Synthese (2021) 199:2883–2923
https://doi.org/10.1007/s11229-020-02915-6

Eight journals over eight decades: a computational topic-modeling approach to contemporary philosophy of science

Christophe Malaterre[1,2] · Francis Lareau[3] · Davide Pulizzotto[2,4] · Jonathan St-Onge[1,2]

Received: 8 June 2020 / Accepted: 12 October 2020 / Published online: 17 December 2020

Abstract
As a discipline of its own, the philosophy of science can be traced back to the founding of its academic journals, some of which go back to the first half of the twentieth century. While the discipline has been the object of many historical studies, notably focusing on specific schools (e.g., logical empiricism) or major figures of the field (e.g., Carnap, Kuhn), little work has focused on the journals themselves. Here, we investigate contemporary philosophy of science by means of computational text-mining approaches: we apply topic-modeling algorithms to eight major philosophy of science journals, from the 1930s up until 2017. Based on the full-text content of some 15,897 articles, we identified 25 research themes and 8 thematic clusters that show how the research agenda of the philosophy of science has changed in its content over the course of the last eight decades, up to the philosophy of science we now know. We also show how each one of the journals contributed in its own way to this thematic evolution.

Keywords Philosophy of science journals · Topic modeling · Text mining · Digital humanities · Digital philosophy

✉ Christophe Malaterre
malaterre.christophe@uqam.ca

1 Département de philosophie, Université du Québec à Montréal (UQAM), 455 boulevard René-Lévesque Est, Montreal, QC H3C 3P8, Canada

2 Centre interuniversitaire de recherche sur la science et la technologie (CIRST), Université du Québec à Montréal (UQAM), 1205 rue Saint-Denis, Montreal, QC H3C 3P8, Canada

3 Département d'informatique, Université du Québec à Montréal (UQAM), 201 avenue Président-Kennedy, Montreal, QC H2X 3Y7, Canada

4 Département d'études littéraires, Université du Québec à Montréal (UQAM), 405 rue Sainte-Catherine Est, Montreal, QC H3C 3P8, Canada

1 Introduction

The life of academic disciplines is closely tied to that of their journals. This is very much so in the natural sciences, but also in the human and social sciences where journals constitute one of the most significant venues for published research. The discipline of philosophy of science is no different: alongside monographs and edited volumes, disciplinary journals have become an increasingly important vehicle for research outcome over the past decades. While the boundaries with the broader discipline of philosophy may be quite permeable (Wray 2010), some journals have come to play a most central role in the development of the philosophy of science up to what it is today. This is for instance the case of journals such as *Erkenntnis*, *Synthese* or *Philosophy of Science* for which the first issues all go back to the 1930s, but also of several other journals that have been founded since—including the recently established *European Journal for the Philosophy of Science*—and which show the vitality of the discipline. The broader historical context in which these journals became established—such as the emergence of the Vienna Circle in the early twentieth century followed by the war-time emigration of some of its leading figures to America—certainly matters to situating the intellectual content of publications, and so does also the smaller-scale context of editorship and editorial decisions (Howard 2003; Reisch 2005 chap. 5; Beisbart et al. 2019). Importantly, the published articles and their content play a most central role when it comes to mapping out the diversity of research questions the philosophy of science has come to address over the years. As a complement to more traditional exegetic and historical approaches, we propose to apply computational text-mining approaches to examine the overall content of these journals with the objective of offering a large-scale and data-driven perspective on the research agenda of the philosophy of science as it has unfolded since the 1930s.

With such approaches, it indeed becomes possible to investigate the content of large corpora of full-text documents in a comprehensive and quantitative way, and from synchronic as well as diachronic perspectives. Initially developed in linguistics and natural language processing, computational textual analyses have been applied in many areas, including the natural sciences (as illustrations, see e.g., Valente et al. 2018; Luiz et al. 2019) and—as concerns us here—in history and philosophy (e.g., Mimno 2012; Murdock et al. 2017; Peirson et al. 2017; Barron et al. 2018; Pence and Ramsey 2018). While the journal *Philosophy of Science* has recently been characterized through topic-modeling analyses (Malaterre et al. 2019), we examine here a much broader and comprehensive corpus composed of the full-text content of 15,897 articles published by eight philosophy of science journals from 1934 up until 2017. These journals, which are among the most recognized journals that publish general philosophy of science research in English language, include: the *British Journal for the Philosophy of Science*, the *European Journal for the Philosophy of Science, Erkenntnis*, *International Studies in Philosophy of Science, Journal for General Philosophy of Science, Philosophy of Science, Studies in History and Philosophy of Science (Part A)*, and *Synthese*.

To investigate the major research themes that interested philosophers of science from the 1930s up to now, we mobilized computational approaches—notably topic modeling algorithms—that could provide information about the semantic content of

the entire corpus and its evolution over time. The results of our analyses document, in particular, the shift in topics in the philosophy of science, with a relative decrease of philosophy of language, logic and philosophy of physics articles over 80 years, and an increase in epistemology, philosophy of biology and of mind. Such quantitative data offer an empirical basis for what might otherwise be informal claims about the discipline and its evolution in the past eight decades as reconstructed from the perspective of its major journals. They are also the type of data that may trigger novel discussions about the directions the field might take.

In what follows, we explain the text-mining methodology that structured our analyses and describe the corpus that we used (Sect. 2; note that this section can be skipped by readers more interested in the results themselves). The topic-modeling results are then presented, with a discussion about their content, their relationship to one another and what can be inferred in terms of the diversity of research work published in philosophy of science journals (Sect. 3). We complement these results with diachronic analyses in order to examine how topics have evolved over time (Sect. 4). We then zoom in on journals and map their topical profile (Sect. 5). As a conclusion, we briefly discuss text-mining methodologies and the broader context of their application (Sect. 6).

2 Corpus and methodology

We usually do not use words at random, but mobilize them in specific combinations that not only respect the syntactical rules of the languages we adopt but also enable us to express ideas and convey meaning to others. Over and over, these combinations of words give rise to repeated patterns. Hence the intuition that examining these patterns may provide insights into the semantic content of the texts in which they occur. As the linguist John R. Firth used to say, "you shall know a word by the company it keeps" (1957, p. 11). This intuition is found at the basis of text-mining methods that mobilize computational tools to quantitatively examine the patterns of occurrences of terms within digitized sets of texts (e.g., Srivastava and Sahami 2009; Aggarwal and Zhai 2012). Because words are usually used in a coherent fashion across texts and authors, such approaches have shown to be very effective. One of them—called "topic-modeling"—makes it possible to identify sets of words that are often used together in similar circumstances across varying documents. Through careful examination of the meaning of their terms and the documents in which they occur, these sets of words can be interpreted as meaningful topics which, in turn, provide a topical perspective on the semantic content of the corpus being studied.[1] By considering metadata such as publication years or journals, additional analyses can be conducted that offer, for instance, diachronic views on the evolution of the corpus content over time or journal profiles in terms of topical content. Here, we applied these approaches to a set of major philosophy of science journals to identify their topical content and the evolution of that content over the past 80 years. The topic-modeling itself was carried out with an algorithm based on the well-established Latent Dirichlet Allocation (LDA) model

[1] Note that metaphoric language and homonymy may affect the effectiveness of such tools as topic-modeling. Yet, depending on how it is implemented, topic-modeling can be used to reveal distinct meanings and contexts associated to specific terms.

(Pritchard et al. 2000; Blei et al. 2003) which is part of a broader family of statistical algorithms for topic discovery in texts (e.g., Griffiths and Steyvers 2004; Blei and Lafferty 2009; DiMaggio et al. 2013). Such approaches have two noteworthy characteristics: not only do they make it possible to gain semantic insights about corpora that would have been too large to investigate manually, but they also function in an unsupervised data-driven way, meaning that topics are identified on the basis of the word content of the corpus, without a priori knowledge of which topics might indeed be present (though such knowledge may prove useful to interpret results, as we will see below).[2] With LDA modeling, each topic is a probability distribution over the lexicon of the corpus—the lexicon being the set of all word types present across all documents of the corpus—and, in turn, each document is modeled by a probability distribution over topics. Any random document can then be thought of as being the result of multiple probabilistic word drawings according to the word probability distributions of topics, these topics also being drawn according to their own probability distribution within said document. The overall methodology we used here can be decomposed in five major stages:

(1) Corpus preparation. We constructed our corpus with the full-text content of the following 8 general philosophy of science journals: the *British Journal for the Philosophy of Science*, the *European Journal for Philosophy of Science*, *Erkenntnis, International Studies in the Philosophy of Science*, the *Journal for General Philosophy of Science*,[3] *Philosophy of Science*, *Studies in History and Philosophy of Science Part A* and *Synthese* (see Table 1 for an overview; more details about each journal can be found in Appendix A). One may comment that philosophy of science is also published in other journals, be they more general philosophy journals (e.g. *Mind*), more specialized philosophy of science journals (e.g. *Studia Logica, Hyle, Biology and Philosophy*), or even science journals (e.g. *Bioscience*). Philosophy of science is also published in many non-English languages (e.g. *Principia, Epistemologia, Philosophia Scientiae*) and in numerous books and edited volumes. Needless to say, our ambition is not to cover the entirety of what has ever been published in philosophy of science. However, by focusing on the 8 major general philosophy of science journals in English language, we hope to provide more than a representative and useful perspective on the thematic content of philosophy of science and its evolution over the past 8 decades. The corpus that we settled on comprises 15,897 full-text articles from 1934 up until 2017, totaling over 62 million word occurrences (for an average word count of about 3912 words per

[2] As with any quantitative approach, results depend on different technical choices among many equally valid options, but ones that are more or less fit for purpose. These options appear at different stages of the methodology, including iterative rounds of parameter settings, simulations and results inspections (Von Luxburg et al. 2012; Hu et al. 2014).

[3] The *Journal for General Philosophy of Science* was founded in 1970 under the name *Zeitschrift für allgemeine Wissenschaftstheorie/Journal for General Philosophy of Science*. The journal renamed itself *Journal for General Philosophy of Science/Zeitschrift für allgemeine Wissenschaftstheorie* in 1990, and then simply *Journal for General Philosophy of Science* in 2014, which is the name we use here (or *JGPS* in short).

Table 1 List of the philosophy of science journals included in the corpus

Journals (by alphabetic order)	Publication dates	Retrieved publications (from start-date until 2017)
British Journal for the Philosophy of Science (BJPS)	1950—present	1861 articles in English (included in corpus)
Erkenntnis	1931—1940; 1975—present	1865 articles in English (included in corpus) *252 articles in German (not included; 166 before 1940); 8 articles in French (not included; before 1940)*
European Journal for Philosophy of Science (EJPS)	2011—present	156 articles in English (included in corpus)
International Studies in the Philosophy of Science (ISPS)	1986—present	560 articles in English (included in corpus)
Journal for General Philosophy of Science (JGPS)	1970—present	514 articles in English (included in corpus) *410 articles in German and 4 in French (not included)*
Philosophy of Science (PS)	1934—present	4604 articles and proceedings in English (incl. in corpus)
Studies in History and Philosophy of Science – Part A (SHPSA)	1970—present	1421 articles in English (included in corpus)
Synthese	1936—1939, 1946—1949, 1955—present	4917 articles in English (included in corpus) *74 articles in German (not incl.; 68 before 1960); 95 articles in French (not incl.; 79 between 1946-1960); 170 articles in Dutch (not incl.; before 1939)*

article).[4] Whenever journals were published in several languages, we retained only those articles that were written in English due to algorithmic linguistic constraints.[5]

(2) Preprocessing of textual data. This preprocessing aims at both removing elements that might create noise and optimizing the size of the data retained for analysis. As is considered best practice, we removed stop-words such as determinants, prepositions or pronouns with the assistance of a part-of-speech (POS) tagging algorithm that makes it possible to identify the morphosyntactic category of every word of the corpus. Here

[4] This set of articles only includes regular articles, meaning that we excluded book-reviews, editorials, errata, and very short texts such as discussion notes (less than 4,000 characters). The articles were downloaded from JSTOR and the publishers Internet platforms: Elsevier, Oxford University Press, Springer, Taylor and Francis and University of Chicago Press.

[5] This decision led us to set aside 1015 other articles (72% of which were in German, 17% in Dutch and 11% in French). About 44% of these articles were published in the 1930s–1940s. During these decades, non-English articles represented 41% of publications, but this share substantially decreased over time, down to 2% from the 1990s onward, resulting in an average of about 6% over the 8 decades. Non-English articles might therefore impact our topical analyses about the first two decades (actually, the first and a half decade, as the real cut-off date is WWII), though their impact on the overall study will be minimal.

we used the Penn TreeBank POS tagging algorithm (Marcus et al. 1993) and only kept nouns, verbs, modals, adjectives, adverbs, proper nouns, and foreign words. On the basis of this POS tagging, we also lemmatized the textual data in order to reduce the number of word variants.[6] This was done using the TreeTagger algorithm (Schmid 1994). We furthermore filtered out words that occurred in fewer than 50 sentences in the corpus. These operations resulted in a lexicon of 22,958 distinct words distributed among over 1 million sentences of the 15,897 articles.

(3) LDA topic modeling. To carry out the topic-modeling itself, we used the Latent Dirichlet Allocation (LDA) algorithm, following (Blei et al. 2003) and (Griffiths and Steyvers 2004).[7] As mentioned above, LDA is a generative probabilistic computational method that models topics as probability distributions over words, and documents as probability distributions over topics. Given a hypothesized number K of topics, the algorithm starts with random probability distributions and iteratively adjusts these distributions (constrained by sparse Dirichlet priors) up until a convergence criterion is met. As with any other well-established topic-modeling approach, LDA assumes K is fixed beforehand. In the present case, the corpus included articles from 8 different journals over some 8 decades. This meant that, to present meaningful results both synchronically and diachronically, as well as overall and per journal, a fairly low value of K had to be chosen. After running different models and assessing them, we chose the value $K = 25$ topics.[8] Implementing the LDA algorithm on that basis thereby resulted in 25 topics and their probability distributions in each one of the 15,897 articles of the corpus.[9]

(4) Topic interpretation and clustering. As mentioned above, the topics that result from an LDA topic modeling are probability distributions over the words of the corpus

[6] Lemmatization consists of replacing inflected forms of words by their lemma—or what may be called their "dictionary form"—on the basis of their intended meaning (for instance, replacing "explains" and "explained" by "explain").

[7] The LDA was performed through an API for Python (see: https://pythonhosted.org/lda/api.html).

[8] Depending on the size of the textual data, tools may be used as heuristics to assess optimal K values, for example coherence measures, perplexity or even rate of perplexity change (Röder et al. 2015; Zhao et al. 2015). These heuristics are however limited and, in practice, the proper number K of topics is usually assessed by expert judgment and manual inspection of topics, as well as, most importantly, by the objectives of the study. In the present case, the textual data was too large to run such heuristic tools and we proceeded by expert judgment (comparing the resulting topics of several models at 10, 25, 50, 100, 180, 200, 250, notably in terms of interpretability and non-redundancy), based also on the types of analyses we then hoped to conduct. From experience, opting for one value of K instead of another only marginally affects the overall results. Usually, increasing K results in more details and more specific topics. Yet lower K values are helpful to zoom out of the details and provide larger-grained views. Hyperparameters were set at alpha = 0.4 and beta = 0.01.

[9] More specifically, a word × article matrix $\mathrm{W} = [\mathrm{w}_{ij}]^{M \times N}$ can be built from the textual data (where $M = 22{,}958$ is the size of the corpus lexicon, $N = 15{,}897$ is the number of articles, and w_{ij} is the frequency of word i in article j). LDA modeling estimates optimal values for two major probability matrices: $\Phi = [\Pr(w|z)]^{MxK}$ where $\Pr(w|z)$ is the probability of finding word w in topic z, and $\Theta = [\Pr(z|s)]^{KxN}$ where $\Pr(z|d)$ is the probability of finding (words that express) topic z in document d. Whereas matrix Φ indicates which word distributions best express a given topic, matrix Θ indicates which topics are the most significant in each article. Mathematically, it can be shown that Φ and Θ on the one hand (which are "latent" or initially unknown) and W on the other (which is known) are linked. The probability distributions being constrained by sparse Dirichlet priors, the iterative procedure followed by LDA modeling consists in solving an optimization problem and encodes the intuition that topics are usually strongly expressed by a few words and that documents only express just a few topics at a time.

lexicon. By examining the words that have the highest probabilities, it is usually possible to identify the semantic content that these words are meant to convey in the corpus. This semantic content can be corroborated by examining the articles in which given topics are the most expressed. One may also look at topic-to-topic similarity (as measured by the distance between their respective probability distributions) and topic-to-topic correlation in documents as heuristics to help with the interpretation. Ultimately, interpreting a word-probability distribution results in giving it a meaningful label. Though manual, this stage is in practice highly constrained both by the sets of words that express topics and by the sets of documents in which they appear. In a second step, we ran clustering analyses to group topics into broader clusters, so as to facilitate their discussion. We did this by running a modularity analysis on the network graph of topic-to-topic (positive) correlations—following the approach of (Blondel et al. 2008; Lambiotte et al. 2008) as implemented in (Bastian et al. 2009)—which resulted in the identification of 8 clusters comprising between 2 and 5 topics each (we describe them below in Sect. 3).[10]

(5) Topic analysis by time-period and by journal. The topics were further analyzed in light of two types of metadata: article publication years and journals. In order to provide a view on the temporal evolution of the relative frequency of topics over time, we segmented the corpus into 21 periods of 4 years each, from 1934 up until 2017, and computed, for every topic and time-period, the average probability of finding that topic in all articles of that time-period.[11] In parallel—and with a view to shed light on the specific topical profiles of the journals—we segmented the corpus per journal and computed, for every topic and journal, the average probability of finding that topic in all articles of that journal.[12]

3 A topical perspective on philosophy of science

The topics that resulted from our topic-modeling analyses cover a broad range of themes that naturally make sense in the philosophy of science. Table 2 provides the list of the 25 topics, with their top-10 words. The 25 topics were grouped into 8 clusters

[10] There are multiple ways of clustering topics, especially depending on the expected end-result granularity. Here, we first calculated the Pearson correlation of topics on the basis of their probability distribution within articles (in other words, articles are more correlated when they tend to appear together in the same articles). We used this topic-to-topic correlation to construct a graph in which nodes are topics and edges correlations; we pruned the edges by setting a minimal threshold value, so as to only keep the most significant ones and we ran a modularity analysis (see Fig. 1 below). When running this analysis, modularity parameters can be adjusted so as to result in fewer or more clusters. Here, our clustering was constrained by the objective to have a manageable number of clusters (i.e., less than 10) while at the same time providing useful clusters based on topic interpretation. Using our best judgment, we settled on a model with 8 clusters.

[11] This choice of 4-year periods was driven by the wish to average out year-to-year topic fluctuations (notably due to special issues) while keeping a fairly fine-grained temporal view.

[12] More specifically, for every topic z and time-period p, we computed the average probability $\Pr(z|p)$ of finding topic z in all articles of time-period p. This resulted in populating a new matrix $\Omega = [\Pr(z|p)]^{K\times T}$ where $K = 25$ is the number of topics and $T = 21$ is the number of time-periods. In addition, for every topic z and journal j, we computed the average probability $\Pr(z|j)$ of finding topic z in all articles of journal j. This resulted in matrix $\Delta = [\Pr(z|j)]^{K\times J}$ where $K = 25$ is the number of topics and $J = 8$ is the number of journals.

following the modularity analyses we conducted on the graph of topic correlations in documents (as depicted in Fig. 1). For each topic, the top-10 articles in which the topic has the highest probability were retrieved so as to provide a representative basis; they are listed in Appendix B.

The first cluster–cluster A—relates to philosophy of logic and philosophy of language. It is the largest cluster and includes five topics. Two topics—LANGUAGE and SENTENCE—are characteristic of philosophy of language themes, with such keywords as "language", "sentence" or "meaning", yet also with terms that denote philosophy of logic (such as "logical" or "predicate"). Representative articles include work on Carnap and translational indeterminacy, antinomies and designation, intensional/extensional definitions, as well as essays on demonstratives, indexicals, or reference among others. The topic TRUTH is closely related to research themes that belong to logic and philosophy of logic (with such keywords as "truth", "proposition", "logic"). This topic covers work on logical truth, modal logic, the meaning of logical constants or on vagueness, to name a few. The other two topics—MATHEMATICAL and FORMAL—appear more mathematical in scope (with keywords such as "mathematics", "proof", "axiom" or "set", "function", "theory"). They relate to research topics that concern the foundations of mathematics, arithmetics and geometry, Hilbert's program, as well as set theory, topology, and how measurement relates to mathematical principles.

Cluster B includes three topics that denote research interests in scientific knowledge and, more generally, epistemology. Topic KNOWLEDGE includes such words as "belief", "knowledge", "epistemic" or "justification", and is very much concerned with research in the theory of knowledge, as exemplified by articles on skepticism, infinitism, self-knowledge, doxastic justification, epistemic luck or testimony. Topic SCIENTIFIC-THEORY appears more specifically centered on scientific knowledge and realism (with keywords such as "theory", "scientific", "theoretical", "empirical" or "realism"). Some of its most representative articles include work on Kuhn, Laudan and scientific rationality, as well as on relativism, structural realism, and more generally scientific realism. The third topic—ARGUMENTS—is an ambivalent topic that may very well capture a real research interest on argumentation while at the same time denote a set of very commonly used terms in philosophy of science articles. Keywords indeed include what may look like very usual terms in the field, such as "argument", "claim", "say" or "question" (explaining, in part, the relatively high probability of the topic across the whole corpus, as can be seen by the relative size of the topic nodes on Fig. 1). Yet at the same time, the topic also denotes a specific research interest in argumentation, with representative articles that are about one-sided arguments, knockdown arguments, verbal disputes, counter-examples or non-argumentation.

Cluster C is about confirmation theory and comprises two topics. The first topic, CONFIRMATION, includes terms such as "hypothesis", "evidence", "test" or "inference" and is most strongly found in several articles about Hempel's and Goodman's paradoxes, and, more generally, confirmation, induction, projection or entrenchment. The second topic, PROBABILITY, reflects the use of probability theory in certain philosophy of science articles. With keywords such as "probability", "measure", "chance", or "distribution", the topic is most characteristic of research work on such problems as Dutch book arguments, sleeping beauties, and Bayesianism more generally.

Table 2 List of all 25 topics with top-10 keywords, sorted by cluster (topic labels include cluster letter, topic name and topic ID)

Topic	Top-10 words
A-Formal (23)	set; function; define; relation; definition; theory; structure; order; model; follow
A-Language (17)	language; term; sentence; concept; statement; meaning; logical; predicate; use; theory
A-Mathematical (5)	mathematical; mathematics; number; proof; axiom; theory; object; geometry; theorem; use
A-Sentence (6)	sentence; context; use; speaker; semantic; language; meaning; content; say; reference
A-Truth (7)	truth; true; proposition; logic; sentence; world; rule; false; logical; follow
B-Arguments (20)	argument; claim; say; question; make; case; fact; view; reason; take
B-Knowledge (2)	belief; knowledge; epistemic; believe; know; case; justification; evidence; reason; true
B-Scientific-theory (12)	theory; scientific; science; theoretical; empirical; realism; realist; problem; truth; scientist
C-Confirmation (3)	hypothesis; evidence; datum; test; method; experiment; inference; use; result; prediction
C-Probability (0)	probability; measure; value; give; chance; case; degree; distribution; function; frequency
D-Agent-decision (8)	action; agent; decision; value; act; choice; rational; moral; utility; preference
D-Game-theory (11)	model; game; strategy; use; system; player; equilibrium; result; figure; represent
E-Evolution (22)	selection; population; organism; evolutionary; gene; biological; individual; group; specie; natural
E-Mind (21)	experience; object; state; mental; perception; see; color; perceptual; content; visual
E-Neurosciences (1)	system; information; function; process; mechanism; cognitive; representation; level; structure; use
F-Causation (14)	causal; cause; effect; event; causation; variable; condition; case; relation; causally
F-Explanation (9)	explanation; law; explain; explanatory; account; phenomenon; condition; theory; reduction; case
F-Property (24)	property; object; world; relation; physical; kind; entity; part; identity; thing
G-Particles (15)	theory; energy; experiment; phenomenon; chemical; atom; electron; experimental; particle; use
G-Quantum-mechanics (10)	state; quantum; system; particle; measurement; theory; mechanic; classical; physical; value
G-Relativity (16)	space; theory; time; field; point; physical; relativity; einstein; equation; spacetime
G-Time (4)	time; event; world; future; universe; present; temporal; history; state; occur

Table 2 continued

Topic	Top-10 words
H-Classics (18)	body; motion; newton; force; galileo; god; aristotle; earth; cause; descartes
H-Philosophy (19)	concept; nature; knowledge; science; experience; world; idea; kant; sense; philosophy
H-Social (13)	science; social; scientific; research; work; study; philosophy; scientist; history; new

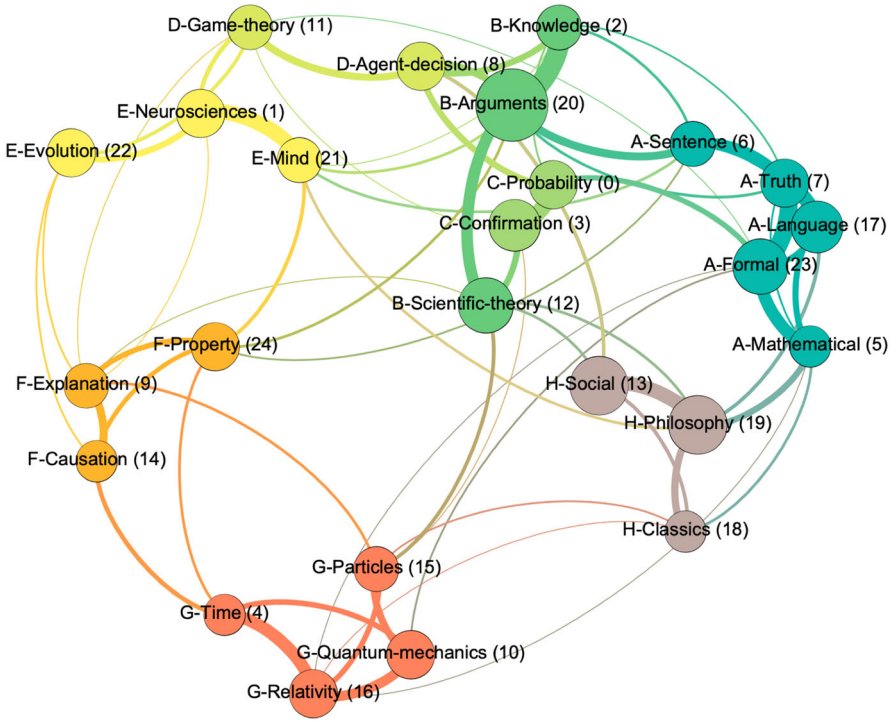

Fig. 1 Graph of the 25 topics grouped into 8 clusters (nodes represent topics that have been colored depending on cluster; node areas are proportional to topic probabilities in the corpus; thickness of edges represent topic correlation within documents; node labels include cluster letter, topic name and topic ID); visualization and community detection tool: Gephi (Bastian et al. 2009), with Multigravity ForceAtlas 2 for layout rendering)

A nearby two-topic cluster concerns rational choice theory and related questions (cluster D). It includes topic AGENT-DECISION (with keywords "action", "agent", "decision", "choice", "rational", "moral", "utility" among others) which is highly probable in articles that concern the prisoner's dilemma, cooperation, coordination, free-riding, exploitation and related issues. The other topic—GAME-THEORY—is closely related, with such terms as "model", "game", "strategy", "player" or "equilibrium", and notably denotes research on social interaction and communication in learning and knowledge formation.

Cluster E is more biological in nature and concerns work on evolutionary theory, mental states and the neurosciences. It includes three topics labeled EVOLUTION, MIND and NEUROSCIENCES. Topic EVOLUTION is denoted by such terms as "selection", "population", "organism", "evolutionary" or "gene", and is found with high probability in articles that concern the problem of the units of evolution, the question of biological individuality, heredity, fitness or the notion of species and gene, among others. This topic is clearly about philosophy of biology. The other two topics of the cluster are more similar and concern mind, cognition, psychology and the neurosciences in general. With keywords such as "experience", "object", "state", "mental", "perception" and "color", topic MIND is characteristic of articles on representationalism, internalism, conceptual and nonconceptual content and, more generally, on mental states. On the other hand, topic NEUROSCIENCES tends to characterize research on the cognitive architecture, on functional modularity, neural mechanisms, neurobiological activities, and the like that often mobilize such terms as "system", "information", "function", "process", "mechanism" or "cognitive".

More general philosophy of science topics are found in cluster F, with CAUSATION, EXPLANATION and PROPERTY. Topic CAUSATION is straightforwardly about causation, with such keywords as "causal", "cause", "effect", "event" or "causation", and is found in articles that investigate different aspects of causation, including probabilistic, counterfactual, interventionist accounts of causation, as well as questions about causal asymmetry, causal relata or contrastive causation. Likewise, EXPLANATION is also a topic with a straightforward interpretation. Its top terms include "explanation", "law", "explain", "account", "phenomenon" and the topic is found in articles that examine the concept of scientific explanation in relationship, for instance, to the concepts of law of nature, deduction, mechanism, theoretical unification, or causal regularities. The third topic of cluster F is PROPERTY. With top-terms that include "property", "object", "relation", "physical", or "kind", the topic concerns research that dwells on ontology, physicalism and related questions such as supervenience and emergence.

Philosophy of physics topics are found in cluster G. That cluster includes topic PARTICLES which is characterized by such keywords as "theory", "energy", "experiment", "chemical", "atom", or "electron". Some of the key articles in which the topic is found concern research on certain particles such as positrons, neutrinos, electrons, and by ways of consequence on related phenomena—electrostatics, electromagnetism—as well as on energy and chemistry. With top-terms such as "state", "quantum", "system", "particle" or "measurement", the topic QUANTUM-MECHANICS picks out a class of research interests that clearly focus on quantum mechanics and related issues, with characteristic articles on the interpretation of quantum mechanics, on the questions of quantum decoherence, locality, the EPR paradox and quantum measurement. Topic RELATIVITY—with keywords such as "space", "time", "field", "relativity" or "Einstein"—is found in articles that investigate different aspects of special and general relativity theories, including questions about isotropy, synchronization, and also space–time. That topic is complemented by the very nearby topic TIME (see Fig. 1), with top-terms such as "time", "event", "future", "present" or "temporal". TIME appears to relate both to the physics of time—hence its proximity to RELATIVITY—and to the metaphysics of time, with articles on McTaggart's temporal series or on time travel.

The last cluster–cluster H—gathers three topics that have a more social or historical nature. With keywords that include "body", "motion", "force" but also "newton", "galileo", "aristotle", "descartes" and "god", topic CLASSICS concern a broad range of work in the history of science, for instance on Galileo's observations, on Descartes' physics or on Newtonian mechanics. Topic PHILOSOPHY appears to characterize work that borders the domain of traditional philosophy or history of philosophy. The topic includes quite general terms such as "concept", "nature", "knowledge", "science" as well as "world", "idea" or "kant", and is found in a broad variety of articles that range from Kant to Hegel and Whitehead. Finally, topic SOCIAL has a more science-studies connotation, as is apparent from some of its top-words: "science", "social", "research", "work" or "study". Related articles include research on the social organization of science, on scientific disciplines or on science museums, among many others.

4 Diachronic perspective (1934–2017)

Diachronic topical evolution can be studied by examining the probability of finding specific topics in articles that were published within specific temporal windows. Here, we segmented the corpus into 21 consecutive time-periods of 4 years each, from 1934 till 2017 (84 years in total) and quantified the relative probability in finding each one of the 25 topics in a given time-period (see Fig. 2). Since topics reveal words that tend to be used in similar patterns by philosophers of science in their essays throughout the corpus, topics also mirror the research interests of these same philosophers of science and the relative significance of these research interests within each time-period. At the topic-cluster level, maybe one of the most striking results of the analyses is the strong probability decrease of cluster H (that includes topics of a more social and historical nature) over time as well as of cluster A (philosophy of language and logic), while clusters that relate to knowledge and epistemology (cluster B), to the philosophy of biology and of the neurosciences (cluster E) and to explanation/causation (cluster F) tended to increase in probability in the corpus over time.

Within cluster A, it is mostly the topic LANGUAGE that decreased in probability: while it was one of the most significant topics overall up until the 1960s, it continuously decreased from the 1970s onward. This trend is very much in line with what is well-known about the history of philosophy of science and the significance of logical empiricism in its early stages. Epistemology-related topics—cluster B—have generally increased in probability over time. In particular, topic SCIENTIFIC-THEORY—which is about scientific knowledge and realism—has tended to increase from the 1970s, with a stabilization in the 2000s. Topic KNOWLEDGE itself—in the sense of theory of knowledge or epistemology—has seen a recent increase since the 2000s. As for the topic ARGUMENTS—which is a fairly dominant topic that can relate both to specialized research on argumentation and to the generic usage of "philosophical jargon"—one notes its increase since the mid-1950s and a leveling off from the 1980s onward.

Within cluster C—which is about confirmation theory broadly construed—, topic CONFIRMATION had its heydays in the 1960s, whereas PROBABILITY has seen a more significant increase since the 2000s. This also shows in the publication dates of the topic most-closely related articles: whereas 6 of the top-10 articles for CONFIRMATION

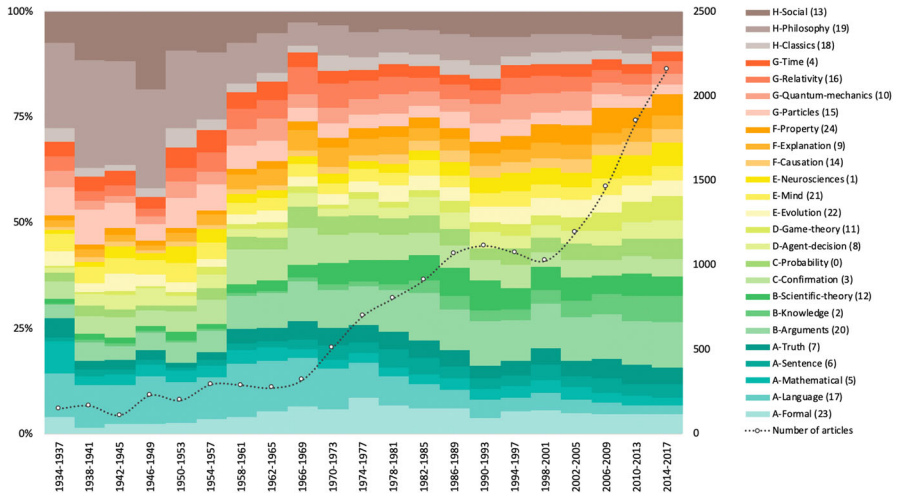

Fig. 2 Overall diachronic evolution of topic probability between 1934 and 2017 (colored bars, left-side *y* axis; legends include cluster letter, topic name and topic ID) and corresponding number of articles (dotted line, right-side *y* axis)

were published before the 1970s, the trend is reversed for PROBABILITY which has 7 of the its top-10 articles published in the 2000s. It is as if research on these themes started in the 1950s–1960s by being framed in terms of confirmation problems or even paradoxes, and then turned to probability theory as a means of addressing such questions.

The evolution of the topics of cluster D—which concerns rational choice theory and related questions—is contrasted, though the cluster as a whole has been on the rise ever since the 1930s: whereas topic AGENT-DECISION appears to signal a philosophical interest that has been more or less constant over time, topic GAME-THEORY denotes a more recent field of investigation that really gained in popularity in the 2000s (all top-10 articles of that topic are posterior to 2000).

The overall probability of cluster E—about the philosophy of biology and the neurosciences—has been slightly increasing from the 1930s up to now, but with fluctuations between topics. For instance, EVOLUTION was somehow present in the 1940s, then decreased in the 1950s–1970s, and started again to increase in the 1980s up untill today. This is consistent with (Byron 2007; Malaterre et al. 2019; Malaterre et al. 2020), who showed that philosophy of science was much concerned with biology-related questions quite early on, in the first half of the twentieth century, and then again starting from the 1980s onward with the establishment of a dedicated field of research. Topic MIND also appears to have followed a similar patter, though its increase in the more recent decades is not as significant, especially compared to topic NEUROSCIENCES that has strongly gained in momentum, especially since the 2000s, denoting a strong interest in the neurobiological mechanisms of mind and different mental phenomena.

Cluster F—which includes explanation/causation topics—also appears to have increased in probability over the eight decades of the study. EXPLANATION had its heydays in the 1950s–1980s, and started picking up again in the 2000s. This is con-

sistent with what is known of the field, for instance through Salmon's *Four decades of scientific explanation* (Salmon 1989) and more recent work on mechanistic approaches to explanation and on reduction (as denoted by some of the top-10 articles of this topic). Interest in CAUSATION developed in the 1980s—typically on counterfactual accounts and issues about causal asymmetry, possibly in the wake of problems encountered by non-causal models of explanation at that time—and continued to spark interest throughout the 2000s, especially on questions about probabilistic and interventionist accounts. While being somehow present in the corpus from the 1960s to the 1980s, topic PROPERTY really increased in probability throughout the 1990s and 2000s: 9 of its top-10 articles were published in the 2000s, in particular on issues about physicalism and supervenience.

Philosophy of physics topics—as defined by cluster G—have been quite prominent in the philosophy of science, yet with an overall slightly declining trend. Topic PARTICLES denotes an interest in sub-atomic particles, chemistry, electromagnetism—among others—that was quite present in the 1950s–1960s and that dwindled thereafter (6 of the top-10 articles of that topic are from the 1960s and earlier). Philosophy of physics appears to have then focused more on relativity theory and quantum mechanics, as shown by the probability of topics RELATIVITY and QUANTUM-THEORY. Interest in relativity theory was notably strong in the 1960s–1970s, with quantum mechanics picking-up more strongly in the 1990s (5 of its top-10 articles are from that period). TIME, which is a topic highly correlated with RELATIVITY (as shown in Fig. 1), appears to have been quite probable in the corpus early on in the 1950s, then decreased in probability from the 1970s onward and leveled out.

Cluster H—which is more social or historical in content compared to other topic clusters—appears to have been very significant in the first half of the twentieth century, and then decreased quite drastically. This trend is dominated by topic PHILOSOPHY—which we interpreted as denoting interest in traditional philosophy or history of philosophy—and, to a lesser extent, by topic SOCIAL, though the latter has seen a renewed interest more recently, especially from the 1990s onward (6 of its top-10 articles were published in the 2000s or after). By contrast, topic CLASSICS—which notably concerns history of science figures or topics, among other more diverse themes—has remained relatively constant in probability all throughout the period.

5 The journals and their profiles

When analyzing the diachronic evolution of topics, one should bear in mind that the volume of publications—in the corpus—increased by a factor of 12 (from about 40 articles per year in the 1930s to about 500 in the 2010s).[13] This increase in publication volume resulted both from an increase in the number of philosophy of science journals

[13] Remember that the corpus only includes research articles in English language from the 8 major philosophy of science journals we focused on. When considering articles published in German, Dutch and French by these same 8 journals, the yearly publication volume increases by a factor of 6 from the 1930s till the 2010s, which is still significant. Figure 4 includes a specific data line for articles in languages other than English.

and an increase in the yearly number of articles published by each journal (see Fig. 3). *Erkenntnis*, *Philosophy of Science (PS)* and *Synthese* were founded in the 1930s, followed by the *British Journal for the Philosophy of Science (BJPS)* in the 1950s, then the *Journal for General Philosophy of Science (JGPS)* and *Studies in History and Philosophy of Science Part A (SHPSA)* in the 1970s. In the 1980s, *International Studies in the Philosophy of Science (ISPS)* was created, and the 2010s saw the launch of the *European Journal for Philosophy of Science (EJPS)*. Though *Synthese* now publishes two- to three-times more articles than either *Erkenntnis* or *PS* (likely due to the topical issues it also publishes), the three first-founded journals still accounted for about 2/3 of all articles in the 2010s. Historically, publications started mostly in German and Dutch, followed by English, in the 1930s. The advent of WWII led to a temporary decrease in publication volumes in the 1940s, followed by a relative stagnation throughout the 1950s. Publications then tripled from the 1960s to the 1980s, at the same time as the discipline of the philosophy of science underwent a strong professionalization (Howard 2003). This upward trend in publication volumes was however interrupted in the late 1980s and 1990s, before picking up again in the 2000s, while the volume of articles published in languages other than English dwindled down to zero. One possible explanation of this slight slump in the 1990s is the creation of specialized journals in several sub-disciplines of the philosophy of science, for instance in philosophy of physics (*SHPS-Part B* was launched in 1995), in philosophy of biology (*Biology and Philosophy* started in 1986, *SHPS-Part C* in 1998) or in other domains (e.g. *History and Philosophy of Logic* launched in 1980, *Economics and Philosophy* in 1985, *Philosophy and Technology* in 1988).[14]

The topical profile we computed for each journal is shown in Fig. 4, while Fig. 5 depicts the diachronic evolution of these profiles. One should bear in mind that not all journals have the same publication span (see Table 1 above and Appendix A): some started in the 1930s such as *Erkenntnis*, others more recently, some even in the past decade such as the *EJPS*. Reassuringly from a methodological perspective, the composition and general evolution of topics for *PS* is fully consistent with what has been obtained independently in another study that focused on the sole corpus of *PS* (Malaterre et al. 2019).

One of the most striking results is that both *Erkenntnis* and *Synthese* have always had a relatively stronger content in topics related to philosophy of logic and philosophy of language—cluster A—compared to the other journals, with an overall probability of about 28% (Fig. 4). Even if the trend has been decreasing over the last decades—after a peak in the 1950s–1970s at about 40% for *Synthese* (see Fig. 5)—both journals continue today to publish articles that concern these topics at a level of about 20%. This could be explained by the logical empiricist mindset of the founding philosophers behind *Erkenntnis*—Carnap and Reichenbach in the 1930s, Hempel for the relaunching of the journal in the 1970s—and possibly, the logic-oriented specialty of Hintikka who served as editor of *Synthese* from 1965 till 2002. The overall trend across all jour-

[14] Note that some specialized journals were also founded earlier (e.g., *Philosophy of the Social Sciences* in 1971, *History and Philosophy of the Life Sciences* in 1979) or later (e.g., *Biological Theory* in 2005, *Philosophy and Theory in Biology*—now *Philosophy, Theory, and Practice in Biology*—in 2009), showing the need for a more thorough investigation of the reasons for the publication volume decrease we observed in the corpus in the 1990s.

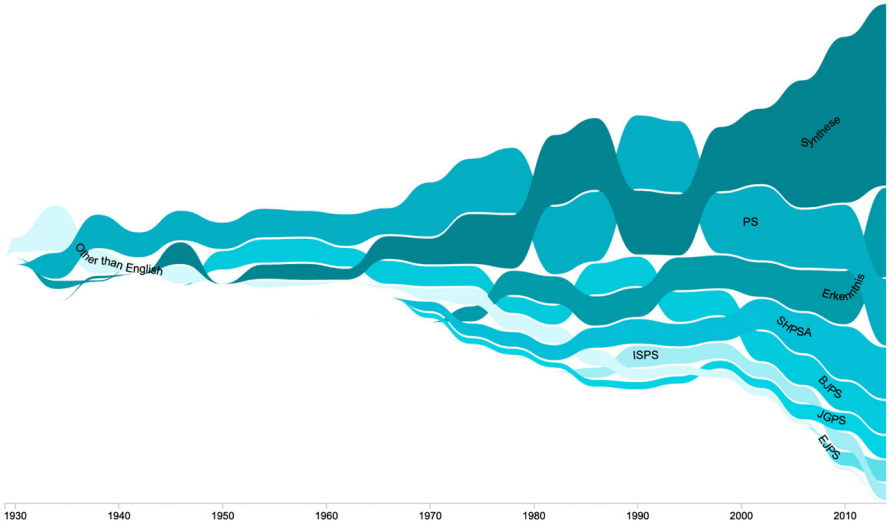

Fig. 3 Number of articles published in *Synthese*, *Philosophy of Science (PS), Erkenntnis, The British Journal for the Philosophy of science (BJPS), Studies in History and Philosophy of Science Part A (SHPSA), International Studies in Philosophy of Science (ISPS), Journal for General Philosophy of Science (JGPS), and the European Journal for Philosophy of Science (EJPS)* in English language, with a specific 'stream' for articles published in languages other than English (total number of articles: 15,897; articles are sorted into 4-year periods; the width of each 'stream' is proportional to the number of articles; for guidance, the width of *SHPSA* in the 2010s is approximately 80 articles per year; the 'streams' are sorted by decreasing size from top to bottom at each time-slice, thereby showing the leading journals in terms of publication volume on top; visualization tool: RAWGraphs (Mauri et al. 2017))

nals has however been a decreasing one over the past decades, even very markedly so in the case of *PS*.

On the other hand, both *Erkenntnis* and *Synthese* display some of the smallest proportions of topics related to historical and social questions (cluster H), especially compared to such journals as *ISPS*, *JGPS* and especially *SHPSA* (for which these topics represent over 30% of the content). These results make sense given the broader positioning of these three journals: in addition to general philosophy of science, *ISPS* highlights an interest also for "philosophically informed history and sociology of science", *JGPS* for "the social, historical and ethical dimensions of the sciences as the context for understanding current problems of philosophy of science" and *SHPSA* for "topical areas of historiography of the sciences, the sciences in relation to gender, culture and society and the sciences in relation to arts" ("*International Studies in the Philosophy of Science*: Aims & Scope | Taylor and Francis" 2020; "*Journal for General Philosophy of Science*: Aims and Scope | Springer" 2020; "*Studies in History and Philosophy of Science Part A* | Elsevier" 2020). Interestingly, the journals that have the lowest probabilities for these historical and social topics in the last decade (approx. 5%)—*Erkenntniss, Synthese, PS* and *BJPS*—displayed much higher probabilities for these same topics in the first half of the twentieth century (in the range of 25–35%). This marked trend was known in the case of *PS* (Malaterre et al. 2019), and has been explained, more generally, by such factors as changes in editorship, the professional-

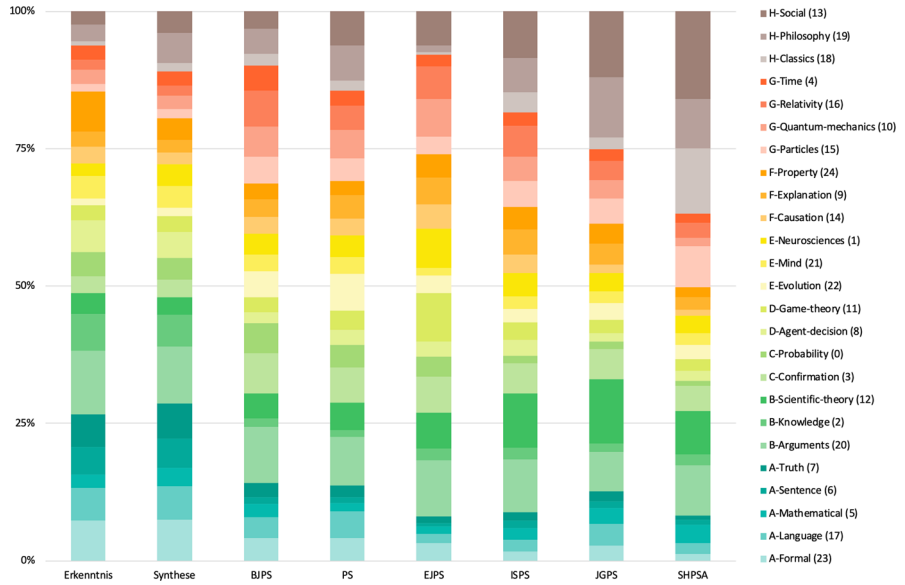

Fig. 4 Topic probability for each journal (calculated by averaging the topic probabilities of journal articles; legends include cluster letter, topic name and topic ID)

ization of the discipline or even decisions made by funding agencies (Howard 2003; Douglas 2010; Vaesen and Katzav 2019). Note however that the present data show that journals such as *ISPS, JGPS* and *SHPSA* all have retained a significant proportion of these topics (between 19 and 31% in the last years). These findings thereby suggest that factors such as disciplinary professionalization or funding agencies policies—which should have affected research themes across the entire discipline, hence across all journals—did not play as significant a role as probably did editorial policies broadly speaking, including journal strategic positioning within the 'academic market' (as revealed by the participation of certain journals to specific academic conferences or by the journal presentation pages on publishers' websites; see Appendix A), journal publication format (possibility of special issues, conference proceedings), topical choices made by editorial teams (determining, for instance through desk reject, which papers fall in and out of a given journal scope) or even reviewer choices by editorial teams (who may reproduce associative patterns).[15]

Scientific knowledge and epistemology—as depicted by topics of cluster B—appear as the second most probable group of topics for both *Erkenntnis* and *Synthese* (with probabilities between 19 and 22%), after topics of cluster A in philosophy of language and logic. This is in line with the reputation of these journals as preferred venues for epistemology articles. Note however that these epistemic topics also have about the

[15] Numerous other factors may influence choice of publication venues by authors, including journal impact factor, perceived reputation, personal acquaintances with editorial team members, publication frequency, publication cost and open access strategies, publication design and layout, perceived journal audience, submission-to-publication lead-time, distribution network or even availability of data repositories. However, the extent to which such additional factors may influence topic distribution across journals is less immediate.

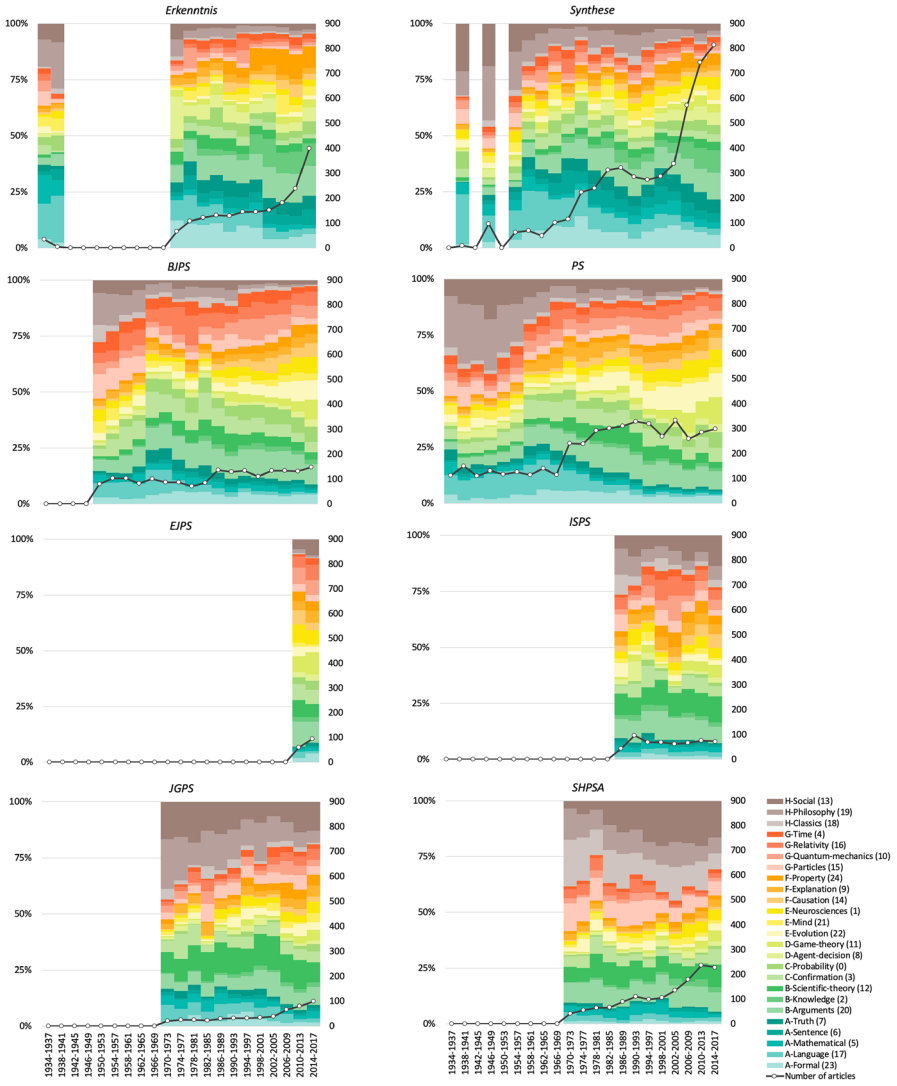

Fig. 5 Evolution of topic probability for each journal (colored bars, left-side *y* axis) and publication volume (dark curve representing number of published articles, right-side *y* axis) per time-period (*x* axis)

same high probabilities in *ISPS, JGPS, SHPSA* and in the recently launched *EJPS* (about 20%). Note also that the topics have tended to decrease in probability for *PS* and *BJPS* in the last 20 years, while increasing within *Erkenntnis* and *Synthese*.

Topics about probability and confirmation—cluster C—tend to be more present in the profiles of *BJPS, PS* and *EJPS* than in the other journals, with a probability of about 10%. The diachronic evolution shows a probability increase in the 1960s–1970s, even up to 15% for *BJPS*, followed by a slight decrease and relative stagnation thereafter.

Overall, topics of cluster D, which broadly speaking concern rational choice, appear to be comparatively more probable in *EJPS* than elsewhere (about 10%), followed by *Erkenntnis* and *Synthese* (as depicted in Fig. 4). The diachronic profiles (Fig. 5) show that these topic probabilities also tended to increase in other journals, notably in *PS*, in the recent years.

The cluster of topics that concern mind, the neurosciences and biology—cluster E—has a more marked presence in *PS*, *EJPS* and *BJPS* (at about 13%) than in the other journals. This is notably true for the biology-related topic for which the probability has been especially increasing since the 1990s. Yet, it is interesting to note that the topics of this cluster were also quite strongly present in the first half of the twentieth century, in *PS*, *Synthese* and *Erkenntnis*, and even in *BJPS* in the 1950s, which is consistent with other studies (Byron 2007; Nicholson and Gawne 2015; Malaterre et al. 2019). Note also that the creation of *SHPS-Part C* in 1998 could explain the relative drop in probability of this cluster of topics within *SHPS-Part A* in the late 1990s, from about 9% down to 5%, though that probability slowly rose back again to about 9% in the last decade.

EJPS, ISPS and *Erkenntnis* are the journals in which topics that concern causation, explanation and ontology—tend to be the most probable, at a level of about 12–14% (cluster F). These topics are also found in the other 5 journals, though, comparatively, at a slightly lesser level.

Journal profiles with respect to physics-related topics—cluster G—are more marked, with journals such as *BJPS* exhibiting a probability of over 20% in these topics, followed by *EJPS*, *ISPS* and *PS* at about 17%. By comparison, the probability of these physics topics is much less dominant within *Erkenntnis* or *Synthese*, at about 8% overall, even showing a slightly decreasing trend over the last decades. This trend is even more significant for *SHPSA*, with a marked step in the late 1990s when *SHPS* was split into *SHSP-Part A* (general philosophy and history of science) and *SHPS-Part B* (philosophy of modern physics).

6 Conclusion

Over the eight decades that span from its infancy as a discipline to its present day, the philosophy of science has incurred significant changes in its research agenda. The text-mining analyses we conducted on the full-text content of eight major general philosophy of science journals reveal the large-scale topical developments of the field as reflected by the publications in these journals. Broad trends are clearly visible, notably the decrease of philosophical work of a more social and cultural nature in the 1950s, then compensated by the rise of research themes that concerned philosophy of logic and language, these themes then decreasing in the 1970s–1980s, followed by topics about confirmation in the 1980s and philosophy of physics in the 1990s–2000s, though to a lesser extent. Meanwhile, other research themes have flourished in the last four decades, notably in domains that concern scientific knowledge and epistemology, rational choice, philosophy of mind and of biology, as well as topics that concern causation, explanation and ontology: accounting for about only 25% of topic probability in the 1930s, these research themes increased to a level of about 65% lately.

The analyses also show similarities and differences between journals, both in terms of their overall content and of their diachronic evolution. Of course, the number of publications has literally exploded in 80 years, increasing more than ten-fold, novel journals being also founded at several points in time. It is also likely that journals have become an increasingly significant avenue for communicating research to peers, especially compared to books in particular, due to rising concerns about publication speed. Journal history—and the history of their semantic content—has thus become an integral part of the history of the discipline, and much still remains to be investigated.

Of course, the results should always be interpreted in light of a proper understanding of what text-mining methods can and cannot do. As explained earlier (see Sect. 2), LDA topic-models are probability distributions calculated on the basis of how words are distributed within documents in the corpus: topics are probability distributions over words while documents are modeled as probability distributions over topics. The topical content of a document can thereby be understood as resulting from drawing topics according to the probabilities assigned by the topic-model. Yet topic-models remain silent over the reasons why specific topics are likely to be found together. They also cannot reveal the argumentative relationships that topics may entertain in specific articles, nor can they give explanations about why specific topics did change over time—for instance, due to their contextual relevance in light of scientific advances, the maturity of certain lines of inquiry, or simply editorial policies or other pragmatic factors. One should also bear in mind that text-mining results depend, to a certain extent, on choices among many equally valid modeling options, often balanced by expert-judgement. This is for instance the case with the chosen number of topics K as mentioned above, or with the delicate task of topic interpretation. Yet, topic modeling algorithms in general and LDA in particular are well-established approaches to textual analysis that have been tested in many occasions. LDA topic-modeling has notably been shown to be a very reliable algorithmic tool for identifying topics in large textual corpora (e.g., Griffiths and Steyvers 2004; Blei and Lafferty 2009; DiMaggio et al. 2013).

Indeed, one of the most significant characteristics of computational text-mining methodologies is the possibility to deploy them to analyze very large corpora of full-text documents that would otherwise have been out of reach if done by hand. Another is that, thanks to their being quantitative and unsupervised, they provide perspectives that are complementary to classical historical or exegetic methods. They also provide the type of data that contributes an empirical basis for what might otherwise be informal claims—in the present case, claims about the evolution of a field broadly speaking or of some of its specific research themes. In a sense, these methods provide novel ways of answering old questions. But they also open up novel ways of asking novel questions: they have a heuristic value in that they provide insights about trends and patterns to be further investigated, notably with the more classical historical and analytical approaches of the philosophical methodology. Topic-models reveal topical patterns in corpora—such as temporal variations in topic prevalence or specific journal profiles—that can in turn be questioned and formulated as *explananda* worth enquiring about. As we hope to have shown, text-mining approaches are powerful tools to investigate the broader history of the philosophy of science, how this field has

developed and flourished over the course of the past eight decades and how its journals have contributed to this history. No doubt much remains to be uncovered.

Acknowledgements The authors are grateful to JSTOR, Elsevier, Oxford University Press, Springer, Taylor and Francis, and University of Chicago Press for providing access to journal articles for text-mining purposes. They thank Oliver Lean, Charles Pence and Luca Rivelli for comments on an earlier version of the manuscript, as well as the audience of a 2019 TEC seminar at UQAM where this work was presented. They also thank the reviewers at *Synthese* for their valuable comments. Funding from Canada Foundation for Innovation (Grant 34555) and Canada Research Chairs (CRC-950-230795) is gratefully acknowledged. F.L. acknowledges funding from the Fonds de recherche du Québec - Société et culture (FRQSC-276470).

Authors' contribution C.M. conceived the study, analyzed the results, wrote and revised the manuscript. F.L. prepared the corpus, ran the LDA analyses, contributed to the methodology section and revised the manuscript. D.P. and J.S–O. contributed to the corpus preparation and revised the manuscript.

Appendix A: Table of the publication profiles of the 8 selected general philosophy of science journals

Journal	Publication dates	Affiliation/editorship/publisher	Profile (as described on journal websites, in editorials or other sources)
British Journal for the Philosophy of Science (BJPS)	1950—present	Owned by the British Society for the Philosophy of Science (BSPS, founded in 1948 as a Philosophy of Science Group for the British Society for the History of Science, and reconstituted with its present name in 1959). Past editors include J. O. Wisdom, A. Bird, P. Clark, M. Hesse, J. Ladyman, I. Lakatos, and D. Papineau. ("*British Journal for the Philosophy of Science* | Wikipedia" 2020) Current editors: S. French, W. Parker Current publisher: Oxford University Press	The journal "publishes work that uses philosophical methods in addressing issues raised in the natural and human sciences" ("*British Journal for the Philosophy of Science* | Wikipedia" 2020) *BJPS* publishes "international work in the philosophy of science" on a "variety of traditional and 'cutting edge' topics, from issues of explanation and realism to the applicability of mathematics, from the metaphysics of science to the nature of models and simulations, as well as foundational issues in the physical, life, and social sciences. Recent topics covered in the journal include the epistemology of measurement, mathematical non-causal explanations, signalling games, the nature of biochemical kinds, and approaches to human cognitive development, among many others." ("*British Journal for the Philosophy of Science*: About | OUP" 2020)
Erkenntnis	1930—1940; 1975—present	Originally created by R. Carnap and H. Reichenbach when they took charge of *Annales der Philosophie* that they renamed *Erkenntnis*; interrupted by WWII; revived in 1975 by C. G. Hempel, W. Stegmüller, and W. K. Essler ("*Erkenntnis* | Wikipedia" 2019) Current editors: H. Leitgeb, H. Rott, and W. Spohn Published by Felix Meiner (Germany) from 1930 to 1936, then van Stockum (The Netherlands). Current publisher: Springer	"An International Journal of Scientific Philosophy", *Erkenntnis* publishes "papers committed in one way or another to the philosophical attitude which is signified by the label 'scientific philosophy'", in fields inspired by this attitude: "Epistemology, philosophy of science […], philosophy of mathematics, logic […], philosophy of language, ontology, metaphysics […], philosophical psychology, philosophy of mind, neurophilosophy, practical philosophy, i.e. ethics, philosophy of action, philosophy of law." ("*Erkenntnis*: Aims and Scope | Springer" 2020) The journal also was linked to the organisation of conferences (e.g. "Second Conference on the Epistemology of the Exact Sciences", of which it published papers and discussions) ("*Erkenntnis* | Wikipedia" 2019) "As Reichenbach noted in his introduction to the first issue, the editors of *Erkenntnis* were concerned to carry on philosophical inquiry in close consideration of the procedures and results of the various scientific disciplines (Hempel 1975, p. 1). For Hempel, philosophy of science in the 1970s was influenced by thinkers who were themselves "committed to careful analytic investigation and to precise reasoning in support of their ideas, and who hold that sound philosophical inquiry must be informed by adequate knowledge of the scientific disciplines that may be relevant to the subject under investigation" (1975, p. 3). He further argued that the "proper characterization and understanding of the nature and change of scientific knowledge requires explicit reference to certain historical and sociological aspects of the scientific enterprise" (1975, p. 4)

Journal	Publication dates	Affiliation/editorship/publisher	Profile (as described on journal websites, in editorials or other sources)
European Journal for Philosophy of Science	2011—present	Founded in 2011 by the European Philosophy of Science Association (EPSA) Current editors: F. Russo and P. Illari Publisher: Springer	Publishes "works that can deepen understanding of the concepts and methods of the sciences, as they explore increasingly many facets of the world we live in. It is of direct interest to philosophers of science coming from different perspectives, as well as scientists, citizens and policymakers. The journal is interested in articles from all traditions and all backgrounds, as long as they engage with the sciences in a constructive, and critical, way. The journal represents the various longstanding European philosophical traditions engaging with the sciences, but welcomes articles from every part of the world." ("*European Journal for Philosophy of Science* | Springer" 2020) Publishes selected papers from the biennial conferences of the EPSA. ("*European Journal for Philosophy of Science* | EPSA" 2020)
International Studies in the Philosophy of Science	1986—present	Founded in 1986 Current editor: V. Kindi Published by Routledge, then Taylor and Francis (which acquired Routledge in 1998)	Publishes work "in philosophy of science and in philosophically informed history and sociology of science. Its scope includes the foundations and methodology of the natural, social, and human sciences, philosophical implications of particular scientific theories, and broader philosophical reflection on science". Invites contributions "not only from philosophers, historians, and sociologists of science, but also from researchers in the sciences. The journal publishes articles from a wide variety of countries and philosophical traditions" ("*International Studies in the Philosophy of Science*: Aims & Scope | Taylor and Francis" 2020) Initially founded to publish articles from the seminars held at the Inter-University Centre for Postgraduate Studies in Dubrovnik (former Yugoslavia, now Croatia) following an initiative of I. Supek to promote academic dialogue between philosophers of science from western and eastern Europe (Newton-Smith and Wilkes 1986). Started accepting other research articles in 1990.

Journal	Publication dates	Affiliation/editorship/publisher	Profile (as described on journal websites, in editorials or other sources)
Journal for General Philosophy of Science	1970—present	Founded by A. Diemer, G. König and L. Geldsetzer. Past editors include also: G. Schiemann, U. Krohs. Current editors: C. Beisbart, T. Reydon, H. Pulte Published by Steiner (1970–1990), Kluwer (1990–2005), and now Springer (which acquired Kluwer in 2005)	"Its subject matter encompasses both general philosophy of science and the specialized philosophies of particular areas of science, such as the philosophy of physics, the philosophy of biology, the philosophy of the social sciences, and the philosophies of the humanities. Published articles cover the methodological, ontological, and epistemological aspects of these areas of science and science in general. *JGPS* considers also the social, historical and ethical dimensions of the sciences as the context for understanding current problems of philosophy of science." ("*Journal for General Philosophy of Science*: Aims and Scope | Springer" 2020) Initially published under the title *Zeitschrift für allgemeine Wissenschaftstheorie—Journal for General Philosophy of Science*; became *Journal for General Philosophy of Science—Zeitschrift für allgemeine Wissenschaftstheorie* in 1990: "From the very beginning, the English subtitle (which is now the main title) indicated that the journal was meant to be international; in fact, manuscripts written in German, English and French were considered for publication. The journal was further intended to provide a forum for various intellectual traditions and sub-disciplines of the philosophy of science. It was of special importance to the founding editors to represent both the more analytical tradition of the philosophy of the natural sciences and the more hermeneutical tradition of the philosophy of the humanities" (Beisbart et al. 2019, p. 1). "We take the term "general" in the name of the journal to reflect […] the commitment to be open to all approaches in the philosophy that strive for a better philosophical understanding of the various disciplines of the sciences and the humanities, their practices and their findings. In particular, we wish to be open to voices that diverge from "mainstream" and that introduce new perspectives" (2019, p. 7)
Philosophy of Science	1934—present	Owned by the (American) Philosophy of Science Association (PSA) Past editors include: C. W. Churchman, R. Rudner, K. Schaffner (Howard 2003) Current editor: A. Woody Current publisher: University of Chicago Press	The journal "has been dedicated to the furthering of studies and free discussion from diverse standpoints in the philosophy of science." ("*Philosophy of Science*: About | UCP" 2019) Its first editor, William Malisoff sought papers ranging from studies on "the analysis of meaning, definition, symbolism," in scientific theories to those on "the nature and formulation of theoretical principles" and "in the function and significance of science within various contexts." (Malisoff 1934, pp. 3–4). Publishes proceedings of the bi-annual PSA meetings (*PSA: Proceedings* ran in parallel to *PS* from 1970 to 1994, then jointly) ("*Philosophy of Science*: About | UCP" 2019)

Journal	Publication dates	Affiliation/editorship/publisher	Profile (as described on journal websites, in editorials or other sources)
Studies in History and Philosophy of Science – Part A	1970—present	Established in 1970 under the name SHPS. Split into Part A and Part B in 1995. Part C created in 1998 Current editor: D. P. Rowbottom Published by Elsevier	*SHPSA* "is devoted to the integrated study of the history, philosophy and sociology of the sciences. The editors encourage contributions both in the long-established areas of the history of the sciences and the philosophy of the sciences and in the topical areas of historiography of the sciences, the sciences in relation to gender, culture and society and the sciences in relation to arts." ("*Studies in History and Philosophy of Science Part A* | Elsevier" 2020) *SHPS* was "established in 1970 as a single journal, and was split into two sections–*Studies in History and Philosophy of Science Part A* and *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics*–in 1995. In 1998, a third section, *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences*, was created." ("*Studies in History and Philosophy of Science* | Wikipedia" 2020)
Synthese	1936—1939, 1946—1949, 1955—present	Founded in 1936 in The Netherlands Past editors include J. Hintikka from 1965 to 2002 Current editors: O. Bueno, C. D. Novaes, W. van der Hoek, K. Miller Current publisher: Springer	"An international journal for epistemology, methodology and philosophy of science", *Synthese* focuses on "contemporary issues in epistemology, philosophy of science, and related fields. More specifically, we divide our areas of interest into four groups: (1) epistemology, methodology, and philosophy of science, all broadly understood. (2) The foundations of logic and mathematics, where 'logic', 'mathematics', and 'foundations' are all broadly understood. (3) Formal methods in philosophy, including methods connecting philosophy to other academic fields. (4) Issues in ethics and the history and sociology of logic, mathematics, and science that contribute to the contemporary studies *Synthese* focuses on, as described in (1)–(3) above." ("*Synthese* | Springer" 2019) Published articles include specific treatment of methodological issues in science such as induction, probability, causation, statistics, symbolic logic, linguistics and ethics. The name *Synthese* (from the Dutch for synthesis) finds its origin in the intentions of its founding editors: making explicit the supposed internal coherence between the different, highly specialised scientific disciplines." ("*Synthese* | Wikipedia" 2020) Hintikka complained about the "argumentative turn" in philosophy of science, and introduced a novel section "problems of philosophy" (Hintikka 1997) "*Synthese* is a journal for epistemology, logic and philosophy of science, thus not a general philosophy journal, let alone one meant only for an in-house audience of philosophers. Rather, *Synthese* is a journal devoted to interdisciplinary philosophical inquiry in which the use of methods from the sciences is found at center stage." (van Benthem et al. 2008, p. 2)

Appendix B: Table of the top-10 articles for each topic. This list includes, for each topic, the 10 articles in which that topic is the most expressed (in the sense of having of highest probability)

Topic	Top-10 articles
A-FORMAL (23)	Normann, Dag. "On Abstract 1-Sections." Synthese 27, no. 1/2 (1974): 259–263 Lenker, Terry D and Richard St. André. "Near Orderings of Topological Spaces." Synthese 55, no. 3 (1983): 327–331 Friedman, Joel. "The Universal Class Has a Spinozistic Partitioning." Synthese 32, no. 3/4 (1976): 403–418 Mikulás, Szabolcs. "The equational theories of representable residuated semigroups." Synthese 192, no. 7 (2015): 2151–2158 Bell, J. L. "Categories, Toposes and Sets." Synthese 51, no. 3 (1982): 293–337 Colonius, Hans. "On Weak Extensive Measurement." Philosophy of Science 1, no. 2 (1978): 303–308 Narens, Louis. "Measurement without Archimedean Axioms." Philosophy of Science 1, no. 3 (1974): 374–393 Jensen, Ronald Björn. "On the Consistency of a Slight (?) Modification of Quine's "New Foundations"." Synthese 19, no. 1/2 (1968): 250–264 Mansfield, Richard and John Dawson. "Boolean-Valued Set Theory and Forcing." Synthese 33, no. 1 (1976): 223–252 Hansson, Bengt. "Choice Structures and Preference Relations." Synthese 18, no. 4 (1968): 443–458
A-LANGUAGE (17)	Cartwright, Richard L. "Comments on Dr. Hochberg's Paper." Philosophy of Science 1, no. 3 (1956): 260–265 Linsky, Leonard. "Some Notes on Carnap's Concept of Intensional Isomorphism and the Paradox of Analysis." Philosophy of Science 1, no. 4 (1949): 343–347 Reach, K. "The Name Relation and the Logical Antinomies." Erkenntnis 7, no. (1937): 236–240 Hochberg, Herbert. "The Ontological Operator." Philosophy of Science 1, no. 3 (1956): 250–259 Matheson, Gordon. "The Antinomy of Designation." Philosophy of Science 1, no. 3 (1959): 260–269 Moreno, Luis Fernández. "Tarskian Truth and the Correspondence Theory." Synthese 126, no. 1/2 (2001): 123–147 Berge, William H. "Carnap and Translational Indeterminacy." Synthese 105, no. 1 (1995): 115–121 Lavers, Gregory. "Carnap, Semantics and Ontology." Erkenntnis 60, no. 3 (2004): 295–316 Keuth, Herbert. "Tarski's Definition of Truth and the Correspondence Theory." Philosophy of Science 1, no. 3 (1978): 420–430 Bergmann, Gustav. "Descriptions in Nonextensional Contexts." Philosophy of Science 1, no. 4 (1948): 353–355

Topic	Top-10 articles
A-MATHEMATICAL (5)	Giovannini, Eduardo. "Bridging the gap between analytic and synthetic geometry: Hilbert's axiomatic approach." Synthese 193, no. 1 (2016): 31–70 Alvarez, Carlos. "Two Ways of Reasoning and Two Ways of Arguing in Geometry. Some Remarks concerning the Application of Figures in Euclidean Geometry." Synthese 134, no. 1/2 (2003): 289–323 Hartimo, Mirja and Mitsuhiro Okada. "Syntactic reduction in Husserl's early phenomenology of arithmetic." Synthese 193, no. 3 (2016): 937–969 Lorenzen, Paul. "Constructive and Axiomatic Mathematics." Synthese 12, no. 1 (1960): 114–119 Hartimo, Mirja Helena. "From Geometry to Phenomenology." Synthese 162, no. 2 (2008): 225–233 Hartimo, Mirja Helena. "Towards Completeness: Husserl on Theories of Manifolds 1890-1901." Synthese 156, no. 2 (2007): 281–310 Gauthier, Yvon. "Hilbert and the Internal Logic of Mathematics." Synthese 101, no. 1 (1994): 1–14 Bråting, Kajsa and Johanna Pejlare. "Visualizations in Mathematics." Erkenntnis 68, no. 3 (2008): 345–358 Webb, Judson C. "Hilbert's Formalism and Arithmetization of Mathematics." Synthese 110, no. 1 (1997): 1–14 Shabel, Lisa. "Kant on the 'symbolic construction' of mathematical concepts." Studies in History and Philosophy of Science Part A 29, no. 4 (1998): 589–621
A-SENTENCE (6)	Corazza, Eros. "Complex Demonstratives Qua Singular Terms." Erkenntnis 59, no. 2 (2003): 263–283 McKinsey, Michael. "Mental Anaphora." Synthese 66, no. 1 (1986): 159–175 Bach, Kent. "Referential/Attributive." Synthese 49, no. 2 (1981): 219–244 Corazza, Eros. "Temporal Indexicals and Temporal Terms." Synthese 130, no. 3 (2002): 441–460 Voltolini, Alberto. "Can There Be a Uniform Application of Direct Reference?" Erkenntnis 61, no. 1 (2004): 75–98 Pelczar, M and J. Rainsbury. "The Indexical Character of Names." Synthese 114, no. 2 (1998): 293–317 Corazza, Eros. "On the Alleged Ambiguity of 'Now' and 'Here'." Synthese 138, no. 2 (2004): 289–313 Stotts, Megan. "Understanding the Intentions Behind the Referential/Attributive Distinction." Erkenntnis 82, no. 2 (2017): 351–362 Maier, Emar. "Reference, Binding, and Presupposition: Three Perspectives on the Semantics of Proper Names." Erkenntnis 80, no. Supplement (2015): 313–333 Bach, Kent. "You Don't Say?" Synthese 128, no. 1/2 (2001): 15–44

Topic	Top-10 articles
A-TRUTH (7)	Jacquette, Dale. "The Validity Paradox in Modal S_5." Synthese 109, no. 1 (1996): 47–62 Read, Stephen. "Self-Reference and Validity." Synthese 42, no. 2 (1979): 265–274 Caton, Charles E. "A Stipulation of Logical Truth in a Modal Propositional Calculus." Synthese 14, no. 2/3 (1962): 196–199 Milne, Peter. "Classical Harmony: Rules of Inference and the Meaning of the Logical Constants." Synthese 100, no. 1 (1994): 49–94 Campos Sanz, Wagner and Hermógenes Oliveira. "On Dummett's verificationist justification procedure." Synthese 193, no. 8 (2016): 2539–2559 Hakli, Raul and Sara Negri. "Does the deduction theorem fail for modal logic?" Synthese 187, no. 3 (2012): 849–867 Ciardelli, Ivano, Jeroen Groenendijk, and Floris Roelofsen. "On the semantics and logic of declaratives and interrogatives." Synthese 192, no. 6 (2015): 1689–1728 Stein, Jordan. "Tharp's theorems of metaphysics and the notion of necessary truth." Synthese 194, no. 4 (2017): 1219–1231 Cobreros, Pablo. "Paraconsistent vagueness: a positive argument." Synthese 183, no. 2 (2011): 211–227 Stachow, E.-W. "On a Game-Theoretic Approach to a Scientific Language." PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association 1978, no. (1978): 19–40
B-ARGUMENTS (20)	Keller, John. "On Knockdown Arguments." Erkenntnis 80, no. 6 (2015): 1205–1215 Van Laar, Jan Albert. "One-Sided Arguments." Synthese 154, no. 2 (2007): 307–327 Ballantyne, Nathan. "Knockdown Arguments." Erkenntnis 79, no. Supplement 3 (2014): 525–543 Jenkins, C. "Merely Verbal Disputes." Erkenntnis 79, no. Supplement (2014): 11–30 Machan, Tibor R and M. L. Zupan. "Back to Being Reasonable." Philosophy of Science 1, no. 3 (1975): 307–310 Stocker, Michael. "Some Problems with Counter-Examples in Ethics." Synthese 72, no. 2 (1987): 277–289 Hazlett, Allan. "Epistemic Conceptions of Begging the Question." Erkenntnis 65, no. 3 (2006): 343–363 Krabbe, Erik and Jan Laar. "That's no argument! The dialectic of non-argumentation." Synthese 192, no. 4 (2015): 1173–1197 Walton, Douglas N. "Begging the Question as a Pragmatic Fallacy." Synthese 100, no. 1 (1994): 95–131 Dancy, Jonathan. "The thing to use." Studies in History and Philosophy of Science Part A 37, no. 1 (2006): 58–61

Topic	Top-10 articles
B-KNOWLEDGE (2)	Alexander, David. "Unjustified Defeaters." Erkenntnis 82, no. 4 (2017): 891–912 Lockard, Matthew. "Closure Provides No Relief from the Problem of Easy Knowledge." Erkenntnis 79, no. 2 (2014): 461–469 Hiller, Avram and Ram Neta. "Safety and Epistemic Luck." Synthese 158, no. 3 (2007): 303–313 Moretti, Luca and Tommaso Piazza. "Phenomenal Conservatism and Bergmann's Dilemma." Erkenntnis 80, no. 6 (2015): 1271–1290 Melchior, Guido. "Skepticism: The Hard Problem for Indirect Sensitivity Accounts." Erkenntnis 79, no. 1 (2014): 45–54 Madison, B. "Internalism in the Epistemology of Testimony Redux." Erkenntnis 81, no. 4 (2016): 741–755 McHugh, Conor. "Self-knowledge and the KK principle." Synthese 173, no. 3 (2010): 231–257 Carter, J. Adam. "A Problem for Pritchard's Anti-Luck Virtue Epistemology." Erkenntnis 78, no. 2 (2013): 253–275 Silva, Paul. "On Doxastic Justification and Properly Basing One's Beliefs." Erkenntnis 80, no. 5 (2015): 945–955 Cling, Andrew D. "The Trouble with Infinitism." Synthese 138, no. 1 (2004): 101–123
B-SCIENTIFIC-THEORY (12)	Doppelt, Gerald. "Empirical Success or Explanatory Success: What Does Current Scientific Realism Need to Explain?" Philosophy of Science 2, no. 4 (2005): 1076–1087 Doppelt, Gerald. "Relativism and the Reticulational Model of Scientific Rationality." Synthese 69, no. 2 (1986): 225–252 Resnik, David. "Repairing the Reticulated Model of Scientific Rationality." Erkenntnis 40, no. 3 (1994): 343–355 Šešelja, Dunja and Christian Straßer. "Kuhn and coherentist epistemology." Studies in History and Philosophy of Science Part A 40, no. 3 (2009): 322–327 Doppelt, Gerald D. "From Standard Scientific Realism and Structural Realism to Best Current Theory Realism." Journal for General Philosophy of Science 42, no. 2 (2011): 295–316 Freedman, Karyn. "Laudan's Naturalistic Axiology." Philosophy of Science 2, no. 3 (1999): S526–S537 Siegel, Harvey. "Meiland on Scheffler, Kuhn, and Objectivity in Science." Philosophy of Science 1, no. 3 (1976): 441–448 Doppelt, Gerald. "The Philosophical Requirements for an Adequate Conception of Scientific Rationality." Philosophy of Science 1, no. 1 (1988): 104–133 Doppelt, Gerald. "The Naturalist Conception of Methodological Standards in Science: A Critique." Philosophy of Science 1, no. 1 (1990): 1–19 Ivanova, Milena. "Friedman's Relativised A Priori and Structural Realism: In Search of Compatibility." International Studies in the Philosophy of Science 25, no. 1 (2011)

Topic	Top-10 articles
C-CONFIRMATION (3)	Machery, Edouard. "Power and Negative Results." Philosophy of Science 2, no. 1 (2012): 808–820 Foster, Lawrence. "Feyerabend's Solution to the Goodman Paradox." The British Journal for the Philosophy of Science 20, no. 3 (1969): 259–260 Boyce, Kenneth. "On the equivalence of Goodman's and Hempel's paradoxes." Studies in History and Philosophy of Science Part A 45, no. C (2014): 32–42 Mayo, Deborah G and Aris Spanos. "Severe Testing as a Basic Concept in a Neyman–Pearson Philosophy of Induction." The British Journal for the Philosophy of Science 57, no. 2 (2006): 323–357 Rogers, Ben. "Material Conditions on Tests of Statistical Hypotheses." PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association 1970, no. (1970): 403–412 Kahane, Howard. "Baumer on the Confirmation Paradoxes." The British Journal for the Philosophy of Science 18, no. 1 (1967): 52–56 Schwartz, Robert. "Paradox and Projection." Philosophy of Science 1, no. 2 (1972): 245–248 Mayo, Deborah G. "How to Discount Double-Counting When It Counts: Some Clarifications." The British Journal for the Philosophy of Science 59, no. 4 (2008): 857–879 Mackie, J. L. "The Paradox of Confirmation." The British Journal for the Philosophy of Science 13, no. 52 (1963): 265–277 Kahane, Howard. "Nelson Goodman's Entrenchment Theory." Philosophy of Science 1, no. 4 (1965): 377–383
C-PROBABILITY (0)	Armendt, Brad. "Is There a Dutch Book Argument for Probability Kinematics?" Philosophy of Science 1, no. 4 (1980): 583–588 Draper, Kai and Joel Pust. "Diachronic Dutch Books and Sleeping Beauty." Synthese 164, no. 2 (2008): 281–287 Singer, Daniel. "Sleeping beauty should be imprecise." Synthese 191, no. 14 (2014): 3159–3172 Koscholke, Jakob. "Carnap's Relevance Measure as a Probabilistic Measure of Coherence." Erkenntnis 82, no. 2 (2017): 339–350 Harper, William L and Henry E. Kyburg. "The Jones Case." The British Journal for the Philosophy of Science 19, no. 3 (1968): 247–251 Park, Ilho. "Rescuing Reflection." Philosophy of Science 1, no. 3 (2012): 473–489 Kyburg,, Henry E. "Levi, Petersen, and Direct Inference." Philosophy of Science 1, no. 4 (1983): 630–634 Lewis, Peter J. "Credence and self-location." Synthese 175, no. 3 (2010): 369–382 Pruss, Alexander. "Infinitesimals are too small for countably infinite fair lotteries." Synthese 191, no. 6 (2014): 1051–1057 Kim, Namjoong. "A dilemma for the imprecise bayesian." Synthese 193, no. 6 (2016): 1681–1702

Topic	Top-10 articles
D-AGENT-DECISION (8)	Tuomela, Raimo. "What Is Cooperation?" Erkenntnis 38, no. 1 (1993): 87–101 Weirich, Paul. "Collective acts." Synthese 187, no. 1 (2012): 223–241 Baier, Kurt. "Rationality and Morality." Erkenntnis 11, no. 2 (1977): 197–223 Gustafsson, Johan E. "A Note in Defence of Ratificationism." Erkenntnis 75, no. 1 (2011): 147–150 Weirich, Paul. "Initiating Coordination." Philosophy of Science 2, no. 1 (2007): 790–801 Ferguson, Benjamin. "The Paradox of Exploitation." Erkenntnis 81, no. 5 (2016): 951–972 Tuomela, Raimo and Kaarlo Miller. "We-Intentions, Free-Riding, and Being in Reserve." Erkenntnis 36, no. 1 (1992): 25–52 Harsanyi, John C. "Morality and the Prisoner's Dilemma Problem: Comments on Baier's Paper." Erkenntnis 11, no. 3 (1977): 441–446 Rabinowicz, Wlodek. "Cooperating with Cooperators: Notes on Österberg's Collective Egoism." Erkenntnis 38, no. 1 (1993): 23–55 Sobel, Jordan Howard. "Money Pumps." Philosophy of Science 1, no. 2 (2001): 242–257
D-GAME-THEORY (11)	Wagner, Elliott. "Communication and Structured Correlation." Erkenntnis 71, no. 3 (2009): 377–393 Zollman, Kevin J. S. "Talking to Neighbors: The Evolution of Regional Meaning*." Philosophy of Science 1, no. 2 (2005): 69–85 Skyrms, Brian. "Signals, Evolution and the Explanatory Power of Transient Information*." Philosophy of Science 1, no. 2 (2002): 407–428 Vanderschraaf, Peter. "In a Weakly Dominated Strategy Is Strength: Evolution of Optimality in Stag Hunt Augmented with a Punishment Option." Philosophy of Science 83, no. 1 (2016): 29–59 O'Connor, Cailin. "The Evolution of Vagueness." Erkenntnis 79, no. Supplement 4 (2014): 707–727 Huttegger, Simon M, Brian Skyrms,, Rory Smead, and Kevin J. S. Zollman. "Evolutionary Dynamics of Lewis Signaling Games: Signaling Systems vs. Partial Pooling." Synthese 172, no. 1 (2010): 177–191 Wagner, Elliott O. "Deterministic Chaos and the Evolution of Meaning." The British Journal for the Philosophy of Science 63, no. 3 (2012): 547–575 Vanderschraaf, Peter and J. McKenzie Alexander. "Follow the Leader: Local Interactions with Influence Neighborhoods*." Philosophy of Science 1, no. 2 (2005): 86–113 Smead, Rory. "The Role of Social Interaction in the Evolution of Learning." The British Journal for the Philosophy of Science 66, no. 1 (2015): 161–180 Wagner, Elliott. "The Explanatory Relevance of Nash Equilibrium: One-Dimensional Chaos in Boundedly Rational Learning." Philosophy of Science 2, no. 1 (2013): 783–795

Topic	Top-10 articles
E-EVOLUTION (22)	Mameli, Matteo. "Nongenetic Selection and Nongenetic Inheritance." The British Journal for the Philosophy of Science 55, no. 1 (2004): 35–71 Booth, Austin. "Populations and Individuals in Heterokaryotic Fungi: A Multilevel Perspective." Philosophy of Science 1, no. 3 (2014): 612–632 McConwell, Alison K. "Contingency and Individuality: A Plurality of Evolutionary Individuality Types." Philosophy of Science 84, no. 5 (2017): 1104–1116 Earnshaw-Whyte, Eugene. "Increasingly Radical Claims about Heredity and Fitness." Philosophy of Science 1, no. 2 (2012): 396–412 Morgan, Gregory J and W. Brad Pitts. "Evolution without Species: The Case of Mosaic Bacteriophages." The British Journal for the Philosophy of Science 59, no. 4 (2008): 745–765 Ereshefsky, Marc. "Species, Higher Taxa, and the Units of Evolution." Philosophy of Science 1, no. 1 (1991): 84–101 Shanahan, Timothy. "Evolution, Phenotypic Selection, and the Units of Selection." Philosophy of Science 1, no. 2 (1990): 210–225 Okasha, Samir. "Does the Concept of "Clade Selection" Make Sense?." Philosophy of Science 2, no. 1 (2003): 739–751 Vorontsov, Nikolay N. "The problem of species and speciation." International Studies in the Philosophy of Science 3, no. 2 (1989) Waters, C. Kenneth. "Genes Made Molecular." Philosophy of Science 1, no. 1 (1994): 163–185
E-MIND (21)	Almäng, Jan. "An Argument for Shape Internalism." Erkenntnis 82, no. 4 (2017): 819–836 Deutsch, Max. "The Way Ripe Tomatoes Look: An Argument Against Externalist Representationalism." Erkenntnis 77, no. 3 (2012): 297–316 Ren, Huiming. "Inverted Earth Revisited." Erkenntnis 81, no. 5 (2016): 1093–1107 De Vignemont, Frédérique and Pierre Jacob. "Beyond Empathy for Pain." Philosophy of Science 83, no. 3 (2016): 434–445 Raftopoulos, Athanasios. "Ambiguous figures and representationalism." Synthese 181, no. 3 (2011): 489–514 De Vignemont, Frédérique and Pierre Jacob. "What Is It like to Feel Another's Pain?." Philosophy of Science 1, no. 2 (2012): 295–316 Millar, Boyd. "Peacocke's trees." Synthese 174, no. 3 (2010): 445–461 Thompson, Evan. "Representationalism and the Phenomenology of Mental Imagery." Synthese 160, no. 3 (2008): 397–415 Raftopoulos, Athanassios. "Cognitive Penetration Lite and Nonconceptual Content." Erkenntnis 82, no. 5 (2017): 1097–1122 Reuter, Kevin. "The Developmental Challenge to the Paradox of Pain." Erkenntnis 82, no. 2 (2017): 265–283

Topic	Top-10 articles
E-NEUROSCIENCES (1)	Bergeron, Vincent. "Functional Independence and Cognitive Architecture." The British Journal for the Philosophy of Science 67, no. 3 (2016): 817–836 Bechtel, William. "Aligning Multiple Research Techniques in Cognitive Neuroscience: Why Is It Important?" Philosophy of Science 2, no. 1 (2002): S48–S58 Johnson, Gregory. "The relationship between psychological capacities and neurobiological activities." European Journal for Philosophy of Science 2, no. 3 (2012): 453–480 Colombo, Matteo. "Moving Forward (and Beyond) the Modularity Debate: A Network Perspective." Philosophy of Science 1, no. 2 (2013): 356–377 Bechtel, William. "Investigating neural representations: the tale of place cells." Synthese 193, no. 5 (2016): 1287–1321 Bechtel, William. "Mechanisms in Cognitive Psychology: What Are the Operations?" Philosophy of Science 2, no. 3 (2008): 983–994 McCaffrey, Joseph B. "The Brain's Heterogeneous Functional Landscape." Philosophy of Science 2, no. 2 (2015): 1010–1022 Craver, Carl F. "Interlevel Experiments and Multilevel Mechanisms in the Neuroscience of Memory." Philosophy of Science 2, no. 1 (2002): S83–S97 Piccinini, Gualtiero. "Computing Mechanisms." Philosophy of Science 1, no. 2 (2007): 501–526 Sullivan, Jacqueline Anne. "A Role for Representation in Cognitive Neurobiology." Philosophy of Science 2, no. 2 (2010): 875–887
F-CAUSATION (14)	Ehring, Douglas. "Papineau on Causal Asymmetry." The British Journal for the Philosophy of Science 38, no. 1 (1987): 81–87 Lee, Jig-Chuen. "Causal Condition, Causal Asymmetry, and the Counterfactual Analysis of Causation." Synthese 67, no. 2 (1986): 213–223 Ehring, Douglas. "Causal Asymmetry and Causal Relata: Reply to Lee." Synthese 76, no. 3 (1988): 371–375 Twardy, Charles R and Kevin B. Korb. "Actual Causation by Probabilistic Active Paths." Philosophy of Science 3, no. 1 (2011): 900–913 Glynn, Luke. "A Probabilistic Analysis of Causation." The British Journal for the Philosophy of Science 62, no. 2 (2011): 343–392 Otte, Richard. "Probabilistic Causality and Simpson's Paradox." Philosophy of Science 1, no. 1 (1985): 110-125. Otte, Richard. "A Critique of Suppes' Theory of Probabilistic Causality." Synthese 48, no. 2 (1981): 167–189 Hitchcock, Christopher. "Trumping and contrastive causation." Synthese 181, no. 2 (2011): 227–240 Hesslow, Germund. "Two Notes on the Probabilistic Approach to Causality." Philosophy of Science 1, no. 2 (1976): 290–292 Hausman, Daniel and James Woodward. "Manipulation and the Causal Markov Condition." Philosophy of Science 2, no. 2 (2004): 846–856

Topic	Top-10 articles
F-EXPLANATION (9)	Goh, S. T. "Newman and Explanation-Sketches." Philosophy of Science 1, no. 3 (1967): 273–275 Barr, William F. "A Pragmatic Analysis of Idealizations in Physics." Philosophy of Science 1, no. 1 (1974): 48–64 Jones, Todd. "Unification, Deduction, and History: A Reply to Steel." Philosophy of Science 1, no. 4 (1998): 672–681 Weslake, Brad. "Explanatory Depth*." Philosophy of Science 1, no. 1 (2010): 273–294 Lange, Marc. "Natural Laws and the Problem of Provisos." Erkenntnis 38, no. 2 (1993): 233–248 Andersen, Holly K. "Mechanisms, Laws, and Regularities." Philosophy of Science 1, no. 2 (2011): 325–331 Bird, Alexander. "Explanation and Laws." Synthese 120, no. 1 (1999): 1–18 Hitchcock, Christopher. "…And Away from a Theory of Explanation Itself." Synthese 143, no. 1/2 (2005): 109–124 Press, Joel K. "On the Virtues of CursoryScientific Reductions." Philosophy of Science 3, no. 1 (2011): 1189–1199 Omer, I. A. "Better Deductive Explanation?" Journal for General Philosophy of Science 14, no. 2 (1983): 350–353
F-PROPERTY (24)	Keinänen, Markku and Jani Hakkarainen. "The Problem of Trope Individuation: A Reply to Lowe." Erkenntnis 79, no. 1 (2014): 65–79 Smith, Deborah. "Quid Quidditism Est?" Erkenntnis 81, no. 2 (2016): 237–257 Roche, Michael. "Physicalism and Supervenience: A Case for a New Sense of Physical Duplication." Erkenntnis 81, no. 4 (2016): 669–681 Von Wachter, Daniel. "On Doing without Relations." Erkenntnis 48, no. 2/3 (1998): 355–358 Melnyk, Andrew. "Pereboom's Robust Non-reductive Physicalism." Erkenntnis 79, no. 5 (2014): 1191–1207 Cameron, Ross Paul. "Truthmakers and Necessary Connections." Synthese 161, no. 1 (2008): 27–45 Morris, Kevin. "Supervenience Physicalism, Emergentism, and the Polluted Supervenience Base." Erkenntnis 79, no. 2 (2014): 351–365 Cowling, Sam. "Haecceitism for Modal Realists." Erkenntnis 77, no. 3 (2012): 399–417 De, Michael. "Intrinsicality and counterpart theory." Synthese 193, no. 8 (2016): 2353–2365 Cohen, Jonathan. "On An Alleged Non-Equivalence between Dispositions and Disjunctive Properties." The British Journal for the Philosophy of Science 53, no. 1 (2002): 77–81

Topic	Top-10 articles
G-PARTICLES (15)	Hanson, Norwood Russell. "Discovering the Positron (II)." The British Journal for the Philosophy of Science 12, no. 48 (1962): 299–313
	Needham, Paul. "Hydrogen bonding: Homing in on a tricky chemical concept." Studies in History and Philosophy of Science Part A 44, no. 1 (2013): 51–65
	Stern, Alexander W. "The Neutrino Concept." Philosophy of Science 2, no. 1 (1941): 614–617
	Ehrenhaft, Felix and Leo Banet. "Is There "True Magnetism" or Not?" Philosophy of Science 1, no. 4 (1941): 458–462
	Gavroglu, Kostas and Yorgos Goudaroulis. "Heike Kamerlingh Onnes' researches at Leiden and their methodological implications." Studies in History and Philosophy of Science Part A 19, no. 2 (1988): 243–274
	Hon, Giora. "H. Hertz: 'The electrostatic and electromagnetic properties of the cathode rays are either nil or very feeble.' (1883) a case-study of an experimental error." Studies in History and Philosophy of Science Part A 18, no. 3 (1987): 367–382
	Forrester, John. "Chemistry and the conservation of energy: The work of James Prescott Joule." Studies in History and Philosophy of Science Part A 6, no. 4 (1975): 273–313
	Bradley, John. "On the Operational Interpretation of Classical Chemistry." The British Journal for the Philosophy of Science 6, no. 21 (1955): 32–42
	Bridgman, P. W. "The Nature of Some of Our Physical Concepts. III." The British Journal for the Philosophy of Science 2, no. 6 (1951): 142–160
	Ehrenhaft, Felix. "The Microcoulomb Experiment. Charges Smaller than the Electronic Charge." Philosophy of Science 1, no. 4 (1941): 403–457
G-QUANTUM-MECHANICS (10)	Lombardi, Olimpia, Juan Sebastián Ardenghi,, Sebastian Fortin, and Mario Castagnino. "Compatibility between Environment-Induced Decoherence and the Modal-Hamiltonian Interpretation of Quantum Mechanics." Philosophy of Science 1, no. 4 (2011): 1024–1036
	Bub, Jeffrey. "From Micro to Macro: A Solution to the Measurement Problem of Quantum Mechanics." PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association 1988, no. (1988): 134–144
	Hemmo, Meir and Orly Shenker. "Quantum Decoherence and the Approach to Equilibrium." Philosophy of Science 1, no. 3 (2003): 330–358
	Albert, David and Barry Loewer. "Wanted Dead or Alive: Two Attempts to Solve Schrödinger's Paradox." PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association 1990, no. (1990): 277–285
	Robinson, Don. "The Infinite Apparatus in the Quantum Theory of Measurement." PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association 1990, no. (1990): 251–261
	Kastner, Ruth E. "Shutters, Boxes, but No Paradoxes: Time Symmetry Puzzles in Quantum Theory." International Studies in the Philosophy of Science 18, no. 1 (2004)
	Bächtold, Manuel. "Five Formulations of the Quantum Measurement Problem in the Frame of the Standard Interpretation." Journal for General Philosophy of Science 39, no. 1 (2008): 17–33
	Elby, Andrew. "Why Local Realistic Theories Violate, Nontrivially, the Quantum Mechanical EPR Perfect Correlations." The British Journal for the Philosophy of Science 44, no. 2 (1993): 213–230
	Bedard, Katherine. "Bohm, Spin, and the Bell Inequalities." Synthese 114, no. 3 (1998): 405–444
	Albertson, James. "The Statistical Nature of Quantum Mechanics." The British Journal for the Philosophy of Science 13, no. 51 (1962): 229–233

Topic	Top-10 articles
G-Relativity (16)	Giannoni, Carlo B. "Special Relativity in Accelerated Systems." Philosophy of Science 1, no. 4 (1973): 382–392 Ungar, Abraham. "The Lorentz Transformation Group of the Special Theory of Relativity without Einstein's Isotropy Convention." Philosophy of Science 1, no. 3 (1986): 395–402 Lam, Vincent. "Gravitational and Nongravitational Energy: The Need for Background Structures." Philosophy of Science 2, no. 1 (2011): 1012–1023 Podlaha, M. F. "Light Signal Synchronisation and Clock Transport Synchronisation in the Theory of Relativity." The British Journal for the Philosophy of Science 30, no. 4 (1979): 376–380 Norton, John D. "The Force of Newtonian Cosmology: Acceleration Is Relative." Philosophy of Science 1, no. 4 (1995): 511–522 Norton, John. "What was Einstein's principle of equivalence?" Studies in History and Philosophy of Science Part A 16, no. 3 (1985): 203–246 Janis, Allen I. "Synchronism by Slow Transport of Clocks in Noninertial Frames of Reference." Philosophy of Science 1, no. 1 (1969): 74–81 Weatherall, James Owen. "Maxwell-Huygens, Newton-Cartan, and Saunders-Knox Space-Times." Philosophy of Science 83, no. 1 (2016): 82–92 Giannoni, Carlo. "Einstein and the Lorentz-Poincaré Theory of Relativity." PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association 1970, no. (1970): 575–589 Leeds, Stephen. "Discussion: Malament on Time Reversal*." Philosophy of Science 1, no. 2 (2006): 448–458
G-Time (4)	Eells, Ellery. "Quentin Smith on Infinity and the past." Philosophy of Science 1, no. 4 (1988): 453–455 Smith, Nicholas J. J. "Bananas Enough for Time Travel?" The British Journal for the Philosophy of Science 48, no. 3 (1997): 363–389 Elga, Adam. "Statistical Mechanics and the Asymmetry of Counterfactual Dependence." Philosophy of Science 2, no. 2 (2001): S313–S324 Macbeath, Murray. "Who Was Dr. Who's Father?" Synthese 51, no. 3 (1982): 397–430 Oaklander, L. Nathan. "McTaggart's Paradox and Smith's Tensed Theory of Time." Synthese 107, no. 2 (1996): 205–221 Wasserman, Ryan. "The Future Similarity Objection Revisited." Synthese 150, no. 1 (2006): 57–67 Small, Robin. "Tristram Shandy's Last Page." The British Journal for the Philosophy of Science 37, no. 2 (1986): 213–216 Bell, John. "The Infinite Past Regained: A Reply to Whitrow." The British Journal for the Philosophy of Science 30, no. 2 (1979): 161–165 Weingard, Robert. "General Relativity and the Conceivability of Time Travel." Philosophy of Science 1, no. 3 (1979): 328–332 Whitrow, G. J. "On the Impossibility of an Infinite Past." The British Journal for the Philosophy of Science 29, no. 1 (1978): 39–45

Topic	Top-10 articles
H-CLASSICS (18)	Ariew, Roger. "The initial response to Galileo's lunar observations." Studies in History and Philosophy of Science Part A 32, no. 3 (2001): 571–581 Glasner, Ruth. "Gersonides on simple and composite movements." Studies in History and Philosophy of Science Part A 28, no. 4 (1997): 545–584 Brown, Harold I. "Galileo, the elements, and the tides." Studies in History and Philosophy of Science Part A 7, no. 4 (1976): 337–351 Ariew, Roger. "Galileo's lunar observations in the context of medieval lunar theory." Studies in History and Philosophy of Science Part A 15, no. 3 (1984): 213–226 Drake, Stillman. "Galileo's steps to full Copernicanism, and back." Studies in History and Philosophy of Science Part A 18, no. 1 (1987): 93–105 Crombie, A. C. "A Note on the Descriptive Conception of Motion in the Fourteenth Century." The British Journal for the Philosophy of Science 4, no. 13 (1953): 46–51 Ariew, Roger. "The phases of venus before 1610." Studies in History and Philosophy of Science Part A 18, no. 1 (1987): 81–92 Nonnoi, Giancarlo. "Against emptiness: Descartes's physics and metaphysics of plenitude." Studies in History and Philosophy of Science Part A 25, no. 1 (1994): 81–96 Brown, Gregory. "Did Samuel Clarke really disavow action at a distance in his correspondence with Leibniz?: Newton, Clarke, and Bentley on gravitation and action at a distance." Studies in History and Philosophy of Science Part A 60, no. C (2016): 38–47 Ducheyne, Steffen. "Understanding (in) Newton's Argument for Universal Gravitation." Journal for General Philosophy of Science 40, no. 2 (2009): 227–258
H-PHILOSOPHY (19)	Steigerwald, Joan. "The dynamics of reason and its elusive object in Kant, Fichte and Schelling." Studies in History and Philosophy of Science Part A 34, no. 1 (2003): 111–134 Haga, Ånund. "Phenomenology and Self-Reflection." Journal for General Philosophy of Science 16, no. 1 (1985): 25–46 Beiser, Frederick. "Hegel and Naturphilosophie." Studies in History and Philosophy of Science Part A 34, no. 1 (2003): 135–147 McKinney, J. P. "Comment on a Paper by Professor Kemble." Philosophy of Science 1, no. 3 (1953): 227–231 Gentry, George. "The Subject in Whitehead's Philosophy." Philosophy of Science 1, no. 2 (1944): 222–226 McKinney, J. P. "Knowledge and Experience: Comment on a Paper by L. von Bertalanffy on "The Relativity of Categories"." Philosophy of Science 1, no. 4 (1957): 349–356 McKinney, J. P. "The Rational and the Real: Comment on a Paper by E. Topitsch." Philosophy of Science 1, no. 3 (1957): 275–280 Rescher, Nicholas. "On the Status of "Things in Themselves" in Kant." Synthese 47, no. 2 (1981): 289–299 Ikonen, Sirkku. "Cassirer's critique of culture: Between the Scylla of Lebensphilosophie and the Charybdis of the Vienna Circle." Synthese 179, no. 1 (2011): 187–202 Meyer, Michel. "Why Did Kant Write Two Versions of the Transcendental Deduction of the Categories?" Synthese 47, no. 3 (1981): 357–383

Topic	Top-10 articles
H-SOCIAL (13)	Mays, W. "History and Philosophy of Science in British Commonwealth Universities." The British Journal for the Philosophy of Science 11, no. 43 (1960): 192–211 Weidenhammer, Erich and Ari Gross. "Museums and scientific material culture at the University of Toronto." Studies in History and Philosophy of Science Part A 44, no. 4 (2013): 725–734 Wray, K. Brad. "Philosophy of Science: What are the Key Journals in the Field?" Erkenntnis 72, no. 3 (2010): 423–430 Jones, Claire L. "How to make a university history of science museum: Lessons from Leeds." Studies in History and Philosophy of Science Part A 44, no. 4 (2013): 716–724 Löwy, Ilana. "On hybridizations, networks and new disciplines: The Pasteur Institute and the development of microbiology in France." Studies in History and Philosophy of Science Part A 25, no. 5 (1994): 655–688 Topham, Jonathan R. "Scientific publishing and the reading of science in nineteenth-century Britain: a historiographical survey and guide to sources." Studies in History and Philosophy of Science Part A 31, no. 4 (2000): 559–612 Jardine, Nicholas. "Reflections on the preservation of recent scientific heritage in dispersed university collections." Studies in History and Philosophy of Science Part A 44, no. 4 (2013): 735–743 Needham, Joseph. "The International Science Co-operation Service Plan (ISCS)." Synthese 5, no. 1/2 (1946): 46–51 Mayer, Anna-K. "Setting up a Discipline: Conflicting Agendas of the Cambridge History of Science Committee, 1936–1950." Studies in History and Philosophy of Science Part A 31, no. 4 (2000): 665–689 Van Sittert, Lance. "'The handmaiden of industry': Marine science and fisheries development in South Africa 1895–1939." Studies in History and Philosophy of Science Part A 26, no. 4 (1995): 531–558

References

Aggarwal, C. C., & Zhai, C. X. (2012). *Mining text data*. Berlin: Springer.

Barron, Alexander T. J., Huang, J., Spang, R. L., & DeDeo, S. (2018). Individuals, institutions, and innovation in the debates of the French revolution. *Proceedings of the National Academy of Sciences, 115*(18), 4607–4612. https://doi.org/10.1073/pnas.1717729115.

Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: An open source software for exploring and manipulating networks. In *International AAAI conference on weblogs and social media*.

Beisbart, C., Pulte, H., & Reydon, T. (2019). Editorial: Fifty years journal for general philosophy of science. *Journal for General Philosophy of Science, 50*(1), 1–8. https://doi.org/10.1007/s10838-019-09453-x.

Blei, D. M., & Lafferty, J. D. (2009). Topic models. In A. N. Srivastava & M. Sahami (Eds.), *Text mining: Classification, clustering, and applications* (pp. 71–94). London: Chapman and Hall/CRC.

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent Dirichlet allocation. *The Journal of Machine Learning Research, 3*(March), 993–1022.

Blondel, V. D., Guillaume, J.-L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment, 2008*(10), P10008.

British Journal for the Philosophy of Science: About | OUP. (2020). Oxford University Press. April 9, 2020. https://academic.oup.com/bjps/pages/About.

British Journal for the Philosophy of Science | Wikipedia. (2020). Wikipedia. April 8, 2020. https://en.wikipedia.org/wiki/British_Journal_for_the_Philosophy_of_Science.

Byron, J. M. (2007). Whence philosophy of biology? *The British Journal for the Philosophy of Science, 58*(3), 409–422. https://doi.org/10.1093/bjps/axm021.

DiMaggio, P., Nag, M., & Blei, D. (2013). Exploiting affinities between topic modeling and the sociological perspective on culture: Application to newspaper coverage of U.S. Government Arts Funding. *Poetics, 41*(6), 570–606. https://doi.org/10.1016/j.poetic.2013.08.004.

Douglas, H. (2010). Engagement for progress: Applied philosophy of science in context. *Synthese, 177*(3), 317–335. https://doi.org/10.1007/s11229-010-9787-2.

Erkenntnis: Aims and Scope | Springer. (2020). Springer. March 26, 2020. https://www.springer.com/journal/10670/aims-and-scope.

Erkenntnis | Wikipedia. (2019). Wikipedia. September 30, 2019. https://en.wikipedia.org/w/index.php?title=Erkenntnis&oldid=918841729.

European Journal for Philosophy of Science | EPSA. (2020). European Philosophy of Science Association. April 6, 2020. http://philsci.eu/EJPS.

European Journal for Philosophy of Science | Springer. (2020). Springer. March 27, 2020. https://www.springer.com/journal/13194.

Firth, J. R. (1957). A synopsis of linguistic theory 1930–1955. In J. R. Firth (Ed.), *Studies in linguistic analysis* (pp. 1–32). Oxford: Blackwell.

Griffiths, T. L., & Steyvers, M. (2004). Finding scientific topics. *Proceedings of the National Academy of Sciences, 101*(suppl 1), 5228–5235. https://doi.org/10.1073/pnas.0307752101.

Hempel, C. G. (1975). The old and the new 'Erkenntnis'. *Erkenntnis, 9*(1), 1–4. https://doi.org/10.1007/BF00223129.

Hintikka, J. (1997). Editorial. *Synthese, 112,* 3–5.

Howard, D. (2003). Two left turns make a right: On the curious political career of north american philosophy of science at midcentury. In G. L. Hardcastle & A. W. Richardson (Eds.), *Logical empiricism in North America Minnesota. Studies in the philosophy of science* (Vol. 18, pp. 25–93). Minneapolis: University of Minnesota Press.

Hu, Y., Boyd-Graber, J., Satinoff, B., & Smith, A. (2014). Interactive topic modeling. *Machine Learning, 95*(3), 423–469. https://doi.org/10.1007/s10994-013-5413-0.

International Studies in the Philosophy of Science: Aims & Scope | Taylor and Francis. (2020). Taylor and Francis. April 9, 2020. https://www.tandfonline.com/action/journalInformation?show=aimsScope&journalCode=cisp20.

Journal for General Philosophy of Science: Aims and Scope | Springer. (2020). Springer. April 8, 2020. https://www.springer.com/journal/10838/aims-and-scope.

Lambiotte, R., Delvenne, J.-C., & Barahona, M. (2008). Laplacian dynamics and multiscale modular structure in networks. arXiv preprint arXiv:0812.1770.

Luiz, O. J., Olden, J. D., Kennard, M. J., Crook, D. A., Douglas, M. M., Saunders, T. M., et al. (2019). Trait-based ecology of fishes: A quantitative assessment of literature trends and knowledge gaps using topic modelling. *Fish and Fisheries, 20*(6), 1100–1110. https://doi.org/10.1111/faf.12399.

Malaterre, C., Chartier, J.-F., & Pulizzotto, D. (2019). What is this thing called philosophy of science? A computational topic-modeling perspective 1934–2015. *HOPOS, 9*(2), 215–249. https://doi.org/10.1086/704372.

Malaterre, C., Pulizzotto, D., & Lareau, F. (2020). Revisiting three decades of biology and philosophy: A computational topic-modeling perspective. *Biology and Philosophy, 35*(1), 5. https://doi.org/10.1007/s10539-019-9729-4.

Malisoff, W. M. (1934). What is philosophy of science? *Philosophy of Science, 1*(1), 1–4.

Marcus, M. P., Marcinkiewicz, M. A., & Santorini, B. (1993). Building a large annotated corpus of English: The Penn Treebank. *Computational Linguistics*, *19*(2), 313–30. https://doi.org/10.21236/ADA273556.

Mauri, M., Elli, T., Caviglia, G., Uboldi, G., & Azzi, M. (2017). RAWGraphs: A visualisation platform to create open outputs. In *Proceedings of the 12th biannual conference on Italian SIGCHI chapter—CHItaly'17* (pp. 1–5), Cagliari, Italy. ACM Press. https://doi.org/10.1145/3125571.3125585.

Mimno, D. (2012). Computational historiography: Data mining in a century of classics journals. *Journal on Computing and Cultural Heritage (JOCCH), 5*(1), 3. https://doi.org/10.1145/2160165.2160168.

Murdock, J., Allen, C., & DeDeo, S. (2017). Exploration and exploitation of victorian science in Darwin's reading notebooks. *Cognition, 159*(February), 117–126. https://doi.org/10.1016/j.cognition.2016.11.012.

Newton-Smith, W. H., & Wilkes, K. V. (1986). Introduction. *International Studies in the Philosophy of Science, 1*(1), 2–2. https://doi.org/10.1080/02698598608573278.

Nicholson, D. J., & Gawne, R. (2015). Neither logical empiricism nor vitalism, but organicism: What the philosophy of biology was. *History and Philosophy of the Life Sciences, 37*(4), 345–381. https://doi.org/10.1007/s40656-015-0085-7.

Peirson, B. R., Erick, E. B., Damerow, J. L., & Laubichler, M. D. (2017). Quantitative perspectives on fifty years of the Journal of the History of Biology. *Journal of the History of Biology, 50*(4), 695–751. https://doi.org/10.1007/s10739-017-9499-2.

Pence, C. H., & Ramsey, G. (2018). How to do digital philosophy of science. *Philosophy of Science, 85*(5), 930–941. https://doi.org/10.1086/699697.

Philosophy of Science: About | UCP. (2019). University of Chicago Press. November 12, 2019. https://www.journals.uchicago.edu/journals/phos/about.

Pritchard, J. K., Stephens, M., & Donnelly, P. (2000). Inference of population structure using multilocus genotype data. *Genetics, 155*(2), 945–959.

Reisch, G. A. (2005). *How the cold war transformed philosophy of science: To the icy slopes of logic*. Cambridge: Cambridge University Press.

Röder, M., Both, A., & Hinneburg, A. (2015). Exploring the space of topic coherence measures. In *Proceedings of the eighth ACM international conference on web search and data mining—WSDM'15* (pp. 399–408), Shanghai, China. ACM Press. https://doi.org/10.1145/2684822.2685324.

Salmon, W. C. (1989). *Four decades of scientific explanation*. Pittsburgh: University of Pittsburgh Press.

Schmid, H. (1994). Probabilistic part-of-speech tagging using decision trees. In *Proceedings of international conference on new methods in language processing* (pp. 44–49).

Srivastava, A. N., & Sahami, M. (2009). *Text mining: classification, clustering, and applications*. Boca Raton: CRC Press.

Studies in History and Philosophy of Science Part A | Elsevier. (2020). Elsevier. March 4, 2020. https://www.journals.elsevier.com/studies-in-history-and-philosophy-of-science-part-a.

Studies in History and Philosophy of Science | Wikipedia. (2020). Wikipedia. March 21, 2020. https://en.wikipedia.org/w/index.php?title=Studies_in_History_and_Philosophy_of_Science&oldid=946563983.

Synthese | Springer. (2019). Springer. November 14, 2019. https://www.springer.com/journal/11229.

Synthese | Wikipedia. (2020). Wikipedia. April 8, 2020. https://en.wikipedia.org/wiki/Synthese.

Vaesen, K., & Katzav, J. (2019). The national science foundation and philosophy of science's withdrawal from social concerns. *Studies in History and Philosophy of Science Part A, 78*(December), 73–82. https://doi.org/10.1016/j.shpsa.2019.01.001.

Valente, C. C., Bauer, F. F., Venter, F., Watson, B., & Nieuwoudt, H. H. (2018). Modelling the sensory space of varietal wines: Mining of large, unstructured text data and visualisation of style patterns. *Scientific Reports, 8*(1), 1–13. https://doi.org/10.1038/s41598-018-23347-w.

van Benthem, J., Hendricks, V. F., & Symons, J. (2008). Editorial. *Synthese, 160*(1), 1–4. https://doi.org/10.1007/s11229-007-9274-6.

Von Luxburg, U., Williamson, R. C., & Guyon, I. (2012). Clustering: Science or art? In *Proceedings of ICML workshop on unsupervised and transfer learning* (pp. 65–79).

Wray, K. B. (2010). Philosophy of Science: What are the key journals in the field? *Erkenntnis, 72*(3), 423–430. https://doi.org/10.1007/s10670-010-9214-6.

Zhao, W., Chen, J. J., Perkins, R., Liu, Z., Ge, W., Ding, Y., et al. (2015). A heuristic approach to determine an appropriate number of topics in topic modeling. *BMC Bioinformatics, 16*(Suppl 13), S8. https://doi.org/10.1186/1471-2105-16-S13-S8.