

Hypothesis-Driven Digital Philosophy of Science

New Directions in Metaphilosophy, 13/05/2021

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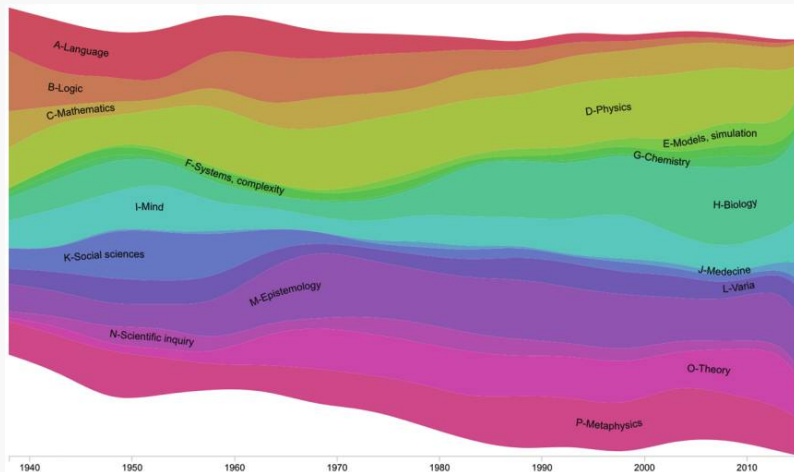
Outline

1. Digital methods in philosophy
2. Discovery, hypothesis, and spurious correlation
3. Two case studies from elsewhere
 - 3.1 Preregistration
 - 3.2 Whig history
4. From scientific literature to empirical philosophy of science
5. Putting it all together

The take-home: Work toward a set of (largely unresolved!) questions we can use to evaluate uses of digital methods

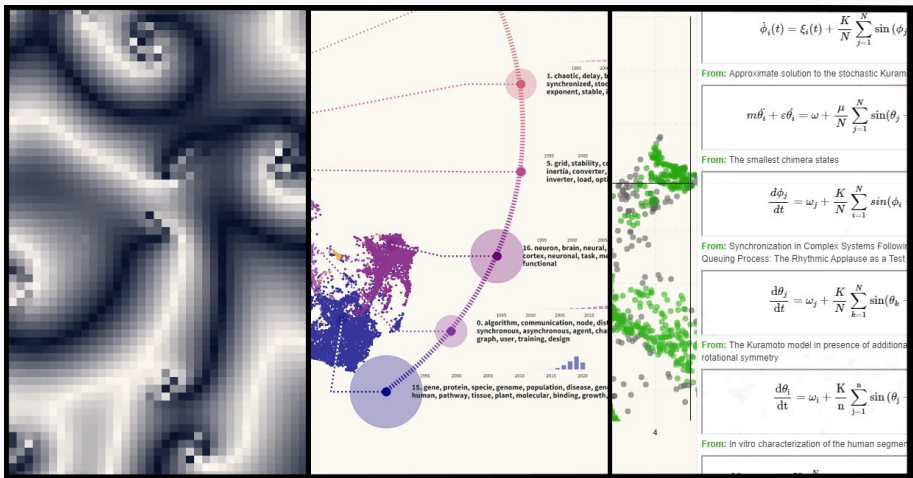
Digital Methods in Philosophy

Mapping the Field



Malaterre et al. (2019), *HOPOS*

Model Templates



$$\dot{\phi}_i(t) = \xi_i(t) + \frac{K}{N} \sum_{j=1}^N \sin(\phi_j)$$

From: Approximate solution to the stochastic Kuramoto

$$m\dot{\theta}_i + \varepsilon\theta_i = \omega + \frac{\mu}{N} \sum_{j=1}^N \sin(\theta_j)$$

From: The smallest chimera states

$$\frac{d\phi_j}{dt} = \omega_j + \frac{K}{N} \sum_{i=1}^N \sin(\phi_i)$$

From: Synchronization in Complex Systems Following a Queuing Process: The Rhythmic Applause as a Test

$$\frac{d\theta_j}{dt} = \omega_j + \frac{K}{N} \sum_{k=1}^N \sin(\theta_k)$$

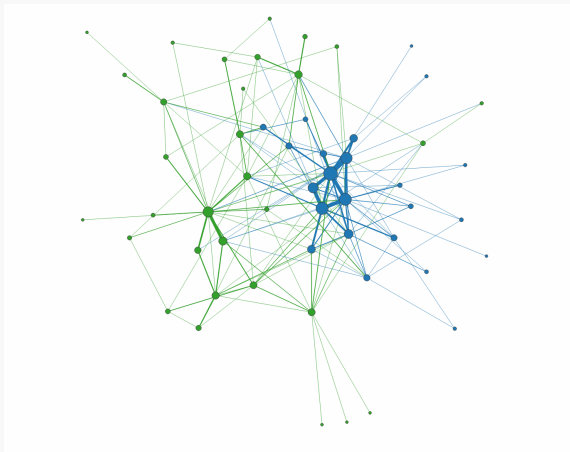
From: The Kuramoto model in presence of additional rotational symmetry

$$\frac{d\theta_i}{dt} = \omega_i + \frac{K}{n} \sum_{j=1}^n \sin(\theta_j)$$

From: In vitro characterization of the human segment

Noichl and Loettgers (talk, 2021), via Twitter

Scientific Controversy



Pence (2021?), in *The Dynamics of Science*, U. Pittsburgh Press

Discovery and Hypothesis

Digital Methods: When and Why?

In general: what kinds of things are these tools good for?

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HINT: There's a dilemma hiding here.

Serendipity

These are **extremely** useful tools for discovery, or for seeing patterns in a subject that you might never have expected.

Serendipity


Selected Properties

- Administrative Data
 - Acronym
 - EndDateYear
 - FundingScheme/Label
 - Program/ShortTitle
 - StartDateYear
 - Status
 - Topic/Label
 - TotalCost
- Participants
 - Coordinator Country
 - GRID: Participant's Org Type
 - Participant Country
 - Participant GRID-GADM: Level 2
 - Participant's Org Type
 - Participant_Abbv

Acronym :

Coordinator Country = NL

EndDateYear = 2018,2019

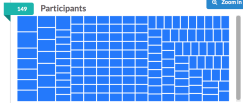


Year	Count
2017	15
2018	35
2019	100
2020	35
2021	45
2022	85

Participant Country = DE

Participant's Org Type = Higher or Secondary Education Establishments

Participants



Resources of type SignedGrantAgreement In Cordis H2020 Projects Dataset 2014-2020 (2016-12-22)

Title	1_Acronym
Inclusive Education and Social Support to Tackle Inequalities in Society	ISOTIS
Modelling and evaluating the socio-economic impacts of research and innovation with the suite of macro- and regional-economic models	MONROE
Authentication and Authorisation For Research and Collaboration	AARC2
Advanced European Network of E-infrastructures for Astronomy with the SKA	AENEAS
Scalable ObInious Data Analytics	SODA
Next Generation Stakeholders and Next Level Ecosystem for CoLaborative Science Education with Online Labs	Next-Lab
Up to University - Bridging the gap between schools and universities through informal education	Up2U
Generations and Gender Programme: Evaluate, Plan, Initiate	GGP-EPI
Astroparticle and Oscillations Research with Cosmics in the Abyss (ARCA and ORCA)	KM3NeT 2.0
Affordable zero energy buildings	A-ZEB
Technology Advances and Key Enablers for Module Integration for 5 nm	TAKEMIS
Organ on Chip in Development	ORCHID

1 Page(s): 1

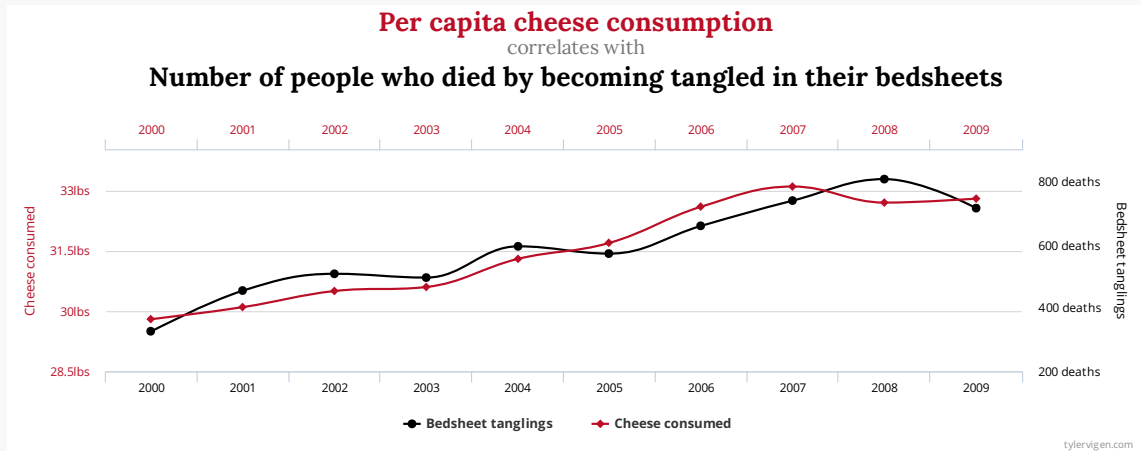
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10 GRAPH <http://risis.eu/cordis#2020> {
11 {
12 SELECT DISTINCT ?s WHERE {
13 GRAPH <http://risis.eu/cordis#2020> {
14 ?s rdfs:type
15 <http://risis.eu/cordis#2020/vocab/SignedGrantAgreement> .
16 ?s <http://rdf-
17 vocabulary.ddialliance.org/discovery#startDateYear> ?v1.
18 ?s <http://risis.eu/cordis#2020/vocab/coordinatorCountry> ?v2.
19 ?s <http://rdf-
20 vocabulary.ddialliance.org/discovery#endDateYear> ?v5.
```

Khalili et al. (2018), in *ESWC 2018*

Spurious Correlations

And yet: any dataset of reasonable size is guaranteed to be **loaded** with spurious correlations.

Spurious Correlations



Hypothesis-Driven Research

The idea: if we **abandon** the use of these datasets as serendipitous tools for discovery, and move toward hypothesis-driven research, we'll avoid spurious correlations.

What's the Problem?

1. Interpreting data through a preexisting theoretical frame – conflating **informing theory construction** with **theory testing**

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1. Interpreting data through a preexisting theoretical frame – conflating **informing theory construction** with **theory testing**
2. Letting the data determine our methodological choices – being too **flexible in analysis** can make room for biased conclusions
3. Difficulty in approaching material with an apt set of concepts – failing to understand our source material **on its own terms**

Looking Elsewhere

The “Preregistration Revolution”

The screenshot shows the OSFHOME interface. At the top, there is a navigation bar with 'OSFHOME' and a dropdown arrow, and buttons for 'Search', 'Support', 'Donate', 'Sign Up', and 'Sign In'. Below this is a breadcrumb trail: 'Estimating the Reproducibility of Experi...' followed by 'Files', 'Wiki', 'Analytics', and 'Registrations'. The main content area features the title 'Estimating the Reproducibility of Experimental Philosophy' with a '0.0B' size indicator and 'Public' status. A list of contributors follows, including Florian Cova, Brent Strickland, Angela Gaia Felicita Abatista, Aurélien Allard, James Andow, Mario Attie, James R. Beebe, Renatas Berniūnas, Jordane Boudesseul, Matteo Colombo, Fiery Cushman, Rodrigo Diaz, Noah van Dongen, Villus Dranseka, Brian D. Earp, Antonio Gaitán Torres, Ivar Rodríguez Hannikainen, José V. Hernández-Conde, Wenjia Hu, François Jaquet, Kareem Khalifa, Hannah Kim, Markus Kneer, Joshua Knobe, Miklos Kurthy, Anthony Lantian, Shen-yi Liao, Edouard Machery, Tanja Moerenhout, Christian Mott, Mark Phelan, Navin Rambharose, Kevin Reuter, Felipe Romero, Jonathan Scott Phillips, Paulo Sousa, Jan Sprenger, Thalabard Emile, Kevin Tobia, and others. Below the contributors, it shows the date created (2017-01-22 11:54 AM) and last updated (2020-01-17 01:57 PM), along with the DOI 10.17605/OSF.IO/DVKPR and the category 'Project'. A detailed description follows, explaining the project's focus on replicability in empirical data and its connection to the XPhi Replicability Project. It also provides the official website URL (https://sites.google.com/site/thexphireplicabilityproject/home) and social media links for Twitter and Facebook. At the bottom, it notes that there are supplemental materials for this project on PsycArXiv.

<https://osf.io/dvkpr>

Preregistration

Sometimes researchers use existing observations of nature to generate ideas about how the world works. This is called postdiction. Other times, researchers have an idea about how the world works and make new observations to test whether that idea is a reasonable explanation. This is called prediction. To make confident inferences, it is important to know which is which. Preregistration solves this challenge by requiring researchers to state how they will analyze the data before they observe it, allowing them to confront a prediction with the possibility of being wrong. (Nosek *et al.* 2018, p. 2605)

Why Preregister?

1. Have these data influenced my theoretical prediction?

“...we should only adjust our confidence in a theory in response to evidence that was not itself used to construct the theoretical prediction in question.”

2. Have these data influenced my choice of statistical test (and/or other dataset-construction/analysis decisions)?

“Flexibility in researcher decisions can inflate the risk of false positives.” (Ledgerwood 2018, p. E10516)

Herbert Butterfield (1900–1979)



The Whig Interpretation of History

...the tendency in many historians to write on the side of Protestants and Whigs, to praise revolutions provided they have been successful, to emphasize certain principles of progress in the past and to produce a story which is the ratification if not the glorification of the present. (Butterfield 1931, p. v)

The Whig Interpretation of History

Thanks in part to Butterfield, we now recognize such narratives as teleological, and we rightly suspect them of doing violence to the past by understanding and judging it with reference to anachronistic values in the present, however dear those values may be to our own hearts. (Cronon 2012:5)

But...

However, an inductivist philosophy of history is no less a philosophy of history because it is inductivist and widely shared by other historians. (Hull 1979, p. 2)

Butterfield

Our assumptions do not matter if we are conscious that they are assumptions, but the most fallacious thing in the world is to organize our historical knowledge upon an assumption without realizing what we are doing, and then to make inferences from that organization and claim that these are the voice of history. It is at this point that we tend to fall into what I have nicknamed the whig fallacy. (Butterfield 1931, pp. 23–24)

A First Question

What does it mean to be whiggish?

Which Background Theories?

[Butterfield] never suggests that we should or could shed our prejudices in the interests of a dispassionate scientific understanding of the past. (Jardine 2003, p. 132)

Although such events, ideas, and actions were never simple, and although we need our best technical skills to understand them, the histories we write typically end somewhere different from where they begin. A new thing emerges by the end of our story that was not there in the beginning. (Cronon 2012, p. 5)

A Second Question

Does whiggishness depend on the character of the subject matter?

Ernst Mayr

[The charge of whiggishness] was based on the erroneous assumption that a sequence of theory changes in science is of the same nature as a sequence of political changes. Actually the two kinds of changes are in many respects very different from each other. ...[I]n a succession of theories dealing with the same scientific problem each step benefits from the new insights acquired by the preceding step and builds on it. (Mayr 1990, p. 302)

Summing Up

1. What background knowledge can we legitimately have in mind “in advance?”
 - 1.1 Theoretical background? (Butterfield, Cronon)
 - 1.2 Knowledge of our data? (Nosek, Ledgerwood)
2. What characteristics of the material that we’re aiming to describe are relevant for our methodological choices? (Mayr)

From Literature to Philosophy of Science

A Framework

This is the author's accepted manuscript without copyediting, formatting, or final corrections. It will be published in its final form in an upcoming issue of The British Journal for the Philosophy of Science, published by The University of Chicago Press on behalf of The British Society for the Philosophy of Science. Include the DOI when citing or quoting: <https://doi.org/10.1086/715049> Copyright 2021 The British Society for the Philosophy of Science.

Digital Literature Analysis for Empirical Philosophy of Science

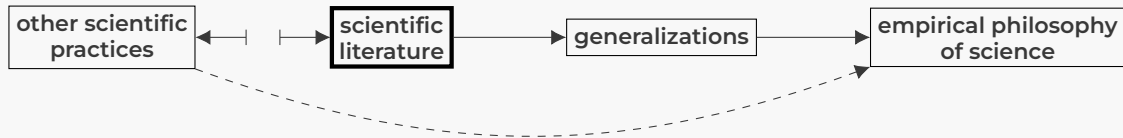
Oliver M. Lean, Luca Rivelli, and Charles H. Pence

Abstract

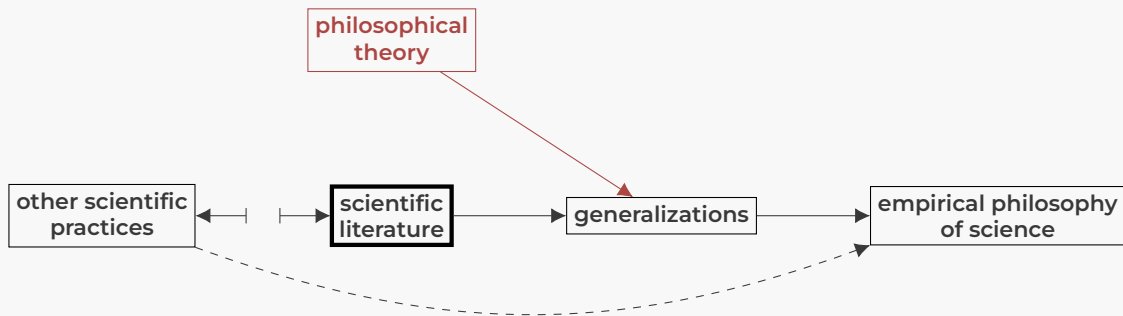
Empirical philosophers of science aim to base their philosophical theories on observations of scientific practice. But since there is far too much science to observe it all, how can we form and test hypotheses about science that are sufficiently rigorous and broad in scope, while avoiding the pitfalls of bias and subjectivity in our methods? Part of the answer, we claim, lies in the computational tools of the digital humanities (DH), which allow us to analyse large volumes of scientific literature. Here we advocate for the use of these methods by addressing a number of long-scale justificatory concerns.

Lean et al. 2021, BJPS, doi:10.1086/715049

A Framework



The Impact of Theory

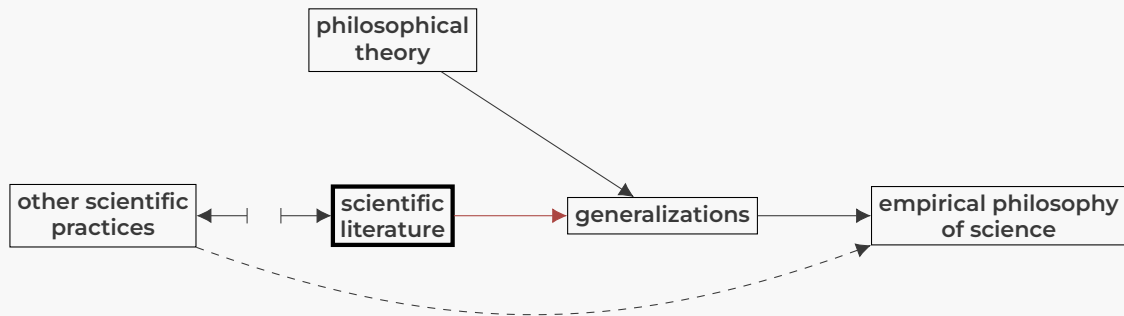


The Impact of Theory

It is obviously impossible to analyze texts “without philosophical beliefs.”

How should we evaluate the potential impacts (not to say biases?) of our prior philosophical commitments on these empirical analyses?

Methods and Data

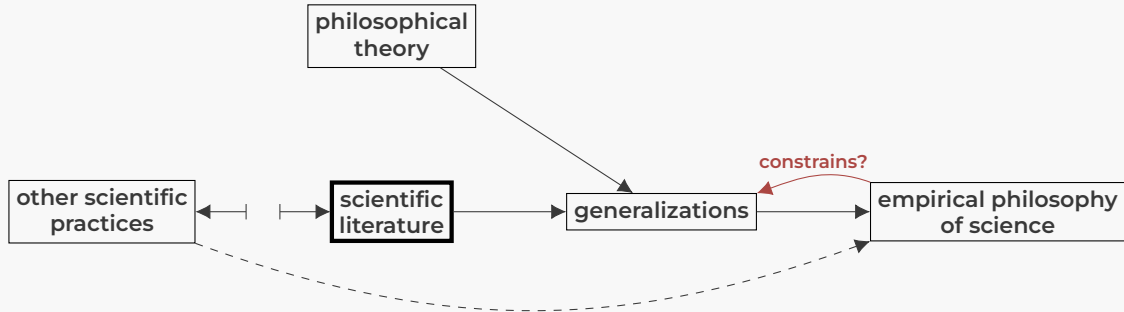


Methods and Data

What will **best practices** look like in the context of digital/empirical philosophy?

We're still in the earliest days of this work, but we need to build spaces for methodological discussion of this sort.

The Nature of Philosophy of Science



The Nature of Philosophy of Science

This question has only rarely been considered.
What might it look like?

Boyd on Realism

If what is at issue is the legitimacy of abductive inferences to theoretical explanations in general, then there is a kind of circularity in the appeal to a particular abduction of this sort in the defense of scientific realism. [...] I suggest that our assessment of the import of the circularity in question should focus not on the legitimacy of the realist's abductive inference considered in isolation, but rather on the relative merits of the overall accounts of scientific knowledge which the empiricist and the realist defend. (Boyd 1983, pp. 80–81)

Boyd on Realism

That is: there's a kind of **virtuous** circularity in arguments for realism. If realism really is the right meta-level stance toward the theories of science, this will in turn govern what kinds of inferences we can make in the philosophy of science!

Boyd on Realism

How much of this kind of “internal structuring” is present in different domains of philosophy, and to what extent does it ground a justification for “feedback” between our philosophical conclusions and our empirical research?

Concrete Future Steps

Build spaces for philosophers to:

- 1.** discuss methodological questions/best practices in detail,
- 2.** work to illuminate ways that our philosophical commitments affect our empirical work, and
- 3.** explore whether the nature of philosophical questions will alter that work.

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2. work to illuminate ways that our philosophical commitments affect our empirical work, and
3. explore whether the nature of philosophical questions will alter that work.

It's not clear that any of this work is currently publishable in philosophy journals!

The Moral?

Though Butterfield himself did little to resolve the issue of the proper uses of theory, he was surely right to agonize about it.
(Jardine 2003, p. 135)

Questions?

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