy of Value Theory					
General VT	Moral expressivism	519	377	204	54.1
	The doctrine of dual effect	291	204	91	44.6
	Subtotal	810	581	295	50.8
Applied VT	Abortion	892	406	218	53.7
	Animal rights	943	551	169	30.7
	Moral status of animals	308	209	80	38.3
	Rape and sexual violence	427	280	85	30.4
	Subtotal	2570	1446	552	38.2
Total		3380	2027	847	41.8
Philosophy of Language, Epistemology, Mind and Metaphysics					
Closure of knowledge		241	171	92	53.8
Minimalism and deflationism		590	399	164	41.1
The exclusion problem		542	386	201	52.1

Table 1 (continued)

Topic	All years	2000–2017		
	No. items	No. items	No. WoS articles	WoS coverage (%)
Truthmakers	588	468	229	48.9
Zombies & conceivability problem	338	214	89	41.6
Total	2299	1638	775	47.3
Grand-total	8421	5097	2369	46.5

30 characters, volume and source title; or (4) identical source title, volume, begin page and fuzzy title match starting from the 10th character; or (5) identical publication year, volume, begin page, source title and fuzzy title match. The different variations of source titles were first checked and compared with the journal abbreviation database collected by ECOOM in previous projects. Only matches seen as identical to WoS indexed items were taken into account in this study.

The matched results suggest that the general WoS coverage in philosophy is around 40–50% for the time-range of the study, which is higher than the coverage of around 30% reported by local depositories for philosophy (cf., Butler & Visser, 2006; Engels et al., 2012; Sivertsen & Larsen, 2012). We speculate that the coverage in this study is higher because researchers may have been required to upload all of their publications to institutional/national depositories but might only upload their academic publications to PhilPapers. In addition, we increased the coverage slightly by replacing three topics with low coverage. Finally, the higher coverage may also be due to the fact that WoS coverage of philosophical papers has increased since previous studies. In this respect, the dataset of this study confirms a broader international trend in increasing WoS coverage across fields in the social sciences and humanities (see Engels et al., 2012; Chi, 2015).

The limited coverage of PhilPapers documents in WoS forms a limitation of this study: in the end, only half of the publications from the comprehensive philosophy database – and only source items[11]—were analysed. However, there is no bibliographic index that provides both a classification system maintained by experts *and* reference/citation data of indexed publications. As this study requires both, the most efficient solution was to use the PhilPapers classification system and retrieve data of the targeted records through an authorised citation index. WoS was chosen because our team has abundant experience in matching and analysing data from it.

Indicators

There are, as discussed above, at least two dimensions of isolation: isolation can vary by the domain a topic is isolated from (philosophy or the rest of academia), and by the direction of isolation (forward-looking or backward-looking). Combining these two dimensions, we get 4 types of isolation: forward-looking disciplinary isolation, backward-looking disciplinary isolation, forward-looking interdisciplinary isolation, and backward-looking interdisciplinary isolation.

As these four kinds of isolation are at least logically independent, we have to use multiple indicators to chart the isolation of philosophical research topics. Defining research topics in terms of collections of documents, as we did, allows us to use the citation-links between these documents and other documents to measure the isolation of research topics. The direction of isolation then depends on whether we look at the citations or references of the documents in a topic: Backward-looking isolation can be measured by looking at the reference-lists of the papers in a research topic, and forward-looking isolation can be measured by looking at number and distribution of citations of the papers in a research topic. The domain of isolation, on the other hand, depends on

[11] Source items are "articles appearing in journals indexed by the Institute for Scientific Information (ISI) in one of its three main indexes – Science Citation Index (SCI), Social Sciences Citation Index (SSCI), and Arts and Humanities Citation Index (A&HCI)" (Butler & Visser, 2006, p. 330).

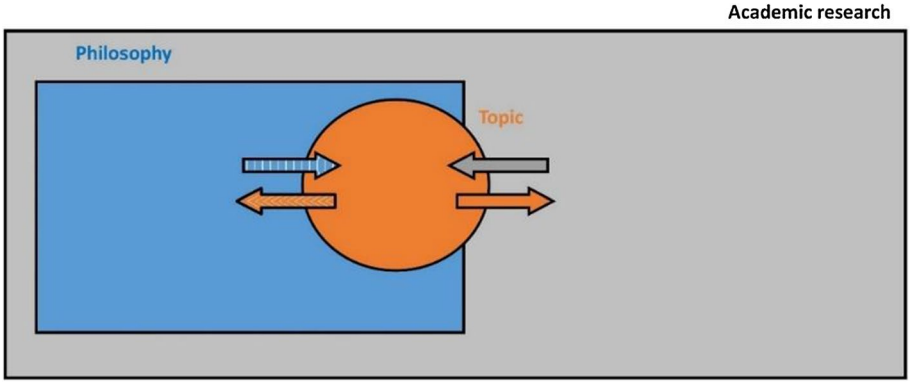

Fig. 2 Different dimensions of isolation. The isolation of research topics (like the orange circle) is investigated in multiple dimensions. Forward-looking indicators (arrows going out of the orange circle) track citations, while backward-looking indicators (arrows going into the circle) track references. Indicators for disciplinary isolation (striped arrows) look at citations and references coming from philosophy (the blue area), and indicators for interdisciplinary isolation (unstriped arrows) look at citations and references coming from the rest of academia. The topic here (orange circle) is partially out of the field of philosophy because some papers in the PhilPapers topic are classified as non-philosophy by WoS

where these references and citations come from: references and citations from philosophy determine disciplinary isolation, while references and citations from the rest of academia determine interdisciplinary isolation. These different dimensions and citing and cited links are further illustrated in Fig. 2.

This means that to measure isolation, we have to assign the references and citations of the documents in our sample to either philosophy or in the rest of academia. Because all our data is drawn from WoS, we can use their subject categories for this. These subject-categories are the leaf-level categories in in WoS, and all journal articles in WoS are assigned to at least one such category on the basis of the journal they are published in. We defined the field of philosophy as any document that WoS places in 'History & Philosophy of Science', 'Philosophy', or 'Ethics'. Any document outside of those categories is taken to be part of non-philosophy. This means that not all papers in each of the topics is part of the field of philosophy: some papers that PhilPapers considers part of a topic, are categorized by WoS as non-philosophy. This is likely to be an accurate reflection of academic reality, as at least some topics should be expected to be partially interdisciplinary.

Table 2 lists eight indicators by which we measure these four types of isolation. There are eight (instead of four) indicators because both forward-looking and backward-looking isolation are measured by a ratio as well as a simple mean rate of citations or references. The ratio tracks the proportion of citations that comes from the field(s) of interest (philosophy or the rest of academia), while the mean citation rate provides an absolute measure of impact. The absolute measure is necessary to interpret the relative measure, as a high proportion of, say, citations from outside philosophy does not necessarily indicate that a topic is not isolated. It may well be that the topic is very rarely cited to begin with, in which case a high proportion of citations from outside philosophy still amounts to very few actual connections. Together, the relative and absolute measures provide a nuanced picture of isolation.

Table 2 Indicators of the four types of isolation and collaborative isolation

		DISCIPLINARY		INTERDISCIPLINARY	
FORWARD	Relative	$\boldsymbol{FIS_{Disc}}$	$\frac{\textit{Philosophical citations from the topic}}{\textit{Total philosophical citations}}$	$\boldsymbol{FIS_{Inter}}$	$\frac{\textit{Total philosophical citations}}{\textit{Total citations}}$
	Absolute	$\boldsymbol{FIM_{Disc}}$	*Mean philosophical citations outside the topic*	$\boldsymbol{FIM_{Inter}}$	*Mean non-philosophical citations*
BACKWARD	Relative	$\boldsymbol{BIS_{Disc}}$	$\frac{\textit{Philosophical references from the topic}}{\textit{Total philosophical references}}$	$\boldsymbol{BIS_{Inter}}$	$\frac{\textit{Total philosophical references}}{\textit{Total references}}$
	Absolute	$\boldsymbol{BIM_{Disc}}$	*Mean philosophical references outside the topic*	$\boldsymbol{BIM_{Inter}}$	*Mean non-philosophical references*
COLLABORATION		$\boldsymbol{CIS_{Disc}}$	$\frac{\textit{Nonphilosophical collaborations}}{\textit{Total number of papers}}$	$\boldsymbol{CIS_{Inter}}$	$\frac{\textit{Noninterdisciplinary collaborations}}{\textit{Total number of papers}}$

The detailed description and methametical equations of all the indicators are supplemented in Appendix B.

These 8 indicators all measure isolation through citations and references. To avoid that our investigation of isolation in philosophy is entirely dependent on these indirect connections, we also take into account the relatively direct and subjective links of collaboration. Unlike in most other fields of research, philosophical papers are typically single-authored. This reflects 'the popular image of […] philosophers […] as independent scholars, working, or at least writing, in relative isolation' (Cronin et al., 2003, p. 868). Writing papers in collaboration with others breaks such isolation in the minimal sense that at least two points of view, and often also two research specializations or academic fields, are combined.

To measure isolation through collaboration practices, we determined for each multi-authored paper whether it was a collaboration between philosophers, between non-philosophers, or between at least one philosopher and at least one non-philosopher. To do this, we relied on author affiliations provided by WoS to determine whether the authors of a paper are philosophers (affiliated to a philosophy department) or non-philosophers (not affiliated to a philosophy department).[12] We did this by applying multiple criteria to the 379 multi-authored papers (10 without address data were excluded) from the 17 topics in two groups: papers showing clear correspondence between addresses and authors, and papers without correspondence between addresses and authors.[13] The lack of correspondence between addresses and authors was not due to WoS, but mainly to publication patterns adopted by authors and journals. For the first group we deduced the authors' field from their corresponding addresses in 5 steps (see Appendix C).

The same steps were also applied to each address in the second group. Even though we cannot identify philosophers for the papers in this group due to the lack of individual author affiliations, the field of addresses (philosophy or non-philosophy) of a paper plus the number of its authors provides enough proof to detect whether the paper is a collaboration between someone with a philosophical affiliation and someone with a non-philosophical affiliation. In total, we found that 174 papers were collaborations by only philosophers, 139 papers were published by only non-philosophers, and 66 papers were collaborations by at least one philosopher and one non-philosopher. We used these data to calculate two additional indicators: disciplinary collaborative isolation and interdisciplinary collaborative isolation (there is no distinction between forward and backward looking isolation for these). The former is the proportion of papers in a topic that is a collaboration between at least two philosophers, and the latter is the proportion of papers in a topic that is a collaboration between at least one philosopher and one non-philosopher. For both of these indicators, a higher value indicates lower isolation.

All in all then, we use 10 indicators to measure the isolation of research topics in philosophy. These indicators, as well as how precisely we calculated them, are listed in Table 2. The data needed to calculate these indicators were extracted in March 2020 from the ECOOM in-house database with WoS raw data (1980–2018). Self-citations were not excluded as self-citing is seen as natural citing behavior and its effect is not expected to

[12] Of course, the distinction between philosophers and non-philosophers are sometimes vague, and one researcher can plausibly fit in both categories; however, we ignore these complications for the purposes of this study and assume that researchers are either philosopher or non-philosopher, and that this is reliably indicated by their affiliation.

[13] The average number of authors per paper is 2.5857, with 971 unique authors combined for all multi-authored papers. The topic 'Rape and sexual violence' has the highest number of authors, namely, 3.2621.

obstruct this study significantly. For the reference-based indicators, only source references indexed in WoS were counted as it was not possible to identify the PhilPapers-topic and WoS-field of non-source references.[14] Similarly, only WoS indexed documents were included for calculating the other indicators. Hence, whenever we refer to a research topic below, this should be understood as those papers from the topic that are indexed in WoS.

Results

The results of all indicators for all topics are listed in Appendix D. Table 3 shows the aggregated values of all indicators for the three subfields of philosophy. Not surprisingly, forward-looking and backward-looking indicators nearly perfectly match across all absolute and relative indicators of isolation. This means that topics that tend to cite more non-philosophy, are also more often cited by non-philosophy. Reversely, it also means that topics that tend to cite more philosophy outside of their topic, are also more often cited by philosophy outside the topic. Because forward-looking and backward-looking indicators tend to match, we focus on the difference between disciplinary and interdisciplinary isolation in the presentation of results.

Relative isolation: citations and references

Figure 3 presents the relative isolation-indicators for the three subfields of philosophy. Across all four indicators, topics in PoS are less isolated than topics in VT, which in turn are less isolated than topics in LEMM. This means that within philosophy, topics in PoS are the least likely to cite sources from within the topic, and topics in LEMM are most likely to do so. Similarly, topics in PoS more often cite work from outside philosophy, and are also more often cited by such work. The differences are far stronger for interdisciplinary isolation than for disciplinary isolation, with LEMM scoring particularly high for interdisciplinary isolation. This indicates that LEMM nearly uniquely cites, and is cited by, philosophical sources.

Absolute impact: citations and references

The absolute indicators of isolation track the citation and reference impact outside the topics in philosophy. Note that a higher score for these indicators implies a lower degree of isolation. In terms of overall citation impact, papers in PoS are generally cited the most, followed by those in LEMM and VT: Papers in the topics of PoS were cited 11 times on average; papers in VT and LEMM were on average cited 3.9 and 4.9 times respectively. Although the overall citation impact of each subfield is not the main focus of this paper, these average citation numbers reveal the unique citation patterns among topics and subfields and to some extent can be seen as baseline for the absolute indicators in this study.

[14] WoS coverage of references is around 25.8% for the 17 topics. The topic 'Functions' has the highest share of WoS indexed references (37%,) while the topic 'Rape and sexual violence' has the lowest ratio (17.9%). Among the three subfields of philosophy, 'Philosophy of Science' has highest ratio of indexed references (28.6%), followed by 'Core Philosophy' (26.3%) and 'Philosophy of Value Issues' (21.5%).

Tabel 3 Aggregated values of all isolation indicators for the three subfields of philosophy (2000–2017)

Topic	Disciplinary					Interdisciplinary				
	Forward-looking isolation	Forward-looking absolute citations	Backward-looking isolation	Backward-looking absolute references	Collaborative isolation	Forward-looking isolation	Forward-looking absolute citations	Backward-looking isolation	Backward-looking absolute references	Collaborative isolation
PoS	17.3%	3.41	19.1%	2.87	92.8%	37.4%	6.90	33.8%	6.95	95.7%
General PoS	12.9%	5.97	16.7%	4.35	91.2%	72.9%	2.55	59.9%	3.50	96.1%
Applied PoS	20.9%	2.44	20.7%	2.31	93.4%	26.6%	8.54	26.1%	8.25	95.6%
PoVT	31.4%	1.61	26.7%	1.84	94.2%	60.2%	1.55	49.9%	2.53	96.3%
General VT	43.4%	2.05	30.9%	3.19	93.6%	85.8%	0.60	79.7%	1.17	98.6%
Applied VT	17.4%	1.37	19.4%	1.12	94.6%	44.7%	2.05	30.0%	3.25	95.1%
LEMM	42.7%	2.60	32.3%	3.83	90.8%	92.4%	0.37	93.0%	0.43	99.6%

These aggregated values were calculated by summing the numerators and denominators of the indicators for all topics in each subfield

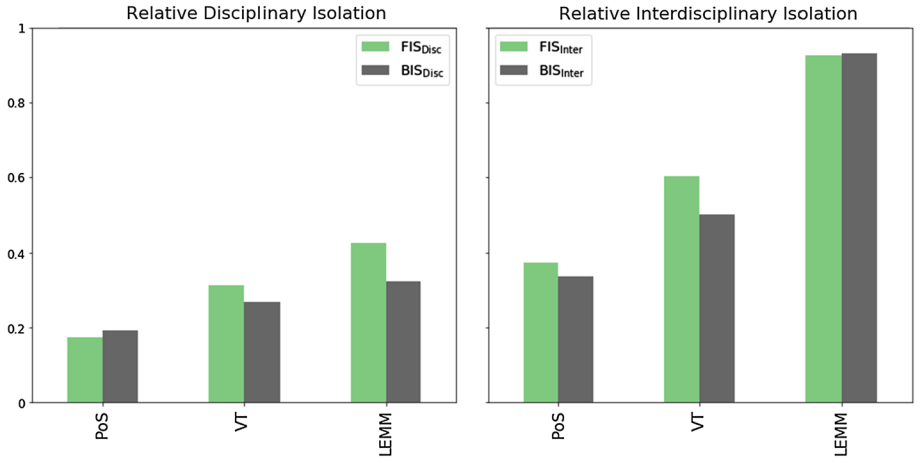

Fig. 3 The forward and backward looking indicators for relative disciplinary isolation (left) and relative interdisciplinary isolation (right) The y-axes indicate the proportion of philosophical citations or references from inside the topic (left) and the proportion of citations/references from philosophy (right). So, a higher score indicates stronger isolation

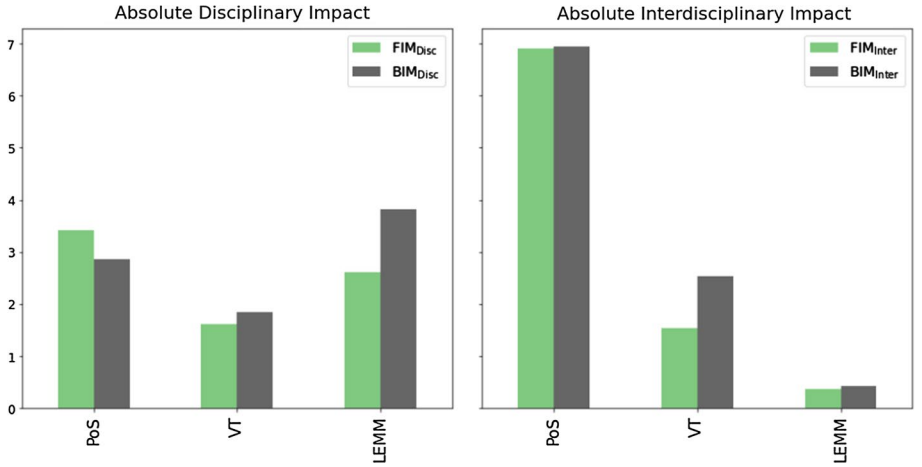

Fig. 4 The forward and backward looking indicators for absolute disciplinary impact (left) and absolute interdisciplinary impact (right) The y-axes represent the mean number of philosophical citations or references from outside the topic (left), and the mean number of citations or references from outside the field (right). So, a higher score corresponds to lower isolation

Figure 4 shows that this large difference between PoS and the other two subfields of philosophy is largely due to citations from outside philosophy. In line with this, topics in PoS rely far more often on sources from outside philosophy than topics in VT and LEMM. In particular topics in LEMM are rarely cited by non-philosophy, and almost never rely on non-philosophical sources. This confirms their interdisciplinary isolation as indicated by the relative indicators discussed above. The indicators for disciplinary isolation show a different pattern: topics in VT less often cite, and are less often cited by, sources within

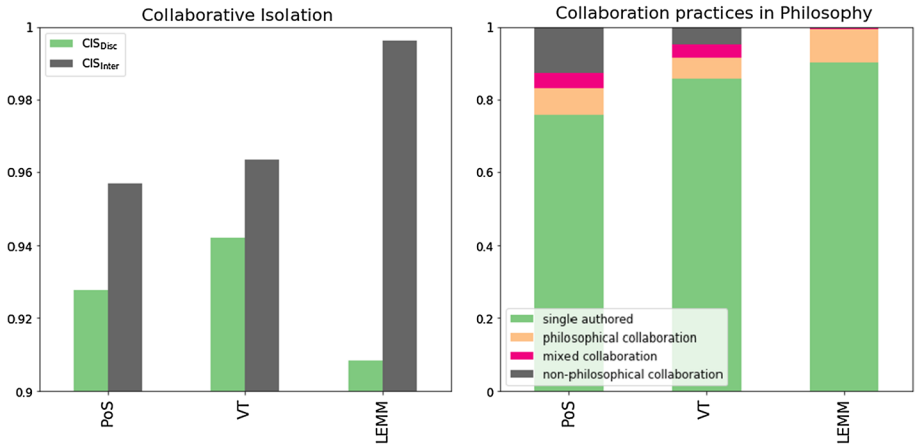

Fig. 5 Collaborative isolation indicators (left) and collaboration practices (right) of the three subfields of philosophy. The indicators for collaborative isolation indicate the proportion of papers that is not authored by at least two philosophers (CIS_{Disc}) or by a philosopher and a non-philosopher (CIS_{Inter}) (left). So, a higher score here indicates stronger isolation. The figure on the right represents the proportions of various kinds of authorship in each subfield of philosophy

philosophy than topics in LEMM and PoS. This means that while the proportion of philosophical citations and references that come from outside the topic is higher for VT than for LEMM, the absolute number of citations and references is lower. The difference between PoS and LEMM is small, with PoS scoring better for philosophical citations from outside the topic, and LEMM scoring better for philosophical references from outside the topic. This means that topics in PoS have more impact on new philosophical work, but topics in LEMM make use of more earlier work in philosophy.

Collaborative isolation

The average number of authors per co-authored paper in the 17 philosophical topics is 2.56, but the average number of authors per paper in the data set is only 1.25. This low number is in line with the results of Cronin et al. (2003), who point out that philosophers acknowledge and co-author less than researchers in other fields. This is illustrated in Fig. 5 (right), which shows that single authored papers are most common in all three subfields of philosophy. But while over 24% of all papers in PoS are multi-authored, this is only 14% for VT and 10% for LEMM. This disparity between LEMM and the other two subfields of philosophy is again most pronounced for interdisciplinary isolation. While around 4% of all papers in PoS and VT are written by at least one philosopher and one non-philosopher, this is the case for only 0.4% of all papers in LEMM. For collaborative isolation within philosophy (see Fig. 5, left), on the other hand, LEMM scores better than both VT and PoS. This means that topics in LEMM more often contain papers that are written by at least two philosophers than topics in PoS and VT. The high degree of interdisciplinary isolation degree of LEMM is again shown by the fact that philosophers in LEMM rarely collaborate with researchers from other fields.

Interestingly, we found that philpaper topics in PoS and VT often have many papers written by authors with only non-philosophical affiliations, such as biologists, physicists,

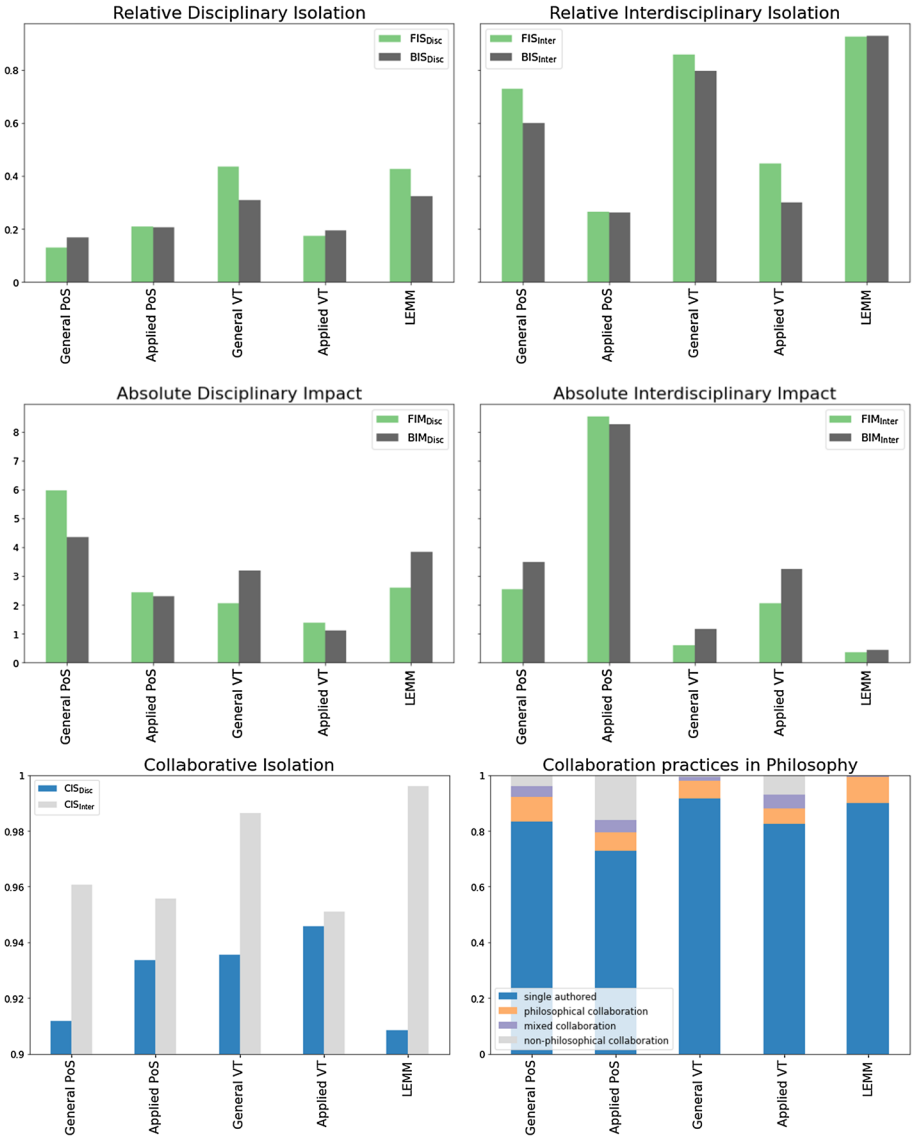

Fig. 6 Relative isolation, absolute impact and collaborative isolation of applied and general topics in the three subfields of philosophy

sociologists and psychologists. These collaborations without philosophers were often published in non-philosophical journals. This is particularly the case for papers in philosophy of physics. Nearly half of the papers in PoS written by only non-philosophers were published in journals belonging to the WoS subject category"PHYSICS, MULTIDISCIPLINARY" and overall two-thirds of these papers were from physics. This suggests that the WoS-classification may not be congruent with how specialists from these fields – which

considered these papers part of a philosophical research topic as well – classified these papers.

General and applied PoS/VT

Figure 6 shows the results for all indicators if we split PoS and VT in applied and general topics. Across almost all indicators, general topics are more isolated than applied topics. This difference is most pronounced for interdisciplinary isolation, where applied topics show very low values of isolation. However, there are important differences between PoS and VT here. General topics in PoS are less isolated within philosophy than applied topics in PoS, and there are also more collaborations between philosophers in general PoS. Overall, these general topics in PoS are also less isolated than topics in LEMM and general topics in VT. These general topics in VT are consistently more isolated than applied VT, and have very similar scores for isolation as topics in LEMM.

Discussion and conclusions

The two hypotheses, drawn from the philosophical literature, were generally confirmed by the indicators for isolation used in this paper. However, nuance is important here, as they were confirmed to different degrees, and not always for all different dimensions of isolation.

Hypothesis A – that PoS is less isolated than LEMM – was confirmed across nearly all indicators. Particularly the difference in isolation from other academic fields shows very strongly. Over 90% of the citations and references for LEMM topics come from philosophy, compared to less than 40% for PoS. In this respect, this study confirms the findings of McLevey et al. (2018). Particularly noteworthy also is the relatively high degree of multi-authored papers that philosophers of science write with researchers from other fields. This confirms the results of survey-research by Plaisance et al (2019), in which nearly all philosophers of science reported to have co-authored work with philosophers and well over half with scientists.

Hypothesis B – that VT is less isolated than LEMM – was also confirmed, but less strongly than hypothesis A. Topics in VT contain more collaborations between philosophers and non-philosophers, and tend to cite, and get cited by, more papers outside philosophy. Topics in VT also tend to cite, and get cited by, proportionally fewer philosophical papers from within the same topic.

Of course, these results should not be taken to imply that *all* LEMM is more isolated than *all* PoS and VT.[15] Indeed, even within the most isolated topics used in this study there surely are publications that productively engage with work from other fields and topics. In addition, many philosophers from all three areas of philosophy are aware of the problems we discuss here, and actively look for solutions like 'field philosophy' (Brister & Frodeman, 2020) or socially engaged philosophy of science (Cartieri & Potochnik, 2014; Fehr &

[15] It is also important to keep in mind that the isolation of philosophical research says nothing about the technical quality of the research. That is, these results should not be taken to imply that philosophical research from PoS and VT is superior in terms of analysis, reasoning or argumentation. Instead, PoS and VT show to be superior in terms of their relevance for other academic research.

Plaisance, 2010). More importantly, the results for isolation also differed across indicators. While topics in LEMM are very strongly isolated from other fields of research, they seem reasonably well-connected to other research within philosophy. For one, topics in LEMM contain more collaborations between philosophers than topics in VT and POS. In addition, topics in LEMM also get cited by philosophical sources from outside the topic more often than topics in VT. This suggests that topics in LEMM have larger absolute impact outside the topic than topics in VT. This should be interpreted with caution, however, as topics in LEMM are also more often cited by sources from the same topic than topics in VT. Thus, even if the absolute impact in philosophy of topics in LEMM is larger than for topics in VT, papers in LEMM also tend to focus more of their impact within their own topic.

In general, relative and absolute indicators did not always match. This inconsistency may be explained by differences in citation practices across fields. Specifically, 95% of papers in LEMM were published in the field of Arts & Humanities according to the modified Leuven–Budapest classification system assorting 16 major fields and 74 subfields based on all the ISI subject categories (see Glänzel et al., 2016); however, only 60% of VT papers and 56% of PoS papers were published in Arts & Humanities. Another 24% of VT papers were published in the field Social Sciences I and additional 28% of PoS papers are in Physics. It is generally expected that papers in the social sciences would receive less citations than papers in physics[16] due to different citation practices and insufficient database coverage (see Hicks, 1999; Nederhof, 2006; Chi, 2014). Unsurprisingly, then, VT and LEMM are cited less often, and have a higher rate of uncited documents (32 and 31% respectively) than PoS (20%).

Given these differences in citation practices between fields, one could argue that the results for hypotheses A and B may be due to the fact that topics in VT and PoS have a substantial proportion of papers that are authored by non-philosophers and published in non-philosophical journals. However, this does not explain the consistently large gaps between PoS/VT and LEMM across most indicators. Moreover, even if there are disciplinary differences with respect to citation practices, it remains plausible that philosophical papers with more citations outside of philosophy are more influential outside of philosophy. The crux of the issue lies in the question of whether papers from non-philosophical journals and with non-philosophical authors can be considered part of the philosophical topics. We argue that the answer is clearly affirmative. PhilPapers states explicitly that it aims to index just papers that are part of academic philosophy, but that these need not be published in philosophical outlets. As all PhilPapers-topics in this study are actively curated by a philosophical expert, this means that these papers were considered part of philosophical debates by a philosophical expert. Thus, the higher proportion in PoS and VT of papers authored by authors without a philosophical affiliation simply shows that these topics are more closely integrated with other fields of academia.

A final finding that is worth highlighting is that general topics in PoS and VT are generally more isolated than applied topics in these subfields. Interestingly, the scores of these general topics were similar to those of topics in LEMM: they have particularly high scores for interdisciplinary isolation, and seem less isolated from other parts of philosophy than they are from other fields of science. This is particularly the case for general topics in VT. This suggests that it may be more accurate to classify the general topics from VT in

[16] For example, the 2020 ESI Field Baselines published by Clarivate reports that during the period 2010 to 2020 WoS papers in Social Sciences, General were cited 7.82 times on average while the papers in Physics were cited 11.9 times on average. https://esi.clarivate.com/, accessed on 9, October, 2020.

LEMM. This would fit with our experience of the field of philosophy, according to which normative ethics and meta-ethics, from which the topics for general VT were chosen, are traditionally part of LEMM. Further research is needed to determine where general topics in PoS are best placed, as this study suggests that they are less isolated than general topics in VT and topics in LEMM. One explanation for this may be that papers in this area are more often multi-authored than those in general VT and LEMM. This suggests that encouraging collaborations may be one effective way of decreasing isolation of LEMM and general topics in the peripheral areas.

These results have at least three important implications for addressing the problem of isolation in philosophy. First, and most importantly, these results support Kitcher's (2011) claim that one way of decreasing the isolation of philosophical research would be to turn philosophy 'inside out': while currently LEMM dominates over the peripheral areas of philosophy (PoS and VT) in terms of prestige, funding, and teaching, these results suggest that isolation could be diminished by reversing this relation. Second, and related to this, these results suggest that such a reversal should prioritize in particular applied rather than general topics in Philosophy of Science and Value Theory.

Third, the results in this paper show that LEMM, and to a smaller extent general topics in the peripheral areas, are particularly isolated from other fields of academia. This means that interventions that focus on this dimension of isolation are likely to have the largest impact. However, such interventions are most likely also very difficult, as they require a substantial change in the current academic culture of philosophy. As McLevey et al. (2018) show, receiving citations from outside philosophy has no impact on the academic success of philosophers of science. Assuming that time spent on publications aimed at other fields takes time away from more narrowly philosophical publications, this means that philosophers are currently punished for connecting to other fields of academia. And while philosophers of science broadly state that engaged or interdisciplinary work should be encouraged, a survey question asking if publications outside philosophy should be given equal weight received relatively low support (Tiberius, 2017). Hence, there may be a gap between what philosophers say about engaging with other fields, and how they act when hiring or training students (see also Plaisance et al., 2019).

Finally, it is worth briefly discussing the limitations of this study. First, this study only looks at 17 out of over 5000 PhilPapers-topics. While these were selected through a stratified approach, the sampling was not truly random and it is hard to evaluate how representative these topics are for the three subfields. In particular, there were some large differences in indicator-scores between topics within each of the kinds of philosophy (in particular 'Matematical structure of Quantum Mechanics', 'Moral expressivism' and 'Truthmakers'; see Appendix D). This suggests that the aggregated scores for the different kinds of philosophy could have turned out differently had we sampled different topics. We see no reason to think, however, that the topics we selected are in some way atypical for the subfield they represent. Still, the small sample size means we should interpret the results with caution and we urge that follow-up research repeats these measures for isolation with a larger sample of topics.

Second, this study assumes that PhilPapers topics contain all recent philosophical papers on that topic, and do not contain items that are irrelevant. If this assumption is not met, the indicators may not give a good representation of the isolation of these topics. While we only used PhilPapers topics with an active editor, we cannot be sure that all topics are well-maintained. To avoid this limitation, future research on this topic could consider using unsupervised algorithms to generate a classification (see e.g. Malaterre et al., 2019, 2021).

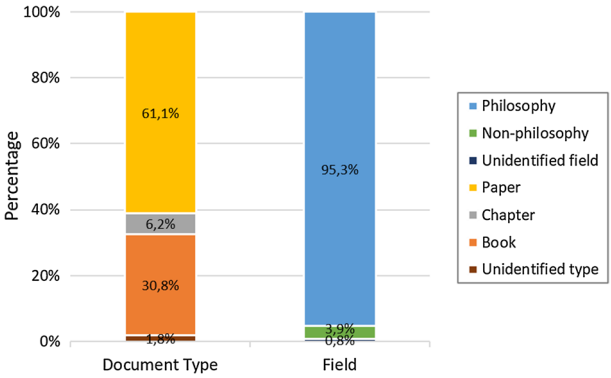

Fig. 7 Reference composition of document type and field of 20 papers in LEMM *Note* 20 papers were selected as those with median reference numbers in the 20 intervals formed by the 5 LEMM topics and 4 time periods (2000–2004, 2005–2008, 2009–2013, 2014–2017), containing 386 references. The second author checked these references manually

Third, we have already pointed at the low WoS coverage of topic papers and references that we did select, and, more particularly, a bias towards source references over references to books and book chapters. This limitation is particularly worrying because it may be that philosophers in LEMM cite fewer source items (typically journal papers) and more other types of documents such as books. To ensure that journal papers are also commonly cited in LEMM, we conducted a small test to estimate the composition of reference lists in LEMM papers. Figure 7 shows that even though journal papers are not the only type of references, they are clearly more common than books. In addition, the distribution of these references between philosophy and non-philosophy is clearly in line with our results based on source references. This suggests that the low coverage and limitation to source items in the reference analysis of this study did not bias the results.

A fourth limitation is that this study only measures *direct* academic influence and isolation through publications. As Plaisance et al. (2019) show, philosophers of science engage and collaborate with scientists in more ways than just co-authoring and citing papers. Our research does not capture such flows of influence. In addition, it may be that LEMM and general topics in the peripheral areas have *indirect* impact on work from other academic fields through the applied topics in the peripheral areas. For example, it may be that applied papers use ideas from LEMM, which in turn influence work in other academic fields. Such indirect influence cannot be traced by the indicators here, but still alleviates the isolation of LEMM and general topics from the peripheral areas. However, such indirect influence is likely to be limited, as the indicators for influence within philosophy also show that applied topics are less isolated than LEMM and general topics.

Finally, this study only measures isolation with respect to *academic research*. It may well be that topics that are highly isolated in an academic sense are highly connected to other audiences, such as lay people and policy makers. This may be particularly so for topics in VT. While the results in this study suggest that topics in VT are more isolated than PoS-topics, it seems likely that they are less isolated from society. Hence, a complete picture of isolation of philosophy requires that such societal connections are also measured. We will take this up in a follow-up study to this paper.

Appendix A. Criteria of selecting analysed research topics

1. To ensure the quality of classification, we selected only research topics that have an active editor in PhilPapers.
2. To ensure that statistical analysis is meaningful, we selected only research topics with at least 150 documents published since 1998.
3. To ensure that the topics are devoted to a single research question, we excluded all topics of which the name indicates that they are heterogeneous, e.g. if they have 'miscellaneous' in their name.
4. To ensure that we could test the hypotheses outlined above, we selected topics from philosophy of science, philosophy of societal issues, and core philosophy. Philosophy of science-topics were selected from the following PhilPapers Areas: 'Philosophy of Biology', 'Philosophy of the Physical sciences', and 'General Philosophy of Science'. Philosophy of societal issue-topics were selected from the following Philpapers Areas: 'Applied Ethics', 'Meta-Ethics', 'Normative Ethics', 'Philosophy of Race, Gender, and Sexuality', and 'Social and Political Philosophy'. Core philosophy topics were selected from the following Areas: 'Epistemology', 'Metaphysics', 'Philosophy of Language', 'Philosophy of Mind'. Within philosophy of science and societal issues, these areas were selected to include both topics close to core philosophy (e.g. meta-ethics) and topics further removed from it (e.g. applied ethics).
5. To ensure that we could test the hypotheses, we excluded topics that fall clearly in more than one of the three main philosophical areas. For example, topics that concern research integrity were excluded, and we did not select topics from 'philosophy of the cognitive sciences' to avoid overlap with 'philosophy of mind'.
6. To avoid overlap between topics, we avoided selecting two topics that are closely related. For example, we did not select both 'Teleology' and 'Functions' for philosophy of biology.
7. To ensure relatively wide coverage of the whole of analytic philosophy, we selected 6 topics from philosophy of science, 6 topics from philosophy of societal issues, and 5 topics from core philosophy.
8. Whenever the decision was not determined by other criteria, we ranked topics by the number of documents they contain.

Appendix B. Detailed overview of ten isolation indicators applied in this study

B-1. Disciplinary isolation (FIS_{Disc}, FIM_{Disc}, BIS_{Disc}, BIM_{Disc}, CIS_{Disc})

B-1–1. Forward-looking isolation

Forward-looking relative isolation: What proportion of a topic's philosophical citations is from papers in the topic?

To investigate the extent to which topics are isolated from other philosophical research, we measure the ratio of philosophical papers in the topic citing the papers in the topic to all

philosophical papers citing the papers in the topic as equation $\boldsymbol{FIS_{Disc}} = \frac{\boldsymbol{C_{Ptp}}}{\boldsymbol{C_P}}$, where C_P is the total number of philosophical papers citing the papers in the topic, and C_{Ptp} is the number of philosophical citations of those papers from papers in the same topic.

Forward-looking absolute impact: How often, on average, are the papers of a topic cited by philosophical papers outside the topic?

We measure the extent to which a topic impacts philosophical work outside the topic by the ratio of the times the papers in a topic are cited by philosophical papers from outside the topic to the total number of the papers in the topic as equation $\boldsymbol{FIM_{Disc}} = \frac{\boldsymbol{C_P - C_{Ptp}}}{\boldsymbol{N_T}}$, where C_P is the total number of philosophical papers citing the papers in a topic,C_{Ptp} is the number of citations of those papers from philosophical papers in the same topic, and N_T is the total number of papers in the topic.

B-1–2. Backward-looking isolation

Backward-looking relative isolation: What proportion of a topic's philosophical references refers to papers in the same topic?

This indicator focuses on a topic's references to philosophical papers. We calculate the ratio of the times the papers in a topic cite philosophical papers in the topic to the total number of philosophical references of papers in the topic as equation $\boldsymbol{BIS_{Disc}} = \frac{\boldsymbol{R_{Ptp}}}{\boldsymbol{R_P}}$, where R_P is the total number of philosophical references of the papers in the topic, and R_{Ptp} is the number of philosophical references from the same topic.

Backward-looking absolute impact: How often, on average, are the papers of a topic citing philosophical papers outside the topic?

This indicator measures the extent to which a topic cites philosophical work outside the topic by the ratio of the times the papers in a topic citing philosophical papers from outside the topic to the total number of the papers in the topic as equation $\boldsymbol{BIM_{Disc}} = \frac{\boldsymbol{R_P - R_{Ptp}}}{\boldsymbol{N_T}}$, where R_P is the total number of philosophical references of the papers in a topic,R_{Ptp} is the number of philosophical references from the same topic, and N_T is the total number of papers in the topic.

B-1–3. Collaborative isolation

Collaborative isolation*: What proportion of papers are NOT co-authored only with philosophers?*

To measure the isolation degree of collaboration with philosophers in the field, we investigate how often the philosophers of a topic not collaborate with only philosophers. To do this, we measure the ratio of the number of the papers in a topic published by at least two philosophers to the total number of papers as equation

$\boldsymbol{CIS_{Disc}} = \frac{N_T - N_{Cp}}{N_T}$, where N_T is the total number of papers in a topic, and N_{Cp} is the number of papers in that topic co-published by at least two philosophers.

B-2. Interdisciplinary isolation (FIS_{Inter}, FIM_{Inter}, BIS_{Inter}, BIM_{Inter}, CIS_{Inter})

B-2–1. Forward-looking isolation

Forward-looking relative isolation: What proportion of a topic's citations is from papers in philosophy?

We measure the ratio of the times the papers in a topic are cited by papers in philosophy to the total number of citations of the papers in the topic as formula $\boldsymbol{FIS_{Inter}} = \frac{C_P}{C_T}$, where C_T is the total number of citations of the topic, and C_P is the number of philosophical papers citing those WoS papers.

Forward-looking absolute impact: How often, on average, are papers in a topic cited by papers from outside the field?

We measure the ratio of the times the papers in a topic are cited by non-philosophical papers to the total number of the papers by the equation $\boldsymbol{FIM_{Inter}} = \frac{C_T - C_P}{N_T}$, where C_T is the total number of citations of the topic,C_P is the number of papers from philosophy citing the topic and N_T is the total number of papers in the topic.

B-2–2. Backward-looking isolation

Backward -looking relative isolation: What proportion of a topic's references refers to papers in philosophy?

We measure the ratio of the times the papers in a topic cite papers in philosophy to the total number of references of all papers in the topic as equation $\boldsymbol{BIS_{Inter}} = \frac{R_P}{R_T}$, where R_T is the total number of references in a topic, and R_P is the number of references of the topic to philosophical papers.

Backward-looking absolute impact: How often, on average, are the papers of a topic citing papers outside the field?

This indicator measures the extent to which a topic cites papers outside philosophy by the ratio of the times the papers in a topic citing papers from outside the field to the total number of the papers in the topic as equation $\boldsymbol{BIM_{Inter}} = \frac{R_T - R_P}{N_T}$, where R_T is the total number of references of the papers in a topic,R_P is the number of philosophical references, and N_T is the total number of papers in the topic.

B-2–3. Collaborative isolation

Collaborative isolation*: What proportion of papers are NOT co-authored with non-philosophers?*

We investigate how often the philosophers of a topic collaborate with non-philosophers and then reverse the perspective to correspond the implication of other indicators: the higher the value, the higher the isolation degree. To do this, we measure the ratio of the number of the papers in a topic published by at least one philosopher and one non-philosopher to the total number of papers and deduct them as equation.

$\boldsymbol{CIS_{Inter}} = \frac{N_T - N_C}{N_T}$, where N_T is the total number of papers in a topic, and N_C is the number of papers in that topic co-published by at least one philosopher and one non-philosopher. Note that the collaborations between only philosophers or only non-philosophers are not included in N_C.

Appendix C. Principles to distinguish philosophers on the basis of their corresponding addresses

1. Identify all the authors from addresses that contain "PHIL", "FILO", "Pholosoph" or "ETH" (excluding "Method", country "Netherlands", and university "ETH")[17] as philosophers.
2. Manually check and identify the authors with addresses showing only the main institution/university names without further department information.
3. Use the philosopher list collected from Step 1 and 2 to exclude the author names which were already known as philosophers.
4. Collect a keyword list of department names (see Appendix B.1) which are clearly not philosophical institutions from the result of Step 3, and identify the authors with these addresses as non-philosophers.
5. Manually check the authors of the remaining 31 papers by their affiliation addresses.

C-1. Keywords for detecting non-philosophic addresses

'%Behav %' OR '%Evolutionsbiol%' OR '%Weather%' OR '%Anim Prod Syst%' OR '%Indigenous Knowledges%' OR '%Sustainabil%' OR '%Neurosci%' OR '%Informat Sci%' OR '%Policy%' OR '%Climate Sci%' OR '%Comparat%' OR '%Conservat Genet'' OR '%Gender%' OR '%Social Care' OR '%Law%' OR '%Invest%' OR '%Media%' OR '%Mediterraneenne%' OR '%Latin%' OR '%Citizenship%' OR '%Urban%' OR '%Accounting%' OR '%Business%' OR '%Basic Sci%' OR '%Biol%' OR '%Commun%' OR '%Soil Sci%' OR '%Dev Sociol%' OR '%Earth%' OR '%Engn%' OR '%Environm%' OR '%Oncol%' OR '%Fis %' OR '%Geol%' OR '%Interact%' OR '%Manage%' OR '%Mat Sci%' OR '%Matemat%' OR '%Commun%' OR '%Mkt%' OR '%Obstet%' OR '%Organism%' OR '%Paediat%' OR '%Geosyst%' OR '%Probabil%' OR '%Psychol%' OR '%Publ Hlth%' OR '%Technol%' OR '%Semiot%' OR '%Sociol%' OR '%Social%' OR '%Zool%' OR '%Sci Fis%' OR '%Sociol%' OR '%Global%' OR '%Polytech%' OR '%Vet Med%' OR '%Hlth%' OR '%Math%' OR '%Brain%' OR '%Chem%' OR '%Coastal%' OR '%Marine%' OR '%Languages%' OR '%Quantum%' OR '%Theoret%' OR '%Transcultural%' OR '%Psycholinguist%' OR '%Nucl%' OR '%Polit%' OR '%Psychiat%' OR '%Neurosci%' OR '%Prevent%' OR '%Physiol%' OR '%Conservat%' OR '%Geosci%' OR '%Agr%' OR '%Mol %' OR '%Disabil%' OR '%Modeling%' OR '%Life%' OR '%IBISC%' OR '%CONICET%' OR '%Review%' OR '%Sch Econ%'.

[17] The latter two exclusions were only initiated when there are on any above characters shown in other part of the address.

Appendix D. Values of all the isolation indicators of 17 topics in three subfields of philosophy (2000–2017)

Topic		Disciplinary					Interdisciplinary				
		Forward-looking isolation	Forward-looking absolute citations	Backward-looking isolation	Backward-looking absolute references	Collaborative isolation	Forward-looking isolation	Forward-looking absolute citations	Backward-looking isolation	Backward-looking absolute references	Collaborative isolation
Philosophy of Science		17.3%	3.41	19.1%	2.87	92.8%	37.4%	6.90	33.8%	6.95	95.7%
General PoS	Theory change	13.9%	2.73	10.5%	3.76	92.4%	79.8%	0.80	71.8%	1.65	98.5%
	The nature of models	12.8%	7.52	18.9%	4.64	90.6%	71.8%	3.38	56.6%	4.38	94.9%
Applied PoS	Functions	22.4%	4.12	21.3%	5.11	81.3%	50.8%	5.14	45.6%	7.75	96.7%
	Mathematical structure of Quantum Mechanics	1.7%	1.58	1.6%	0.82	95.9%	24.1%	5.07	10.1%	7.41	95.3%
	Species	28.1%	3.08	25.2%	2.94	95.5%	19.7%	17.43	27.2%	10.55	95.5%
	Symmetry in physics	17.3%	1.59	17.7%	1.39	95.9%	29.3%	4.64	19.6%	6.97	95.2%
Philosophy of Value Theory		31.4%	1.61	26.7%	1.84	94.2%	60.2%	1.55	49.9%	2.53	96.3%
General VT	Moral expressivism	46.1%	2.15	32.0%	3.55	92.6%	90.3%	0.43	88.2%	0.70	99.5%
	The doctrine of dual effect	34.5%	1.81	26.8%	2.37	95.6%	74.1%	0.97	59.1%	2.24	96.7%
Applied VT	Abortion	19.8%	1.73	24.2%	1.29	95.4%	52.7%	1.93	41.2%	2.44	94.5%
	Animal rights	15.6%	0.86	14.7%	0.79	97.0%	33.6%	2.02	18.9%	3.96	94.7%
	Moral status of animals	12.8%	2.48	13.4%	2.10	83.8%	69.2%	1.26	53.3%	2.13	97.5%
	Rape and sexual violence	23.4%	0.42	21.3%	0.44	97.6%	14.9%	3.16	10.0%	5.00	95.3%

Topic	Disciplinary					Interdisciplinary				
	Forward-looking isolation	Forward-looking absolute citations	Backward-looking isolation	Backward-looking absolute references	Collaborative isolation	Forward-looking isolation	Forward-looking absolute citations	Backward-looking isolation	Backward-looking absolute references	Collaborative isolation
LEMM	42.7%	2.60	32.3%	3.83	90.8%	92.4%	0.37	93.0%	0.43	99.6%
Closure of knowledge	31.1%	2.20	17.7%	4.09	89.1%	94.5%	0.18	88.2%	0.66	98.9%
Minimalism and deflationism about truth	42.4%	1.27	16.9%	4.03	90.9%	93.1%	0.16	95.1%	0.25	100.0%
The exclusion problem	41.8%	3.71	36.3%	4.58	92.0%	91.0%	0.63	94.7%	0.40	100.0%
Truthmakers	50.3%	2.83	46.7%	3.01	90.0%	97.2%	0.17	98.1%	0.11	99.1%
Zombies and the conceivability argument	23.9%	2.39	18.0%	3.57	92.1%	78.0%	0.89	75.8%	1.39	100.0%

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References

Baumann, P. (2013). Philosophy upside down? *Metaphilosophy*, *44*(5), 579–588. https://doi.org/10.1111/meta.12046

Boghossian, P., & Lindsay, J. (2017). Chmess, abiding significance, and rabbit holes. In R. Blackford & D. Broderick (Eds.), *Philosophy's future: The problem of philosophical progress* (pp. 63–74). John Wiley & Sons.

Brister, E., & Frodeman, R. (2020). *A guide to field philosophy: Case studies and practical strategies*. Routledge.

Butler, L., & Visser, M. S. (2006). Extending citation analysis to non-source items. *Scientometrics, 66*(2), 327–343.

Cartieri, F., & Potochnik, A. (2014). Toward philosophy of science's social engagement. *Erkenntnis, 79*(5), 901–916. https://doi.org/10.1007/s10670-013-9535-3

Chalmers, D. J. (2015). Why isn't there more progress in philosophy? *Philosophy, 90*(1), 3–31. https://doi.org/10.1017/S0031819114000436

Cherry, M. (2017). Coming out of the shade. In R. Blackford & D. Broderick (Eds.), *Philosophy's future: The problem of philosophical progress* (pp. 21–30). John Wiley & Sons.

Chi, P. S. (2014). Which role do non-source items play in the social sciences? A case study in political science in Germany. *Scientometrics, 101*(2), 1195–1213.

Chi, P. S. (2015). Changing publication and citation patterns in political science in Germany. *Scientometrics, 105*(3), 1833–1848.

Cronin, B., Shaw, D., & Barre, K. L. (2003). A cast of thousands: Coauthorship and subauthorship collaboration in the 20th century as manifested in the scholarly journal literature of psychology and philosophy. *Journal of the American Society for Information Science and Technology, 54*(9), 855–871. https://doi.org/10.1002/asi.10278

Dennett, D. C. (2006). Higher-order truths about chmess. *Topoi, 25*(1), 39–41. https://doi.org/10.1007/s11245-006-0005-2

Dewey, J. (2004). *Democracy and education*. Dover Publications.
Dietrich, E. (2011). There is no progress in philosophy. *Essays in Philosophy, 12*(2), 330.
Engels, T. C. E., Ossenblok, T. L. B., & Spruyt, E. H. J. (2012). Changing publication patterns in the social sciences and humanities, 2000–2009. *Scientometrics, 93*(2), 373–390.
Fehr, C., & Plaisance, K. S. (2010). Socially relevant philosophy of science: An introduction. *Synthese, 177*(3), 301–316. https://doi.org/10.1007/s11229-010-9855-7
Frodeman, R., & Briggle, A. (2016). *Socrates Tenured: The Institutions of Twenty-first-century Philosophy*. Rowman & Littlefield International.
Frodeman, R. (2013). Philosophy dedisciplined. *Synthese, 190*(11), 1917–1936. https://doi.org/10.1007/s11229-012-0181-0
Glänzel, W., Thijs, B., & Chi, P. S. (2016). The challenges to expand bibliometric studies from periodical literature to monographic literature with a new data source: The Book Citation Index. *Scientometrics, 109*(3), 2165–2179.
Hicks, D. (1999). The difficulty of achieving full coverage of international social science literature and the bibliometric consequences. *Scientometrics, 44*(2), 193–215.
Higgins, A., & Smith, B. (2013). A citation based view of the ontology community in philosophy. In *Proceedings of the ACM Web Science 2013*.
Higgins, A., & Dyschkant, A. (2014). Interdisciplinary collaboration in philosophy. *Metaphilosophy, 45*(3), 372–398. https://doi.org/10.1111/meta.12091
Kitcher, P. (2011). Philosophy inside out. *Metaphilosophy, 42*(3), 248–260. https://doi.org/10.1111/j.1467-9973.2011.01684.x
Klavans, R., & Boyack, K. W. (2017a). Research portfolio analysis and topic prominence. *Journal of Informetrics, 11*(4), 1158–1174. https://doi.org/10.1016/j.joi.2017.10.002
Klavans, R., & Boyack, K. W. (2017b). Which type of citation analysis generates the most accurate taxonomy of scientific and technical knowledge? *Journal of the Association for Information Science and Technology, 68*(4), 984–998. https://doi.org/10.1002/asi.23734
Kreuzman, H. (2001). A co-citation analysis of representative authors in philosophy: Examining the relationship between epistemologists and philosophers of science. *Scientometrics, 50*(3), 525–539. https://doi.org/10.1023/A:1012778307249
Ladyman, J. (2017). What has philosophy ever done for us? In R. Blackford & D. Broderick (Eds.), *Philosophy's future: The problem of philosophical progress* (pp. 31–40). John Wiley & Sons.
Malaterre, C., Chartier, J.-F., & Pulizzotto, D. (2019). What is this thing called philosophy of science? A computational topic-modeling perspective, 1934–2015. *HOPOS: The Journal of the International Society for the History of Philosophy of Science*, *9*, 215–249. https://doi.org/10.1086/704372
Malaterre, C., Lareau, F., Pulizzotto, D., & St-Onge, J. (2021). Eight journals over eight decades: A computational topic-modeling approach to contemporary philosophy of science. *Synthese*, *199*, 2883–2923. https://doi.org/10.1007/s11229-020-02915-6
McLevey, J., Graham, A. V., McIlroy-Young, R., Browne, P., & Plaisance, K. S. (2018). Interdisciplinarity and insularity in the diffusion of knowledge: An analysis of disciplinary boundaries between philosophy of science and the sciences. *Scientometrics, 117*(1), 331–349. https://doi.org/10.1007/s11192-018-2866-8
Nederhof, A. J. (2006). Bibliometric monitoring of research performance in the social sciences and the humanities: A review. *Scientometrics, 66*(1), 81–100.
Petrovich, E., & Buonomo, V. (2018). Reconstructing late analytic philosophy A quantitative approach. *Philosophical Inquiries, 6*(1), 151–182. https://doi.org/10.4454/philinq.v6i1.184
Pigliucci, M. (2017). Philosophy as the evocaton of conceptual landscapes. In R. Blackford & D. Broderick (Eds.), *Philosophy's future: The problem of philosophical progress* (pp. 75–90). John Wiley & Sons.
Plaisance, K. S., Graham, A. V., McLevey, J., & Michaud, J. (2019). Show me the numbers: A quantitative portrait of the attitudes, experiences, and values of philosophers of science regarding broadly engaged work. *Synthese*. https://doi.org/10.1007/s11229-019-02359-7
Plant, B. (2012). Philosophical diversity and disagreement. *Metaphilosophy, 43*(5), 567–591. https://doi.org/10.1111/j.1467-9973.2012.01770.x
Rescher, N. (1985). *The strife of systems: An essay on the grounds and implications of philosophical diversity*. University of Pittsburgh Press.
Sivertsen, G., & Larsen, B. (2012). Comprehensive bibliographic coverage of the social sciences and humanities in a citation index: An empirical analysis of the potential. *Scientometrics, 91*(2), 567–575.
Tiberius, V. (2017). The well-being of philosophy. In *Proceedings and Addresses of the American Philosophical Association, 91*, 65–86
Wilson, J. (2017). Three barriers to philosophical progress. In R. Blackford & D. Broderick (Eds.), *Philosophy's future: The problem of philosophical progress* (pp. 91–104). John Wiley & Sons.