Pursuitworthy Experiments: A Virtue-Economic Account

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Abstract

It has been argued that pursuitworthy theories can be tracked by paying attention to certain theoretical virtues such as potential explanatory power, scope, and simplicity. Here I employ that idea to provide an account of the pursuitworthiness of experiments. I argue that pursuitworthy experiments can be tracked by overarching epistemic and pragmatic virtues such as signal clarity, precision, and experimental simplicity. Drawing from Peirce's idea of an economy of research, I argue that some virtues promote pursuitworthiness by increasing an experiment's epistemic gains, while others achieve this by decreasing the experiment's costs.

Keywords: Pursuitworthiness; Experiment; Theoretical Virtues

1 Introduction

The concept of pursuitworthiness goes back to Larry Laudan's (1977) distinction between two "contexts" or modes of appraisal.[2] In the context of acceptance, according to Laudan, scientists are choosing the theory that they can treat as if it were true. In the context of pursuit, by contrast, scientists decide what theories they will "work on". Working on a theory can be motivated by the desire to improve that theory or because that theory is considered particularly fruitful, but it does not require that the theory is acceptable. Since Laudan introduced this distinction, many philosophers have discussed a series of epistemic and pragmatic virtues as indices for theory promise, such as potential explanatory power, simplicity, and scope.

In addition to these virtues, testability and the availability of appropriate empirical strategies are frequently mentioned as key criteria for a theory's pursuitworthiness (e.g., Whitt 1992; Fleisher 2022; King 2025). The pursuitworthiness of such empirical strategies itself, however, has attracted comparatively limited philosophical attention (see Laymon and Franklin 2022; Franklin and Laymon 2024; contributions to Fischer and Fábregas-Tejeda forthcoming, for recent exceptions). In particular, we have little understanding of the overarching criteria that make an experiment pursuitworthy.[3]

In this paper I propose an account of the pursuitworthiness of experimentation, or short: experimental pursuitworthiness. Drawing from extant literature on the pursuitworthiness of theories and the epistemology of experimentation, I argue that overarching epistemic and pragmatic

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[3] There is, of course, a sizeable literature in the epistemology of experimentation that concerns the *acceptability* of experimental results (e.g., Collins 1985; Franklin 1989; Boyd 2021).

virtues can be employed to assess and guide experimental pursuits. That is, like theory pursuits are guided by theoretical virtues, experimental pursuits are guided by experimental virtues such as clarity of signal, precision, and experimental simplicity. More specifically, I argue that these virtues fall into two overarching categories. On the one hand, there are virtues that promote pursuitworthiness by increasing expected epistemic gains. On the other hand, there are virtues that promote pursuitworthiness by decreasing the experiment's costs. Choosing and designing pursuitworthy experiments requires apt balancing of the virtues in these categories.

In Section 2, I review and discuss extant accounts of theoretical pursuitworthiness that assign a central role to virtues. In Section 3, I turn to experimental pursuitworthiness. Taking inspiration from Peirce, I argue that experimental pursuitworthiness depends on expected epistemic gains and the experiment's costs. In Section 4, I argue that such gains and costs can be assessed through the lens of epistemic and pragmatic virtues that have been central to extant discussions in the epistemology of experimentation, and for which Peter Mättig and Michael Stöltzner (2025) have recently coined the term "experimental virtue". In Section 5, I address in more detail how such virtues can be employed to assess and guide experimental pursuits. Section 6 discusses a few limitations of my account.

2 Pursuitworthiness and Theoretical Virtues

The philosophical literature on the pursuitworthiness of theories is motivated by two questions.[4] First, what are the overarching principles that guide scientists' decisions to work on a theory or research program, given that they cannot know in advance the ultimate outcomes of such research? Second, how can it be rational that scientists sometimes choose to work on theories that are evidently less acceptable than their best-established competitors?

Philosophers of science have discussed a series of indices or indicators of theory promise that guide scientists' decisions and that help construe such decisions as rational. According to Laudan (1977), for example, it is not a theory's actual problem-solving capacity that determines its pursuitworthiness but the *rate* at which the theory succeeds at solving problems. According to McMullin (1976), a theory needs to be equipped with a powerful heuristic that helps address new problems. Whitt (1992) identifies strong analogies and useful experimental strategies as important parts of such a heuristic.

More recently, several authors have linked discussions of pursuitworthiness to theoretical virtues or values. Talk of virtues or values[5] goes back to Kuhn (1977), who argued that in choosing a theory, scientists are guided by certain overarching criteria such as empirical adequacy, internal and external consistency, simplicity, scope, and fruitfulness. Others have expanded the list of criteria to also include features such as explanatory depth, unification, and applicability (Keas 2018).

The basic idea is that theories are pursuitworthy insofar as they instantiate certain theoretical virtues. Thus, virtues are not only decisive when scientists choose what theory to accept. They

[4] See also related discussions on fertility (McMullin 1976; Schindler 2017), fruitfulness (Ivani 2018; Haufe 2024), and promisingness (Shan 2020).

[5] Kuhn uses the term "value" instead of "virtue". "Value" puts an emphasis on the evaluator's preferences. Virtue, instead, emphasizes that we are concerned with the properties of a specific theory or experiment. As is common in the literature, we will use the terms interchangeably.

already play an essential role in earlier stages of inquiry when theories are being developed. Moreover, it has been argued that even episodes commonly understood as instances of Kuhnian theory choice are better reconstructed in terms disagreement about pursuitworthiness (Lichtenstein 2021). According to Lichtenstein, disagreement between adherents of geocentric and heliocentric astronomies, for example, was not a matter of choice between two completed scientific theories. Instead, it is better understood as disagreement about what theory will be more successful down the road.

There are several proposals as to how the relation between virtues and pursuit is to be spelled out. Šešelja and Straßer (2014), for example, develop a coherentist approach that identifies potential explanatory power, potential consistency, and potential inferential density as key criteria, where potential inferential density comes down to "the presence of a unified core of hypotheses" (3126). Douglas (2013) introduces a double distinction between (1) values that act as minimal criteria and values that act as desiderata, and (2) values that relate to a theory per se and values that are applied to theories in relation to evidence. She identifies values that are mere desiderata and relate to theories per se as particularly relevant for pursuitworthiness, mentioning "scope, simplicity, and (potential) explanatory power" (800) as examples. Finally, Duerr and Fischer (2025) take up this line of reasoning and embed it within an "economic" framework, arguing that pursuitworthiness comes down to balancing epistemic benefits and costs where theoretical virtues act as proxies for such benefits and costs.

The current paper agrees with the foregoing approaches that theoretical virtues can play an essential role in the assessment of pursuits. Yet there are also a few important limitations to the guidance given by such virtues, limitations that should be kept in mind for the following discussion.

First, consider the kinds of decisions that are facilitated by theoretical virtues. They will to some degree guide decisions between theories that address the same (or roughly the same) research object, such as in the case of the competing geocentric and heliocentric astronomies. They do not, however, facilitate decisions between theories that address widely different domains. Even if research on theories like the Standard Model of particle physics and the psychological theory of behaviorism could be competing for the same research funds, theoretical virtues will do little to help us decide between them. Note that this isn't an issue when it comes to theory acceptance, because in the context of acceptance there simply is no relevant sense in which the Standard Model of particle physics competes with behaviorism.

Second, in the context of pursuit virtues are not employed to choose between two (or more) theories that are completed. Instead, they are primarily employed to assess the prospects of theories that are in a developing stage. Importantly, this implies that there can be considerable leeway regarding how such theories will be developed—a development in which guidance by virtues can be central. That is, often virtues are employed to guide *how* theories are to be developed in addition to determining *what* theories are to be chosen.

Third, while virtues can play an important role in assessing and guiding theoretical pursuits, they never act in isolation. They need to be combined and complemented with local and specific desiderata and criteria. Empirical adequacy can only be assessed in light of relevant evidence, external consistency only in light of the theories and principles that our theory needs to be consistent with, and potential explanatory power only in light of what phenomena are to be explained.

3 Pursuitworthy Experiments

In what follows, we will employ the notion of virtue to shed some light on the pursuitworthiness of experiments. Like theoretical virtues help theoreticians identify pursuitworthy theories, I will argue, experimental virtues help experimentalists identify pursuitworthy experiments. Before I go on and explain that analogy in more detail, I will make a few remarks about the pursuitworthiness of experiments.

Philosophical debates so far have mostly focused on the pursuitworthiness of theories. Only more recently have philosophers of science started to employ the concept of pursuitworthiness to also address experimental practices (Laymon and Franklin 2022; Franklin and Laymon 2024; contributions to Fischer and Fábregas-Tejeda forthcoming). Importantly, while experimental pursuitworthiness certainly depends on the pursuitworthiness of the theories that are being addressed, it does not reduce to it (Fischer 2026). For a theoretical research question, there are usually many ways to address it experimentally. Moreover, experimentation can have considerable autonomy from theory (e.g., Hacking 1983; Steinle 1997). In particular, there arise distinct issues of concept use (DiMarco 2025), error management (van Panhuys and Jadreškić 2026), and science funding (Shaw 2025).

The key concern in experimental pursuitworthiness is optimal use of scarce resources. This motivates taking inspiration from the Peircean idea of an *economy of research* (Peirce 1960; Rescher 1976; Nyrup 2015): we should perform experiments that we can expect will give the highest return on investment, that is, high epistemic gain at low costs.

Epistemic gains can be of various kinds, including new and more data and the discovery of new phenomena. Eventually such data and phenomena will be valuable in so far as they can be related to new or extant theories, models, and hypotheses. Epistemic gains can also be of an indirect character. They can consist in establishing new instrumentation, the development of novel methods and researcher training. Costs are primarily the funds required for performing research, for example, for setting up and running a lab with required facilities and researchers. Cost assessment is highly contextual. For example, the costs will depend on the infrastructure that is already in place in the lab in which it is pursued. Apart from such financial costs considerations of pursuitworthiness should also reflect non-financial costs associated, for example, with moral hazards. Moreover, pursuit of an experiment can come with additional costs that derive from withholding a verdict regarding the hypothesis under consideration (Han 2026).

This framework raises two questions. First, how can we assess the expected epistemic gains and costs of an experiment? Second, given such an assessment, how can we compare the expected epistemic gains and costs of competing pursuits? In what follows, I aim to make some progress on the first issue by discussing a series of indicators for epistemic gains and costs. The second issue will not be covered in detail because it is hard to address at the level of generality of the current discussion.[6]

[6] Note that epistemic gains are often hard to compare with concrete financial costs, especially in foundational research. Comparisons between the epistemic gains of competing projects are harder the more widely the research addressed questions differ. See Section 6 for further discussion. See also (Duerr and Fischer 2025) for a more extensive discussion of the economic framework in the context of theory pursuit.

4 Experimental Virtues

What we need are criteria that help us assess an experiment's epistemic gains and costs. This is where experimental virtues come in. The concept of experimental virtue—as an analogue to theoretical virtues—has recently been introduced by Mättig and Stöltzner (2025), and it is backed up by other epistemological discussions of overarching epistemic and pragmatic features that make experiments particularly powerful (see, e.g., Schickore 2019; Currie and Levy 2019; Boyd and Matthiessen 2024). Below, we will give a more detailed characterization of the concept of experimental virtue. Before that it will be useful to discuss some concrete instances.

We begin with features that promote an experiment's epistemic benefits. In general, an experiment will be particularly suited to yield epistemic gains if (or insofar as) its results clearly reflect a signal of a phenomenon of interest, its results are precise and not overly dependent on theoretical assumptions, and its sensitivity is broad.

Consider *signal clarity*. Ideally an experiment should pick up only the signal of the phenomenon that is of interest. However, typically the experimental result will be affected by various kinds of background processes, resulting from the measurement instrument itself, features of the phenomenon that are not of interest to the inquiry, and various other causal factors that interfere with the experiment. All else being equal, an experiment will improve insofar as it succeeds in shielding the phenomenon of interest against any such background processes. Alternatively, an experiment can be improved by apt characterizations of backgrounds, that is, by measuring them independently or by modelling them such that they can be subtracted from the recorded data, giving a clearer picture of the phenomenon of interest (Boyd and Matthiessen 2024).[7]

Another virtue is *precision*, which is the "closeness of agreement between independent test results" (ISO 2026, Sec 3.12). According to this definition, "precision depends only on the distribution of random errors and does not relate to the true value [...]".[8] The higher the expected precision of an experiment is, the more informative will its results be. Therefore, every increase in precision will also increase the expected epistemic benefit of the experiment.

Moreover, the *directness* of observation that is facilitated by an experiment increases that experiment's expected epistemic gain. Direct observation is favored over indirect observation because it limits the dependency of the observational result on additional theoretical assumptions. The epistemic gain of direct observation is higher in this sense in so far as its evidential value does not require commitment to these additional theoretical assumptions. Whether and to what degree directness is an epistemic asset, of course, depends on the theoretical assumptions. The more speculative those assumptions are, the more they inhibit potential epistemic gains.

Finally, *broad sensitivity* means that the experiment can distinguish between a large number and variety of conditions. Such broadness plays multiple roles in promoting epistemic gains. First, it enhances the experiment's ability to characterize the phenomenon in a variety of ways. If the "precipitating conditions" (Boyd and Matthiessen 2024, 125) in an experiment are easily discriminated and highly variable, this facilitates a broader and more detailed understanding of the

[7] For similar considerations relevant to the life sciences see discussions of experimental control (Schickore 2019).

[8] Such distortions from the true value are instead quantified by a measurement's *accuracy*. Some have described this latter characteristic as precision (see, e.g., Mättig and Stöltzner 2025).

phenomenon in question. For example, Ampère's ability to vary the relation between a wire with electric current and an astatic needle allowed him to characterize the magnetic field surrounding that wire in a more comprehensive way (Steinle 1997). Second, broadness of sensitivity also increases an experiment's ability to produce unexpected results. For example, Penzias' and Wilson's (1965) radio astronomic antenna was sensitive to a broad variety of radiation phenomena. This facilitated the discovery of the Microwave Background radiation—something that Penzias and Wilson did not at all expect when they were operating their antenna. Third, the broadness of sensitivity plays also an indirect epistemic role by allowing cross checking (Mättig and Stöltzner 2025). If an experiment is sensitive to a variety of phenomena one can increase one's confidence in the apparatus by calibrating it with known phenomena, before it is employed to test the unknown.

The list of virtues given here is not exhaustive. For example, additional criteria are the *absence of* or the *ability to control systematic errors* (Staley 2020). Moreover, an experiment's *technological novelty* can be seen as an indicator that it will produce epistemic gains (Laymon and Franklin 2024). In addition, an experiment's *interactivity* can facilitate the experimenter's understanding of the research object (Murphy et al. forthcoming). Finally, an experiment's *replicability* will render its results more trustworthy and thus epistemically valuable.

Similar overarching virtues can be identified as proxies for experimental costs. Here we focus on simplicity and continuity with extant practices. First, simplicity of design will be a key factor. All things being equal, the simpler an experimental design the cheaper it will be to set it up and to maintain its functionality. 'Simplicity' of an experiment, of course, has various dimensions. Among other things, it can refer to the technological simplicity, the ease of operation, and the kind of direct understanding that the experiment facilitates. An example for the latter case is the Meselson-Stahl (1958) experiment, which established the hypothesis of semi-conservative replication, by tracking the ratios of light and heavy nitrogen isotopes in bacteria DNA (Ivanova 2023). This form of simplicity should clearly be distinguished, for example, from technological simplicity of instrumentation.

Another overarching virtue that will help control an experiment's costs is its continuity with extant experiments and experimental practices. Insofar as an experiment continues an existing tradition, it may allow the transfer of skills and of material and organizational resources. For example, Myers (2021) argues that the Future Circular Collider is a promising follow-up project to the Large Hadron Collider at CERN because it continues a successful research tradition of circular particle colliders. Moreover, Myers contrasts this with cases in which a lack of such continuity inhibited or even prevented success. An example is the failure of the Superconducting Super Collider (SSC) that was supposed to be built in Waxahachie, Texas. A central reason for the failure, according to Myers, was that "Waxahachie was a 'green field' site without existing accelerators and poor infrastructure" (7). This is a problem because the "development of an accelerator complex like that of Fermilab, Stanford, Brookhaven and CERN takes decades" (ibid.).

5 Experimental virtues and pursuitworthiness

What exactly is the role of these virtues in experimentalists' decision making? The key idea here is that they act as proxies for the experiment's expected epistemic gains and costs and thereby guide assessments of an experiment's pursuitworthiness. The clearer the signal, the higher the precision, the more direct the measurements, and the broader the sensitivity is, the higher are the epistemic gains that can be expected from the experiment. Likewise, the simpler and the more continuous with extant practices an experiment is, the lower its costs will be.

It seems that the above-mentioned virtues do not just have a close relation to matters of pursuitworthiness but also to the acceptability of experimental results. This should not be surprising. Pursuitworthy experimentation should aim for acceptable results. Thus, all else being equal, the more acceptable we can expect an experiment's result to be, the more pursuitworthy the experiment is. Accordingly, any virtue that increases a result's acceptability will thereby increase the experiment's pursuitworthiness. Replicability, for example, increases the pursuitworthiness of an experiment in virtue of enhancing the acceptability of the experiment's results. The converse, however, is not true. A virtue may increase an experiment's pursuitworthiness without thereby increasing the acceptability of that experiment's results. Broad sensitivity can enhance an experiment's pursuitworthiness by increasing its epistemic output without making each item of that output more acceptable, per se. As mentioned above, broadness of sensitivity may facilitate cross-checking and thus increase acceptability, but it does not have to facilitate it, when the targeted phenomena are sufficiently diverse. Moreover, Simplicity and continuity promote pursuitworthiness by lowering an experiment's costs. Here as well, pursuitworthiness is achieved quite independently of considerations regarding the acceptability of the experiment's result: whether an experimental result should be accepted or not will not depend on the costs incurred by the experiment.

Recall that Kuhn (1977) describes theory choice as a matter of "value judgment". Values provide "effective guidance in the presence of conflict and equivocation" (362). Here Kuhn alludes to the fact that when two agents subscribe to the same set of values, there is still plenty of room for disagreement. When values stand in tension, agents can have diverging views on how to weigh those values. Moreover, there is considerable leeway regarding how the values are to be spelled out. Theoretical simplicity, for example, can refer to the simplicity of the entities posited by the theory or to the tractability of the theory's equations.

The same holds for experimental virtues. First, the above-mentioned virtues can stand in tense trade-off relationships. For example, usually an increase in signal-to-noise ratio or precision requires shielding the experiment against additional interfering factors, which usually makes an experiment more complex and more expensive. Likewise, experiments that seek to maximize precision are not necessarily the ones that lead to versatility. The muon g-2 experiment at Fermilab, for example, determined the anomalous magnetic dipole moment of the muon to unprecedented precision (Aguillard et al. 2025). But the experiment is not versatile, as its sole purpose is determining that constant with maximum precision. Consequently, decision-making in concrete cases will depend on how virtues are to be weighed, whether, e.g., precision or versatility should be given priority. Moreover, two individuals subscribing to the same set of virtues may still come to different judgements as to what experiment should be pursued. As pointed out above, for example, the criterion of experimental simplicity can impose potentially conflicting demands on experimental design.

Moreover, note that the weights and precise meanings of the discussed virtues will depend on the purpose of experimentation. What matters for hypothesis testing is (1) an indication that the hypothesis is epistemically relevant and (2) that the test will warrant a clear verdict on the hypothesis at (3) reasonable costs. These demands are promoted, for example, if the experiment has a favorable signal-to-noise ratio and achieves its results with a high precision. What matters for exploratory experimentation (see, e.g., Steinle 1997) is (1) some initial motivation that the surveyed parameter space will yield relevant insights and (2) that the experimental facilities are sufficiently versatile to cover a wide range of parameters at (3) reasonable costs. Here signal-to-noise ratio and precision will certainly also play a role, but they will be traded more readily against the experiment's broadness of sensitivity and interactivity.

6 Limitations and Clarifications

I anticipate a series of objections to the proposed account of experimental pursuitworthiness. First, I have argued that what matters for an experiment's pursuitworthiness is how epistemic benefits and costs are balanced. Moreover, I have argued that, on the most general level, experimental virtues act as indicators of epistemic gains and experimental costs. However, there is a question as to what kinds of comparisons between experiments are facilitated by this. Note that there are two kinds of contrastive judgements of experimental pursuitworthiness. Two experiments can be competing as approaches to the same research questions. Under such circumstances clear criteria for pursuitworthiness may be derived from the above-discussed virtues. For example, comparisons between competing particle collider proposals can be made in considerable detail (see Fischer 2026). However, experiments often compete for the same resources even if they have widely different epistemic goals. This case is more challenging because it is much harder to compare the epistemic outputs if the experiments concern different scientific domains. It would be an unwarranted inference to say that Penning traps (see Huggett and Schneider 2025 for discussion) are more pursuitworthy than large particle colliders because Penning traps are simpler and cheaper. The reason is that Penning traps simply do other things than particle colliders. A full answer to these issues of pursuitworthiness would require a more far-reaching assessment of the epistemic gains to be expected from probing high energy levels as opposed to precision measurements at low energy levels (Koberinski 2026). Such comparisons become increasingly difficult, the larger the difference is between the research questions that are being addressed. If two experiments from widely different fields compete for the same resources, there may simply be no meaningful comparison of epistemic pursuitworthiness.

Second, in the context of pursuit we are not dealing with the acceptability of experimental results, nor are we concerned with fully determined experimental designs. Instead, we assess the prospects of experiments that are in a developing stage. As in the case of theory, this implies that there can be considerable leeway regarding *how* such experiments will be designed and performed—a development in which guidance by virtues can be central. Analogously to the case of theory development, often virtues are employed to guide *how* experiments should be designed and performed in addition to determining *what* experiments are to be chosen.[9]

Third, one may be worried that the guidance provided by features as abstract as the discussed virtues is not sufficiently informative to be relevant to practicing scientists. I agree that in addition to the above-mentioned virtues other, more specific and contextual, constraints are needed to assess experimental pursuits. As in the case of theoretical virtues, experimental virtues never act in isolation. Signal clarity requires concrete assumptions about the nature of the signal, the degree of precision to be reasonably expected from an experiment requires an understanding of one's instruments, and continuity with extant practices is beneficial to new projects only insofar as insights from past experiments are transportable to the new experiment.

In summary, my response to these potential objections is to concede that the role of virtues is limited in important regards. But the point is that the assessment of experimental pursuits thereby faces challenges that were already present in the assessment of theoretical pursuits as discussed in Section 2.

7 Conclusion

In this paper I have proposed an account of the pursuitworthiness of experiments. I have argued that just as in the case of theory, there are overarching epistemic and pragmatic virtues that indicate an experiment's pursuitworthiness. More specifically, there are virtues that track the expected epistemic gains of an experiment and virtues that track costs. Experimental pursuits are, thus, guided by the need to balance these virtues accordingly. Such guidance is largely domain-restricted, often concerns *how* experiments are to be performed, and importantly depends on contextual characteristics of the experiments in question.

[9] See Dolcini et al. (2025) for a related distinction for experiments in neurolinguistics.

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