



October 2023

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Recommended Citation

Baker, David (2023) "Pluralism and Foundationalism in the Applied Sciences," *International Journal of Undergraduate Research and Creative Activities*: Vol. 6: Iss. 2, Article 3.

DOI: <https://doi.org/10.7710/2155-4838.1096>

Available at: <https://digitalcommons.cwu.edu/ijurca/vol6/iss2/3>

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Pluralism and Foundationalism in the Applied Sciences

Abstract

Nancy Cartwright develops her scientific pluralism within *The Dappled World* and argues for its supremacy over foundationalism. Cartwright believes that the sciences should be applied for humane benefits and not for knowledge's sake alone. However, Cartwright does not give enough credit to the practical applications produced by foundationalists. Cartwright's goals are not hindered or detracted from when working with foundationalists. In fact foundationalism and pluralism offer complimentary means of practical application, the outcome of which is a bettered ability to apply our sciences towards practical concerns than either position offers alone. I will use exemplary cases demonstrating these isolated shortcomings and complimentary benefits to advance this position.

Pluralism and Foundationalism in the Applied Sciences

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Published online: 4 June 2014

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Abstract

Nancy Cartwright develops her scientific pluralism within *The Dappled World* and argues for its supremacy over foundationalism. Cartwright believes that the sciences should be applied for humane benefits and not for knowledge's sake alone. However, Cartwright does not give enough credit to the practical applications produced by foundationalists. Cartwright's goals are not hindered or detracted from when working with foundationalists. In fact foundationalism and pluralism offer complimentary means of practical application, the outcome of which is a bettered ability to apply our sciences towards practical concerns than either position offers alone. I will use exemplary cases demonstrating these isolated shortcomings and complimentary benefits to advance this position.

Whether we understand our scientific theories as unified or plural is an important question for the philosophy of science. The stance we choose has implications respecting the applied sciences, where science is meant to alter the world and better human lives. Foundationalists advance the unified perspective, arguing for a full reducibility of our scientific theories to a single science. Contrarily, the pluralist claims that the sciences are not entirely reducible to each other or to a single science.

In *The Dappled World*, Nancy Cartwright argues that foundationalism is less effective in solving immediate real world problems. However, Cartwright's goals that are characterized by immediate application and practicality are not thwarted by the unified stance she rejects. If there are instances where both scientific perspectives aren't in conflict but are complimentary to each other, they aren't in opposition to Cartwright's practical goals. To show the absence of conflict between Cartwright's pluralism and foundationalism I will present cases showing the shortcomings of each when isolated, but also the benefits of both when cooperating. These exemplary cases demonstrate the positives and negatives of foundationalism and Cartwright's pluralism when in isolation versus when in cooperation. Through these cases I advance that a mutual acceptance between the two perspectives is better fulfilling of Cartwright's practical aims than either when operating in isolation.

1. Cases

Case 1: SQUIDs (Super Conducting Quantum Interference Devices) are hospital devices that, according to Cartwright, “can make very fine measurements of magnetic fluctuations that help in the detection of stroke victims.”¹ Based on the hospital’s findings, individuals who have had a stroke can be treated prudently. The knowledge of whether a stroke has occurred is of clear importance when designing rehabilitation. Individuals left untreated face declining health and wellbeing in a variety of ways, such as decreased mental functioning and increased dependence on regular assistance.

Case 2: Hunger and starvation are genuine concerns for many people. Scientists can use available technology to chemically and genetically alter methods of food production to increase yields. There can be more food produced, but that food may be unhealthy and contributive to many unforeseen problematic side effects in the future. It is hardly better solving a problem by causing another future one.

These cases will be treated in turn.

2. Why Foundationalism Needs Cartwright’s Pluralism

Cartwright’s account of nomological machines is demonstrative of how situational knowledge can be developed as practical applications. These nomological machines are how we are able to develop scientific laws about a particular domain of the world in a realist sense. They are the bridges that tether our theories to the empirical world modeled in the theories. Scientists perform this modeling by deciding what object’s behavior they wish to observe and subsequently aim to fulfill these observations through experimentation. To gather this data, scientists must reduce and neutralize the impeding variables of the experiment that must necessarily be removed for the object under investigation to behave as theories predict. Thus we have an arrangement of controlled variables that produce a causal sequence, whose consistent outcome will regularly be produced as long as the conditions of the variables are upheld to a sufficient degree. Cartwright labels this causal sequence a nomological machine. A nomological machine is “a fixed (enough) arrangement of components, or factors, with stable (enough) capacities that in the right sort of stable (enough) environment will,

¹ Nancy Cartwright, *The Dappled World: A Study of the Boundaries of Science* (Cambridge: Cambridge University Press, 1999), p. 29.

with repeated operation, give rise to the kind of regular behavior that we represent in our scientific laws.”²

The nomological machine is representative of what conditions must be altered and maintained to produce regular and reliable results with respect to the expected behavior of the object and the factors guiding and influencing its behavior. If the various influencing factors have been accounted for so that the nomological machine produces regular and predictable results, a scientific law can be determined and established.

Because of the particularity of nomological machines, operating from this ‘dappled’ approach allows intervention in the world by applying our situational knowledge to specific issues of immediate concern that we wish to alter in some humane way. The humane concerns focused on in these cases are health related concerns. In light of this qualification, Cartwright’s “ultimate concern in studying science is with the day-to-day world where SQUIDS can be used to detect stroke victims and where life expectancy is calculated to vary by thirty-five years from one country to another.”³

There is a focus of immediacy driving Cartwright’s efforts. She wishes to apply the sciences to the here and now to help people who are suffering in various ways presently. Cartwright’s rejection of the unified stance is largely based on this concern. She feels that the goal of unification is less practically beneficial and is a metaphysical hope not strictly based on our empirical sciences or concrete evidence. A unified theory is not warranted by evidence in light of our current standards of scientific empiricism, according to Cartwright. Not to say we have evidence of its falsity, but simply that we do not have evidence presently for its truth based on data or observations. Instead of simply believing in such an ideal theoretical construct absent of sufficient evidence, scientists should establish laws “when we have direct empirical evidence... but not merely because they are the ‘best explanation’ for something which may well have no explanation.”⁴

Cartwright states that a unified theory is a metaphysical hope because it presently does not satisfy our science’s empirical standards that require evidential data. Thus the truth of unification is presently indeterminable through our scientific empiricism. But this is an independent claim from whether or not efforts towards this goal produce beneficial applications in the real world. Cartwright’s claim seems to disregard applicable benefits that aren’t purposefully developed towards particular practical ends but that fall out of more general theories when a situation presents

² Nancy Cartwright, *The Dappled World: A Study of the Boundaries of Science*, p. 50.

³ Nancy Cartwright, *The Dappled World: A Study of the Boundaries of Science*, p. 5.

⁴ Nancy Cartwright, *The Dappled World: A Study of the Boundaries of Science*, p. 31.

itself. Examples of such practical benefits are finding applications for theories that those theories weren't explicitly tailored for, like being able to model aspects of intelligence, a psychological phenomenon, through theories within thermodynamics, a physical phenomenon. Likewise she overlooks the role that a unified approach to science plays when being utilized by the 'dappled' approach when developing practical nomological machines, which is related to the development of theories not specifically tailored for a specific circumstance.

Many valuable discoveries made by individuals operating from the foundationalist perspective are utilized even today, such as Newtonian Physics in the launching and maintaining of satellites or transporting people and things all over the world. Despite Newton having goals of unification, his theories do have practical import, which are extremely useful to scientists like Cartwright who may not pursue the same goals, but who can utilize the successes of such pursuits with no difficulty. Cartwright's focus of developing tailor made theories that are applicable to specific situations of immediate ethical concern utilizes both classical Newtonian and quantum mechanics within her own work on SQUIDS. Thus without these foundationalist's prior efforts, her utilization and application of their theories would be much more complex if even possible at all. All we know is they were discovered and they are presently helpful, even if their development wasn't necessarily guided by Cartwright's practical constraints.

Practically speaking, it is unnecessary for theories to be reduced to each other entirely for possible positive applications; the parts of the theories used simply must produce a nomological machine with consistent results when relevant conditions are upheld in a controlled enough manner. The reduction of classical mechanics into quantum mechanics is far from being achieved, but utilizing the two congruently in the here and now works fine if they produce nomological machines, which Cartwright's SQUIDS are exemplary of.

3. Why Pluralism Needs Foundationalism

C.S. Peirce is an advocate for the unified perspective, which he argues for in "How To Make Our Ideas Clear." The different sciences to Peirce are pursuits hoping to attain knowledge of Truth. Given that different scientific domains are all pursuing truth within their own fields, Peirce contends that the science's paths will eventually converge on the same end. "With all scientific research... different minds may set out with the most antagonistic views, but the progress of investigation carries them by force outside of themselves to one and the same conclusion."⁵ The foundational structure that the theoretical sciences take from the unified perspective is founded on a hierarchy of more fundamental theories and laws. For example, in developing a

⁵ C. S. Peirce, "How to Make Our Ideas Clear," in *Philosophical Writings of Peirce*, Ed. Justus Buchler (New York: Dover, 1955), p. 38.

representative model, scientists develop their theories and use their theoretical model to observe whether the theory conforms to reality. If parts of what they observe fit this standard but others don't, what does is then more appropriately factored into the next model so as to have more constituents of the model that work. Thus the model evolves, getting closer to accurately representing more of what is really happening within the empirical world. Subsequently scientists can gain insights as to where to look for necessary experimental observations required to advance theoretical models from such a type of structuring. Scientists know what data would fill in gaps of a theory to make advancements towards unification. Unification here being a reduction of all theories to one or as few theories as possible that have universally applicable modeling capabilities.

Scientists then have directives as to the empirical domains that they should study for required data based on the information available to them. Scientists don't just probe in the dark, but use past successes and current theories to help instruct them as to how to advance their theories. They receive guidance towards future hypotheses by analyzing presently available theories and looking for empirical data that fill in gaps within the accuracy of the modeling of the theory.

But the issue Cartwright has with this approach is that matters of humane importance may fall outside of the situations delineated by this progressive structure of advancement towards unification. There are prudent hypotheses that differ from this sort of structuring based on foundational predecessor theories. When faced with situations we wish to alter, certain hypotheses may be practically useful despite not contributing towards the unification of our sciences generally. In instances like these, such as treating individuals with SQUIDS, it is more beneficial to develop domain specific nomological machines that can be used immediately. Given that many ethical problems are constrained temporally, such as properly treating stroke victims with deteriorating health, the immediacy in which we can address these issues is of immense practical importance. But despite being extremely important, immediacy is not the only concern when addressing problems; foresight is always necessary to avoid replacing current predicaments with different unforeseen problems.

Individuals suffering from hunger can be helped by Cartwright's pluralism through developing nomological machines related to the production of food products. Foundationalists could help also, but they would be limited to depending on a theory already developed as opposed to quickly developing a useful one, which Cartwright is not constrained to. In either case, the technology is available to implement methods of chemical and genetic altering of agriculture and livestock to produce much higher yields. Subsequently, if the domain of situational knowledge is limited to alleviating hunger alone while not looking for other relevant factors, increasing the amount of food seems to bolster this aim. However, this limited domain is insufficient for taking

into account all of the relevant factors necessary to help the complex cases of people who suffer.

There would be more food, but it could possibly be much less nutritious and unhealthy, leading to unforeseen problematic side effects. A limited domain focused on increasing yields alone but not on, for example, maintaining or increasing nutrition is insufficient for representing and altering the living conditions of people who need help. If people who are starving simply trade one form of suffering in for another, their situation may have changed without becoming more satisfying and or hospitable. There must be a balance between immediate application and long-term foresight so that we don't just fix problems by replacing them with new problems to solve.

4. Conclusion: A Complimentary Relationship

If Cartwright and foundationalist scientists adopt a relationship of mutual cooperation and acceptance, the balance between short-term intervention and long-term prevention and avoidance would be bettered beyond what either stance could fulfill in isolation from the other. Cartwright should embrace individuals pursuing foundationalism congruently with pluralism. Aiming towards unification, whether it is possible or not, can serve valuable purposes by advancing our range of theories for scientists like Cartwright to utilize, subsequently extending the situational knowledge that our theories encompass. They also may happen to model instances warranting intervention, but this depends less on willful development towards such an end as to a situation presenting itself that we happen to know how to handle. These foundationalist advancements progressively amplify our current theories based on present information directing scientific pursuits. This amplification comes from finding the relevant data to further unify theories by looking at the shortcomings of present theories and searching for solutions.

But in instances that are not modeled by this sort of advancement, scientists can use tailor-made nomological machines suited for specific situations that we wish to willfully intervene in. Knowledge as to situations that the theory can model and be fitted-out towards would be gained, which is very valuable in conjunction with the more broad aims of foundationalist theories. The theoretical advancements produced by foundationalists are applied to immediate real world instances through nomological machines in the 'dappled' style and also produce a level of foresight absent from Cartwright's approach. Counter to what Cartwright suggests; the individuals who pursue unification bolster the efforts of the individuals from the 'dappled' perspective by deepening theoretical knowledge and developing more theories to utilize in the form of nomological machines.

If scientists transition to operating from only the 'dappled' perspective described by Cartwright, our array of theories that we fit-out into the empirical world would be

largely wounded. Individuals aiming for unification have developed many theories that are sampled from for particular nomological machines, including those of Cartwright's SQUIDS. Their efforts greatly benefit individuals like Cartwright in taking applicable pieces and applying them to real world issues. Without the efforts of these individuals aimed towards unification, applicable theories would be vastly reduced in the future because they would no longer be explicitly produced but would come only along with very specific applications of nomological machines, which some problems may not be so patient as to wait for.

These theories may not have been developed to apply to distinct and specific domains, but aspects of them are applicable to such domains when situated within a workable nomological machine. If scientists were to use the unified approach alone, our abilities to fit-out our theories into the real world would be greatly harmed. We could only apply our sciences when situations presented themselves that our theories worked with. We would not be able to work with our theories in a more malleable way to fit the situation, but would have to wait for the situation to be represented by our sciences, which could possibly never happen. And similarly Cartwright's approach is inadequate when operating in isolation in light of her practical goals. If this were the only perspective we occupied, our range of theories that scientists apply in more general and future oriented instances would be unimaginably contracted and trimmed. Given that our aims are focused on practicality in terms of positively affecting humane concerns, it seems quite evident that this end is met much better when using both approaches than either alone.

The unified stance can serve to develop theories that may at some point be hugely beneficial if the right situation presents itself, but even if this doesn't happen these theories also add to the theoretical toolbox that people like Cartwright sample from depending on the necessary task. Thus even if the goal of unification doesn't have any evidence to back it, it is still practically beneficial when applied in conjunction with nomological machines or when the right circumstance arises to work alone. However, in light of this shortcoming, in instances regarding immediacy it seems more practical to operate from the domain specific 'dappled' approach when time is constrained. But this does not take away from the benefits that arise from foundational theories. The benefits found in the foundational efforts alone would also be greatly increased. Even when foundationalists cannot model an important situation themselves they could be contributing forces to pluralists doing so, making their efforts practically prudent and beneficial.

The foundationalist perspective towards the sciences fosters advancements that produce beneficial outcomes when empirical situations become modeled by its theories. But this fitting-out is limited to using our current scientific pursuits for the future, or past discoveries in the present. But the 'dappled' approach can be used with immediate problems that we cannot simply wait for our theories to give us a solution.

This is an extremely important goal for the sciences given that we can gain knowledge about situations we inhabit and subsequently intervene if necessary. The sciences should be aiming to amplify and deepen our knowledge of these situations by strengthening our abilities to model the empirical world with representational theories. Cartwright's account of the conflict between the two perspectives seems to be a mistaken antagonism. They are not contradicting views at all; but are cooperating and complimentary views that can and should work side by side to better help people now and in the future.

Works Cited

Nancy Cartwright, *The Dappled World: A Study of the Boundaries of Science*. Cambridge: Cambridge University Press, 1999.

C. S. Peirce, "How to Make Our Ideas Clear." In *Philosophical Writings of Peirce*, Ed. Justus Buchler. New York: Dover, 1955.