

# Does Speculation Belong in Social Science Research?

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## Abstract

This article addresses the following question: Can speculation be used in social science research or should this not be an option? The secondary literature on speculation, which is minimal, is presented and discussed. It is noted that natural scientists often differentiate between a scientific form of speculation and the old metaphysical form of speculation. Following the lead of Charles Lave and James March in *An Introduction to Models in the Social Sciences*, close attention is also paid to the kind of speculation that is part of ordinary research, as opposed to the extraordinary type of speculation that can be found in the work of geniuses like Newton or Galileo. An attempt is then made to outline situations in which it is not only helpful but also necessary to speculate in social science. It is concluded that speculation is an important tool for social scientists if used with caution.

## Keywords

speculation, theory, empirical research, philosophy of science, conjectures

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The word speculation has two basic meanings: It refers to risky but potentially very profitable economic activities, and it refers to the making of conjectures without firm evidence. This article deals with the second of these two meanings. It especially attempts to answer the following question: Does speculation belong in social science research and, if so, how and when should it be used?

One way to begin a discussion of the role of speculation in social science is to see how speculation has been looked upon and used in other sciences. One would, for example, expect speculation to play more of a role in, say, astronomy and paleoanthropology than in botany and chemistry. One would also expect there to exist a relatively huge literature on speculation, especially if one includes not only the social sciences but also the natural sciences.

In searching for literature on speculation, however, one is soon faced with the surprising fact that the literature is minimal. There does not seem to exist one single monograph on the topic and the number of articles is miniscule.<sup>1</sup> This is not only true for the social sciences; it goes for all the sciences (plus philosophy and the philosophy of science).

This absence of work on speculation is peculiar since the words “speculation” and “to speculate” are commonly used by scientists, just as they are in everyday life. So why is there so little work on speculation? Is the reason perhaps that speculation is seen as an illegitimate and outmoded way of doing science of the type that was popular during the Middle Ages when science was seen as a form of metaphysics? Or is there some other reason, say that modern scientists have tried to use speculation but found it wanting?

An answer to these questions will be suggested later in this article. First, however, it is necessary to take a closer look at what is meant by speculation, so we know exactly what we are talking about. Given the paucity of scholarly material on the topic, it may be helpful to begin by consulting some dictionaries. This way of proceeding follows Durkheim’s (1964) advice for how to approach the task of formulating scientific concepts: “one always starts with the lay concept and the lay term” (p. 37). These are then used as one’s “suggestions and guides” for constructing a scientific concept.<sup>2</sup>

Two common definitions of speculation are the following:

The activity of guessing possible answers to a question without enough information to be certain. (Cambridge Dictionary 2017)

The forming of a theory or conjecture without firm evidence. (Oxford Dictionary 2017)

These definitions are vague, as everyday words often are. The demand to meet necessary and sufficient conditions does not apply here, and the reason for this is that ordinary dictionaries just try to signal the most common meaning of a word, not present a scientific definition.

Both of the definitions suggest that three features are typical for the way speculation is understood in everyday life. There is (1) a lack of facts that necessitates (2) guesses or conjectures, in order for someone (3) to understand a phenomenon. It is helpful to keep these three features in mind till a more precise definition can be presented later in this article.

### *Metaphysical Speculation*

The term speculation was used in ancient Greek philosophy, but in a very different sense from today (e.g., Aristotle 1924:1025-26A). Its current meaning, as illustrated by the two definitions just cited, seems to have appeared at the dawn of the modern age (Oxford English Dictionary 2000). During the Middle Ages, speculation became closely connected to a special version of metaphysics. From the late Renaissance and onward, however, Aristotelian science was attacked for relying on syllogisms and logical arguments, as opposed to the observation of facts. According to *Novum Organon* (1620) by Bacon (1999), “what in observation is loose and vague, is in information deceptive and treacherous” (p. 130).

In a work from the late 1600s, one can read the following attack on speculation for leading science astray in contrast to the method of using experiments:

We must consider, the distinction we have made of Speculative and Experimental, and, as much as possible, Exclude the first, for an indefatigable and laborious Search into Natural Experiments, they being only the Certain, Sure Method to gather a true Body of Philosophy, for the Ancient way of clapping up an entire building of Sciences, upon pure Contemplation, may make indeed an Admirable Fabrick, but the Materials are such as can promise no lasting one. (Dunton 1692:vi-vii; cf. Anstey 2005:216)

Since the 1600s, it has been commonplace to severely criticize “metaphysical speculation,” by which is meant scientific thoughts that have been made without a foundation in facts based on observation. In terms of the lay definition of speculation that was cited earlier, metaphysical speculation can be described as a guess about the nature of some phenomenon that is not based on facts.

### *The Scientific Concept of Speculation*

During the 20th century, scientists and philosophers began to reevaluate the role of metaphysics in science and, closely related to this, also speculation (e.g., Alexander 1963:187 ff.). What had earlier been condemned and banned from science was now granted a small but significant role in its activities. It was, for example, realized that some parts of reality are ultimately unknowable. You need to speculate when you discuss these parts and also in some other cases when it is not possible to have access to the facts.

The changing attitude to metaphysics and speculation, or rather, to a new type of metaphysics and a new type of speculation can be followed with advantage in the literature on the philosophy of science. The scientific concept of speculation comes out with much clarity, especially in the works of Karl Popper and Thomas Kuhn (see also, e.g., Hacking 1983:210-19, 1991).<sup>3</sup>

But even if this is the case, there exist very few references to speculation in the literature on the philosophy of science. In this, to repeat, it is not very different from the situation in general when it comes to speculation. Popper ([1934] 1959), for example, rarely uses the term speculation in his main work *The Logic of Scientific Discovery*. In a few places, however, Popper does refer to speculation, and these deal with the issue of how scientific progress comes about:

Bold ideas, unjustified anticipations, and speculative thought, are our only means for interpreting nature: our only organon, our only instrument, for grasping her. And we must hazard them to win the prize. Those among us who are unwilling to expose their ideas to the hazard of refutation do not take part in the scientific game. (Popper 1999:280)

It is similarly hard to find the term speculation in Popper's later work (but see, e.g., Popper 1992:55-60, 150-51). *The Logic of Scientific Discovery* does, however, give a central place to the word "conjecture," which is a synonym to speculation and also used in this sense by Popper.

In fact, Popper's (1962) most important work after *Logic* is entitled *Conjectures and Refutations*. The meaning of speculation-conjecture as used here is basically the same as in *Logic*:

The way in which knowledge progresses, and especially our scientific knowledge, is by unjustified (and unjustifiable) anticipations, by guesses, by tentative solutions to our problems, by conjectures. These conjectures are controlled by criticism; that is, by attempted refutations, which include severely critical tests. (Popper 1962:vii; emphasis in the text)

Once a conjecture has been made, Popper also argues, it has to be tested against facts in as stringent manner as possible. The role that is played by observation and facts in coming up with a conjecture is in contrast minimal. “The actual procedure of science is to operate with conjectures: to jump to conclusions—often after one single observation (as noticed by Hume and [German physicist] Born)” (Popper [1934] 1959:181).

In his later works, Popper also argues that no scientific theories or laws are valid forever but should be viewed as conjectures or tentative hypotheses (e.g., Popper [1934] 1959:182; for a discussion of Popper on conjectures, see, e.g., Cleveland 1997; Radnitzky 1987). This means that the meaning of conjecture or speculation has been extended by Popper from being a suggestion for a scientific insight to all scientific knowledge and existing insights.

Also, Thomas Kuhn ([1962] 2012) discusses speculation in his major work, *The Structure of Scientific Revolutions*. But—again—the term itself is rarely used. As it turns out, however, speculation does play a key role in the transition to a new paradigm in Kuhn’s work. Presented with anomalies that cannot any longer be ignored, the scientist does not know how to proceed but wants nonetheless to move forward:

He will, in the first place, often seem a man searching at random, trying experiments just to see what will happen, looking for an effect whose nature he cannot quite guess. Simultaneously, since no experiment can be conceived without some sort of theory, the scientist in crisis will constantly try to generate speculative theories that, if successful, may disclose the road to a new paradigm, and if unsuccessful, can be surrendered with relative ease. (Kuhn [1962] 2012:87; cf. Kuhn [1962] 2012:61).

The new paradigm that will eventually result is, however, not necessarily the direct result of successful speculations. But speculation is nonetheless the main motivating force:

Both during the pre-paradigm periods and during the crises that lead to large-scale changes of paradigm, scientists usually develop many speculative and unarticulated theories that can themselves point the way to discovery. Often, however, that discovery is not quite the one anticipated by the speculative and tentative hypotheses. Only as experiment and tentative theory are together articulated to match does the discovery emerge and become a paradigm. (Kuhn [1962] 2012:61)

Scientists can proceed in two different ways when they speculate, according to Kuhn. One is to question the very foundations of some existing

paradigm, and this constitutes “an effective way to weaken the grip of a tradition upon the mind and to suggest the basis for a new one” (Kuhn [1962] 2012:88). The second way to proceed is to use thought experiments. With their help, existing facts can be reinterpreted, or more precisely, seen in a new way (Kuhn 1964:332).

It should be noted that to Kuhn revolutionary science (“extraordinary science”) is very different from ordinary science (“normal science”). Normal science dominates the periods when scientists agree on a paradigm, while extraordinary science is needed to usher in a new paradigm. According to Kuhn, revolutionary science can also result in two different kinds of breakthroughs. Scientists can either establish new facts (“discovery”) or they can come up with a new theory (“invention”; e.g., Kuhn [1962] 2012:53). Facts and theory are closely related in Kuhn’s view.

Summing up what has been said so far, it is clear that while the term speculation occurs very rarely in the works of Popper and Kuhn, it nonetheless plays a central role in their general theories of how science develops. For Popper, scientists struggle with problems, which they try to solve with the help of conjectures or speculations. They then try to falsify these, and the conjecture that can be corroborated the best will stand (till it is replaced by a better theory).

According to Kuhn, scientists address puzzles during periods of normal science. These puzzles are then solved by drawing on the basic principles of the reigning paradigm. Results that are anomalous, however, are common, and when these no longer can be ignored, a period of extraordinary science begins. Speculations now take place in the form of thought experiments and attempts to replace the foundations of the declining paradigm. Eventually, these lead to a new paradigm.

### *Speculation as Guessing*

Just as the word “conjecture” is a synonym for speculation and is used in this sense by Popper, Kuhn, and many others, so is guessing. For some scientists and philosophers, however, guessing rather than speculation is the preferred term.

This is especially the case with Charles Sanders Peirce (but see also, e.g., Polanyi 1946, 1962:144-45; Polya 1950:99, Polya 1979). Peirce sometimes engaged in the old-fashioned grand form of speculation—but still preferred the term “guess,” as in *A Guess at the Riddle* (see, e.g., Lowe 1964).<sup>4</sup> He is also the author of an article on how to speculate successfully, called “Guessing.” And throughout his work, one can find many brief references to the importance of guessing in philosophical and scientific research.

According to an electronic search of Peirce's published writings, he only used the word speculation a handful of times.<sup>5</sup> The most important of these can be found in *A Guess at the Riddle*, where speculation is described as a leap ("One bold saltus landed me in a garden of fruitful and beautiful suggestions"—Peirce 1992:253). The universe, Peirce speculates, probably began as a random event and has since developed in the direction of first habits and later natural laws.

Peirce was well aware that his guess about the nature of the universe was just a form of speculation. "To raise it from the rank of a philosophical speculation to that of a scientific hypothesis," he wrote, "we must show that consequences can be deduced from it with more or less probability which can be compared with observation" (Peirce 1992:277). What differentiates this type of speculation from the old type of metaphysical speculation is that it must be confronted with data, even if this is not possible just now (similarly, e.g., Popper 1994). With this in mind, Putnam (1992) has called Peirce's type of speculations about the universe a form of "testable" or "empirical metaphysics" (pp. 79, 86).

"Guessing" by Peirce (1929) is one of the strangest and also one of the most original writings that has been devoted to the topic of speculation. The main part of the article is devoted to the odd tale of how an expensive instrument was stolen from Peirce while he was traveling from Boston to New York. He eventually figured out who the thief was and where the stolen object had been hidden—all with the help of guesses.

Peirce uses the example of the theft to illustrate the fact that people's capacity to guess comes out most forcefully under difficult circumstances. But in order to guess well, he also notes, it is important to be relaxed. If you tense up when you guess, you are bound to fail. It is imperative to put yourself "in as passive and receptive a state" as possible (Peirce 1929:285).

All of this, including the advice to try to relax when you guess, may sound idiosyncratic and something that should not be taken too seriously. For this reason, it should be pointed out that Peirce is also the author of an article in which it is shown, with the help of experiments, that if people relax, this will increase the likelihood that they will guess right. The way these experiments were carried out was pioneering at the time (through the use of a randomizer), and the article in which the results are presented is considered a classic in modern psychology (Peirce and Jastrow 1885; see, e.g., Hacking 1990:205-6).

According to Peirce (1929), guessing represents "a chapter in the art of inquiry" (p. 282). He also suggests that human beings are endowed with a "guessing instinct" and points to the record of modern science as evidence of

this. If scientists had just tried out every conceivable hypothesis one by one, he argues they would never have made any progress. There exist billions of possible hypotheses for every phenomenon. Human beings, Peirce suggests, must therefore have developed a capacity to guess right for evolutionary reasons. Most guesses will naturally be wrong, but they will be right much more often than if they had been made at random.

Peirce also touches on guessing in other writings than *A Guess at the Riddle* and "Guessing". He notes, for example, that guessing often takes a plural form. You typically make a number of guesses when you try to solve a problem. One guess may also lead to another, till you have reached your goal. Guessing games, such as charade and the game of twenty questions, are examples of this way of proceeding (Peirce 1958:220).

If you make many guesses to solve a problem, you also have to make a choice which one to pursue. Peirce discusses this topic as part of what he calls "the economy of research" (e.g., Fann 1970:47-51). When you decide on what guess or hypothesis to pursue, three factors should be taken into account: the cost for the scientist (in terms of money, time, energy, and thought), the value of the idea, and its relationship to other projects you may have.

Peirce was also of the opinion that guessing is more powerful than reasoning. Guessing "direct[s] us as if we were in possession of facts that are entirely beyond the reach of our senses" (Peirce 1998:218). But even if guessing has this somewhat mysterious quality, it is also important to understand that guesses are usually wrong. It is therefore imperative to always check a guess against the facts.

What Peirce says on guessing is usually seen as synonymous with his ideas on abduction, which is Peirce's most celebrated concept (e.g., Fann 1970). Whether this is correct, or if there exist some important differences between the two, is a complex topic and will not be discussed here (but see, e.g., Tschaepé 2013). What can be said, however, is that the concept of abduction belongs very much to the tradition of speculation, even if it has its origin in Peirce's ideas on logic. The tradition of speculative thinking goes far back in Western thought and is still very much alive (see, e.g., the attempt to update Peirce's ideas on abduction in Chomsky 2016:25, 55-56).

### *Social Science Speculation*

Like natural scientists, social scientists have shown very little interest in speculation, either as a phenomenon to be studied or as a tool to be used in the analysis. Articles on speculation by economists, political scientists,



and sociologists are to my knowledge practically nonexistent (see note 1). In sociology, for example, there exists a very strong tradition of positivism that dates back to its founder, Auguste Comte. Positivism is very hostile to all that can be seen as metaphysics or speculation. This may be one of the reasons for the silence of sociologists on the topic of speculation.

The hostility to the metaphysical form of speculation, and the tendency to identify all of speculation with this particular type, was also expressed very strongly after World War II. People with as different approaches to sociology as C. Wright Mills, Talcott Parsons, and Robert K. Merton all united in rejecting the kind of theory that engaged in “grandiose speculative construction” (Parsons 1963:154; similarly Merton 1968; Mills 1959:ch. 2).

It was also to distance themselves from this type of theorizing that made Merton develop the concept of middle-range theory and Mills to attack “grand theory” (e.g., Holton 2004). The attitude of many sociologists to speculation at this time was summarized by Zetterberg (1965) in *Theory and Verification in Sociology* as follows: “The days are gone when ‘theory’ and ‘speculation’ meant the same thing and the theorist did not have to know anything except the location of the space bar on his typewriter” (p. 19).

The tendency to view speculation (and guesses and conjectures) as nothing but metaphysical speculation seems to have continued till today in mainstream sociology. This is regardless of attitude to theory and type of explanation, both of which are contested terms in today’s sociology.<sup>6</sup> Speculation should not be used, period.

There does, however, exist one partial exception to this development. This is speculation about the future of society or what is also known as social forecasting or futurology. Two well-known examples of this type of work are Young’s (1958) *The Rise of Meritocracy* and Bell’s (1973) *The Coming of Post-Industrial Society*. Social forecasting differs from ordinary prediction, in that the question is not if some specific event will occur or not in the future; instead an attempt is made to outline a new and emerging type of society. What can today be identified as seeds of the future are in the works on social forecasting followed into their full development.

While it is not uncommon with works in social science that engage in predictions about the future (e.g., Tetlock 1999), the literature on speculation as a practical tool that can be used in social science analysis more generally is practically nonexistent. While this no doubt reflects the fact that speculation is disapproved of, it also means that there exists little guidance on how to proceed in the few cases where it might be useful to speculate in social science.

There does, however, exist one very important exception to this trend. This is *An Introduction to Models in the Social Sciences* by Lave and March

([1974] 1993). The goal of this work is to teach students how to speculate and to build models, and in this way improve their skills in social science. The book also represents an interesting contribution to the literature on speculation. It does so by focusing on a different type of speculation than can be found in the works of Kuhn and Popper. While the latter two mainly view speculation as useful for making major advances in science, Lave and March aim their work at the kind of speculation that the average social scientist can engage in. Drawing on Kuhn's terminology, one can say that while Kuhn and Popper focus on extraordinary speculation, Lave and March are mainly interested in normal speculation.

The main message of *An Introduction to Models* is that "speculation is the soul of the social sciences" (Lave and March 1993:2; emphasis added). In the view of the authors, speculation should be assigned a central place when you build models in social science. A model, they explain, represents a formal attempt to explain some phenomenon. To construct and use a model you need to be able to do several things such as formulate hypotheses, interpret data, and solve problems. But the heart of the analysis consists of something else, namely, imaginative attempts to come up with several explanations through speculation.

Lave and March do not only want to teach students how to build a model but also to come up with interesting explanations (March and Lave 1993:2). An interesting explanation in their view is one that is imaginative and where the process from cause to effect is carefully spelled out. A good model often leads to surprising results, and the explanation can be generalized.

Lave and March (1993) summarize the way you build a speculative model as follows:

Step 1: Observe some facts

Step 2: Look at the facts as though they were the end result of some unknown process (model). Then speculate about processes that might have produced such a result.

Step 3: Then deduce other results (implications/consequences/predictions) from the model.

Step 4: Then ask yourself whether these other implications are true and produce new models if necessary. (pp. 19-20)<sup>7</sup>

To teach students how to construct and test a model, Lave and March provide several simple examples in their book. In each of these, they emphasize the need for students to always try to come up with several explanations when they speculate. By doing this, the authors argue there is less of a danger

**Table 1.** Testing Different Speculations About Dumb Football Players.

Question	Model 1 Limited Time	Model 2 Need Success	Model 3 Jealousy
Will athletes ask dumb questions "out of seasons"?	No	Yes	Yes
Will athletes ask dumb questions in schools that deemphasize athletics?	Yes	No	No
Will athletes who do not look like athletes ask dumb questions?	Yes	Yes	No

Source: Lave and March ([1974] 1993).

to become fixated on a favorite explanation. It also forces you to try to figure out which explanation is the best one through the use of arguments, data, experiments, and so on. And finally, it also teaches you that suggesting explanations that turn out to be wrong is part of the process of finding the right explanation. In brief, working with several explanations helps you to develop a capacity for speculative thinking.

The authors illustrate how to create several explanations by going through a number of examples, the most famous of which is that of "the dumb football player" (Lave and March 1993:25-6, 58-60). The research question here is: Why are football players in college considered dumb? The authors slowly walk the reader through the process of creating and testing several possible explanations. Maybe football players spend all of their energy on their sport (Speculation/Explanation # 1)? Or maybe athletes, like people in general, feel that it is enough to excel in just one type of activities (Speculation/Explanation # 2)? Or maybe the other students are jealous of successful people and call them dumb (Speculation/Explanation # 3)?

In order to test each of these theories, Lave and March continue, they must be confronted with facts. It is helpful if you can reason your way into rejecting a suggested explanation with the help of "natural experiments" or "critical experiment" (Lave and March 1993:40, 58-61). But if this is not possible, you will have to get the facts yourself (see Table 1).

Lave and March (1993) also point out that one way to find out if you have located a good speculative theory is to see if your ideas are generalizable (pp. 25, 64-65). In fact, when you construct a model, you should always see whether this is the case. The way to find this out is to focus on the nouns and the verbs in the speculative proposition. A football player at college can, for example, be generalized into, say, an athlete at college and from there

into a professional athlete. And looking dumb at college can be generalized into looking dumb at work and looking dumb in general.

The book by Lave and March is still in print, but its impact on social science seems to have been minimal. This is a pity because *An Introduction to Models* is a pioneering work when it comes to speculation. Not only does it contain an interesting argument about the role of speculation in social science, it also contains exercises for how to teach students how to speculate.

### *When to Speculate in Social Science: Some Examples*

The time has now come to address the central question in this article: When should social scientists engage in speculation? Should speculation inform everything they do or should it only be used in certain situations? The answer that will be suggested in this article is that speculation can be used to good effect in a small number of well-specified situations. A few of these occur in many everyday research activities and belong to what was earlier called normal speculation. But there also exist situations in which a scientific paradigm is challenged and the type of speculation that is involved here falls into the category of extraordinary speculation.

Beginning with the cases that belong to normal speculation, there is first of all situations in which it is not possible for the analyst to have access to all the facts that are necessary to come up with an explanation of some phenomenon. You then have to guess, and in this way make up for the missing facts—or end the analysis then and there. This is perhaps the case that is the most commonly associated with speculation. To test the speculation against facts is not possible at this point, and it may or may not be possible in the future. Still it is necessary that the explanation is constructed in such a way that it is testable in principle. It should also be stated clearly that the proposed explanation is the result of speculation and, if possible, what type of facts are needed to fill the gap of information.

This type of speculation is necessary in a number of different situations. One of these is forecasting of the type that was mentioned earlier. Are the signs around us, inconclusive as these may be, indications that, say, a dictatorship is about to be imposed soon? Or does, for example, the current divorce rate indicate that a breakdown of the family is about to happen? These are two examples where speculation is necessary because of urgent political and social concerns. Social scientists can be of help in this situation by clearly showing what the existing facts are and what they mean—and to what extent everything else is speculation and therefore to some extent guess work.

But speculation of the type where data are missing can also be helpful when the issue is not driven by political or social concerns but is purely scientific. There may not exist, for example, enough information to solve some difficult theoretical problem. Still a good guess about the answer may push the discussion ahead and inspire research by others that will eventually lead to important advances backed up by data. In this case, as when some important political or social issues are involved, it is imperative to state in a clear way that speculation is involved. The speculations should ideally also be formulated in such a way that they are testable.

Can you also speculate your way to a solution in situations where the problem is neither theoretical nor political but purely empirical in the sense that you need to carry out an empirical analysis but parts of the data are missing? It may simply not be possible to get the data that is needed, say for ethical, political, or some other reason. One way to proceed in this situation would be to guess what the missing facts are and then carry out the analysis based on this guess. This can be done with several different sets of imagined data, accompanied by arguments why each has been chosen. If this is done in cases where the lacking facts will be available in the near future, it will also be possible to check and see how close the imagined data are to the correct ones.<sup>8</sup>

The idea of using facts that will be available in the future, as a check on speculation in the present, comes from Peirce (1958) who advocated this way of proceeding in historical research (pp. 89-164). Based on his or her knowledge, a historian may argue that something should have happened in the past even if we currently do not know if this is true or not. If, however, a discovery is later made that proves this to be the case (say that some new documents are found), this would testify to the scientific acumen of the historian.

So much for examples of situations where speculation is necessary because some of the data are missing. Another situation in which speculation is useful in social science is when a decision has to be made if a topic is worth being studied, in the sense that a full research project should be devoted to it. The key question to be answered in this situation is the following: Is the research of this topic likely to lead to some important findings or not? One way to get a preliminary answer to this question is to speculate on the basis of incomplete information, say a nonrepresentative sample that you have quickly put together or the like (e.g., Swedberg 2014:25-28). When the full study is conducted, in contrast, much more information will be available, and the hypotheses can now be tested according to existing rules (representative sample, proper scope, etc.).

This type of speculation is clearly related to what Peirce calls the economy of research. Scientists, to recall, typically have many ideas but cannot

pursue them all. They have to choose which one to devote their energy and resources to. Speculation, in brief, is of help in this situation.

There also exists another situation in which it is necessary to engage in normal speculation, namely, as part of the actual research process in a study. As the research moves along, there is often a need to advance even if some data are missing. The data may not be impossible to get; it is just not convenient to stop and get it. It may take too much time, and the answer seems clear enough. This situation is not very different from the way that people behave in their everyday lives when they cannot rely on their habits. They have to act, and they do act, even if they don't have as much information as they may want.

This is a relatively trivial example of how speculation has to be used during the actual research process, even if it is clear that dangerous mistakes can be committed if one is not aware that speculation is involved. More interesting, there also emerge moments during the research process when speculation-like suggestions for explanations have to be made for the analysis to be carried out. The reason for using the expression "speculation-like suggestions" is that this type of guesses or conjectures are not the same in the more common type of speculation, where some important data are missing. In fact, all the data that are needed to proceed to an explanation is available in these cases; but in order to come up with a good explanation, a guess or conjecture of sort has nonetheless to be made.

One reason for this is that it is not possible for the researcher to hold all the data in his or her mind. Some data are therefore "missing," not from the data set but from what is available to the analyst in his or her mind. It should be emphasized that this also holds true even if some way of reducing the complexity of the data is used, say with the help of statistics or coding. The analyst always has to select—or semiguess—what variables or categories are relevant in order to formulate hypotheses.

To repeat, this is not the same as facing a situation where some crucial data are missing. It is however clear that the analyst has to draw on some of the same hidden resources of the mind when hypotheses are formulated. Even in the most ordinary types of research, in other words, a bit of the magic spark of speculation is necessary for an explanation to come into being.

So far, a few cases have been discussed in which the social scientist needs to engage in speculation. What they all have in common is that they fall in the category of normal speculation or the type of speculation that the average social scientist must engage in as part of carrying out her research. This is also a type of speculation that can be taught and learned, a topic that will be discussed in the next section of this article. Just as social scientists need to

learn statistics, the technique of interviewing, and so on, it can be argued that they need to learn how to speculate or, more precisely, when to speculate and how to do it.

Before discussing this topic, however, it is important to present one other type of speculation that is central to social science. This is extraordinary speculation or the type of speculation that has as its goal to move science forward in a major way.<sup>9</sup> This type of speculation differs on a number of points from normal speculation. For one thing, it is highly unlikely that it can be taught. Second, it usually challenges rather than accepts the existing paradigm, and it does so by aiming at the very foundations of social science or its presuppositions (e.g., Alexander 1982:36-40).

The main function of presuppositions in social science is to enable research to be carried out. This is done with the help of ideas such as the notion that social facts can only be explained through other social facts (Durkheim) or that people's interaction in work determines the basic structure of society (Marx). Presuppositions of this type help the individual researcher to locate problems and also to solve these.

The reason why presuppositions fall in the category of speculation is that they are not based on facts. They are simply assumptions that are made in order that research can be conducted. According to Dewey and Bentley (1945), these "postulations" (as they call them) must not be taken for granted or be seen as beliefs; they are just assumptions required for carrying out the analysis (p. 646). Wittgenstein (1969) has similarly described presuppositions as analogous to hinges or the kind of mechanical devices that are necessary for doors to open as well as close (p. 17c).

For substantial progress to be made in social science, it is necessary that its presuppositions are challenged and replaced with new and more productive ones, and this can only be done through speculation. What is needed are new presuppositions that enable research to move ahead in new directions. Mainstream sociology, for example, is still based on the assumption that biology plays a negligible role in explaining social behavior. Modern biology, however, differs on crucial points from the type of biology that existed in the days of say Weber and Durkheim. New presuppositions are probably needed as a result of this. Research in cognitive science and neighboring social sciences may also lead to changes in the foundations of today's sociology.

To challenge and successfully replace some part of the foundation of social science, you need the extraordinary type of speculation, which can be described as bold and knowledgeable at the same time. It differs from the normal type of speculation by being much more radical and skeptical in

nature. It is doubtful that the extraordinary type of speculation is something that can be taught and learned. Being rare, it is also difficult to generalize about its nature as well as when and how it makes its appearance. Its importance for the progress of social science can however not be questioned.

### *Learning How to Speculate in Social Science*

In this section, the following topic will be addressed: Is it possible to teach yourself and students to speculate, and if so, how can this be done? In *An Introduction to Models*, Lave and March emphasize, to repeat, the importance of trying to come up with several explanations for the same phenomenon, as a way for students to improve their capacity to speculate. The students need to learn the art of trying out several possible explanations, not just one.

This seems like a good suggestion for how to proceed when you teach a topic like explanation, and also other social scientists have argued along these lines. In *Constructing Social Theories*, Stinchcombe (1968) describes, for example, how he has worked exercises on speculation into his teaching of sociological theory:

I usually assign students in a theory class the following task: Choose any relation between two or more variables which you are interested in; invent at least three theories, not now known to be false, which might explain these relations; choosing appropriate indicators, derive at least three different empirical consequences from each theory, such that the factual consequences distinguish among the theories. (p. 13)

Stinchcombe's (1968) conclusion from having his students do exercises of this type is that "a student who has difficulty thinking of at least three sensible explanations for any correlation that he is really interested in should probably choose another profession" (p. 13).

In addition to Lave–March and Stinchcombe, there also exist other scientists who have argued that it is important to come up with several explanations (e.g., Dewey 1910:75; Platt and Baker 1931; Rescher 1976:95; Whewell 1858:59). To this can be added that many scientists typically begin with one theory or explanation, and then add to it, revise it, or replace it with one or several new theories, during the course of a research project. The suggestion of Lave–March and Stinchcombe for students to come up with several explanations at the same time, for a certain phenomenon, can be seen as a way of helping them to develop this capacity.



Lave and March have also proposed two other ways that are helpful in teaching students how to speculate. The first is to always turn the explanation into a process and the second to see if you can generalize the explanation to a broader group of phenomena. A good explanation, they suggest, should cover the distance from cause to effect in a clear and detailed manner. And just as you have to be imaginative in coming up with an idea for an explanation, you have to use your imagination when you turn it into a process. What Lave and March have in mind when they talk about processes is roughly what others call social mechanisms or process tracing. A good speculative theory is also one that can be generalized, as was discussed earlier in this article.

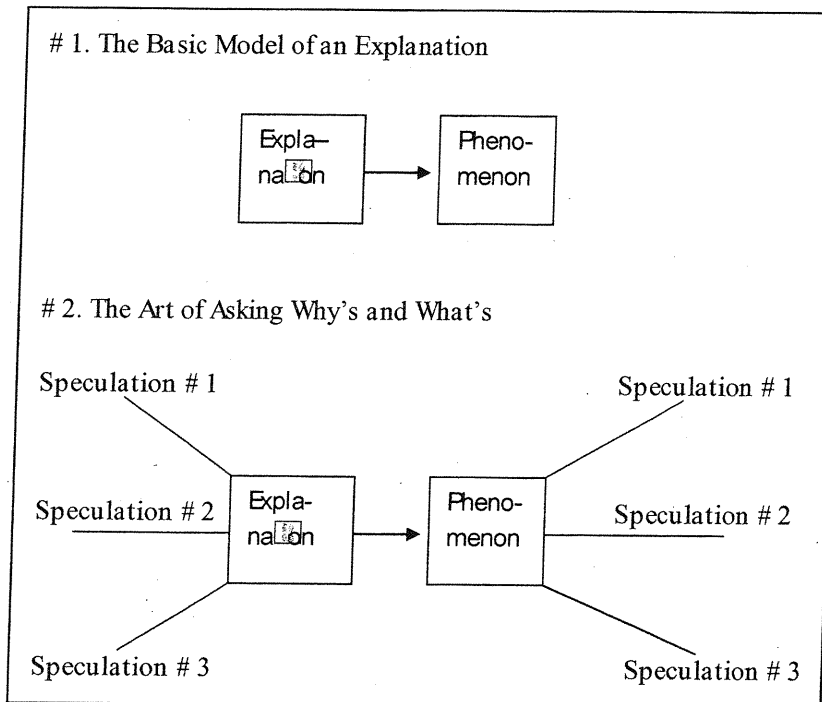
But even if the works of Lave–March and others contain many important ideas on how to speculate, they also need to be complemented and improved on some points. As will be discussed next, some of these suggestions for changes have to do with the topic of observation and how this is related to speculation.

It can be argued that not only the explanation is important when you speculate but also the phenomenon to be explained, as established through observation. That observation is part of the social science process is no novelty to sophisticated social scientists like Lave–March and Stinchcombe, but they nonetheless fail to mention this. The reader of their books is given the impression that the phenomena to be explained are given from the beginning and that the main task of speculation is to come up with a number of different explanations for these.

One reason for this is that neither Lave–March nor Stinchcombe insists that the students have to work with empirical cases when they learn how to speculate. They do not have to gather any data on the phenomenon to be explained; they are just given a topic to analyze. It is imperative, however, that exercises on speculation are based on empirical facts that have been gathered by the students themselves, if it is to be similar to the way that real research is carried out in social science.

Explanations, as is well known, are closely linked to facts. If the facts change, so may the explanation. And there exist many reasons why the facts can change. Once you look at reality, it is, for example, not so clear what meaning people assign to something, nor what specific meaning the researcher should focus on. A meaning can also shift, as the research progresses or when you try to figure out why only some facts are available to the researcher and not all of them (Liebersohn 1985:229-31).

It is in other words not only important to teach the students how to speculate in an imaginative way about the explanation, as Lave–March and Stinchcombe suggest. This must also be done for the phenomenon to be explained.<sup>10</sup> Students need in other words to be trained, not only to be



**Figure 1.** Exercises in Speculation.

imaginative in coming up with explanations but also in how they look at the facts. They need to be able to come up with several explanations for some phenomenon—but also with several ways of looking at the phenomenon. Are football players “dumb” because they look dumb in the eyes of the other students? Or is it because they feel dumb or because they have a low IQ? In each of these cases, the data that are needed for the analysis will shift with the perception of the phenomenon—and so will the explanation.

One possible exercise, that would take this into account, would be for students to suggest not only three explanations for some phenomenon but also three different ways of looking at the phenomenon (see Figure 1). It would also be useful for students to learn how to generalize, from the explanation as well as the phenomenon that is being analyzed. Note that depending on what you choose to focus on, you will generalize in different directions. Students can, for example, be asked to generalize in three different directions, from the explanation as well as from the phenomenon. You may generalize from a football player who gets tired by training very hard, to a person who gets tired by doing manual labor, to a person who gets tired by working from 9 to 5. A dumb football player can also be a dumb team player as well as a dumb member of an ordinary organization.

While it is probably true that extraordinary speculation can only be carried out well by extraordinarily talented social scientists, one can also make an argument for having exercises centered on the presuppositions of sociology. This way students would become aware of what the foundation looks like, on which their analyses are based. It could also be useful for the average student, as part of her education, to try her hand a few times at the bold and radical type of speculation. Here as elsewhere, it is clear that only if you try something, it is possible to find out if you are good at it.

Students can, for example, be asked to go through some foundational text in modern sociology, say some article by Coleman, Goffman, or Stinchcombe, and try to locate as well as specify the presuppositions of the analysis. They should also be encouraged to try to replace these with suggestions of their own or from other sciences and see what happens when this is done.

By way of concluding this section, it is now time to return to the question of how to define speculation. At the beginning of this article, the following two lay definitions of speculation were cited:

The activity of guessing possible answers to a question without enough information to be certain. (Cambridge Dictionary 2017)

The forming of a theory or conjecture without firm evidence. (Oxford Dictionary 2017)

These definitions can now be replaced by a definition that better captures what is the characteristic about speculation, as used in social science:

Speculation refers to the use of guesses, conjectures and similar ways of thinking, that help the scientist to come up with explanations and redefinitions of phenomena, in situations where important facts are missing.

The reference to the expression “ways of thinking” in the definition above indicates that speculation is one of the mental tools that scientists use in their research. Ways of thinking is also a technical term used by Emile Durkheim in his definition of what constitutes a social fact.<sup>11</sup> Including the idea of ways of thinking in the definition of speculation opens it up for a sociological analysis.

### *Concluding Remarks and Discussion*

All knowledge is speculation. William Whewell, *On the Philosophy of Discovery* (1860)<sup>12</sup>

I think that only daring speculation can lead us further and not accumulation of facts. Albert Einstein, Letter to Michele Desso (1952)<sup>13</sup>

The quotes above by Whewell and Einstein express the idea that speculation is more or less the same as the production of science and knowledge. This is a very broad claim, and it raises the question if speculation should be seen as the central factor in the scientific enterprise. If this was the case, it would have important consequences not only for science as it is practiced today but also for the way it is being taught.

Before addressing this question, a few issues need to be discussed that were mentioned earlier in the article but left unaddressed. It was, for example, noted in the beginning that there exists very little material on speculation and that an explanation for this would be suggested later on. Is this state of things perhaps due to the fact that what is called speculation often appears under other names, along the lines of conjectures? Should, for example, the use of clues and hunches be seen as ways of speculating or are they perhaps closer to, say, intuition?<sup>14</sup> Intuitions are often seen as being primarily subconscious in nature and something that just happens to the scientist, a bit like serendipity (e.g., Bunge 1962; Hogarth 2001; Knorr Cetina 2014). Speculation, on the other hand, is typically a conscious and more active way of proceeding.

Another possible reason for the invisibility of speculation is that many scientists gradually work their way toward a solution to a problem, and once they have done so, their early attempts to come up with an explanation are forgotten. All but the very last version of a paper is typically discarded by scientists. The fact that the early versions are practically never published also makes it hard to study these and the speculations that went into them.

Emotions are central to theorizing, and also, they may have played a role in making speculation invisible. There probably exists a vague fear among social scientists to speculate, due to the long tradition of viewing this type of activity as nonscientific and suspicious (e.g., Gross 2017). Self-censorship may play a role as well. Michael Faraday has, for example, written:

The world little knows how many of the thoughts and theories which have passed through the mind of a scientific investigator have been crushed in silence and secrecy by his own severe criticism and adverse examination; that in the most successful instances not a tenth of the suggestions, the hopes, the wishes, the preliminary conclusions have been realized. (Faraday cited in Pearson 1892:11)

An attempt has been made in this article to bring together as much as possible of the material that exists on speculation, especially as it relates to

science and social science. But there clearly exists more, and having access to this additional material will no doubt be very useful, as the discussion of speculation gets under way. The different sciences also approach speculation in different ways. Philosophers of science may, for example, want to know more about the role of speculation in what they call the context of discovery, while say sociologists may want to interview scientists about the role of speculation in their work, and also try to study how speculation takes different expressions in different social contexts (e.g., Halewood, 2017; Weber 1922:291, 316, 304, 341).

It should also be pointed out that one important difficulty with doing research on speculation is conceptual in nature and has little to do with the absence of literature on the topic. Take, for example, the word speculation. This is basically a lay term that draws its meanings from a number of different activities that have been given the same name for reasons in the past that are not very clear today. One of these meanings is that speculation means to suggest a theory, while ignoring the facts (metaphysical speculation). Another is to suggest a theory when some of the facts are missing and then submit this theory to an empirical test (scientific speculation). A special version of scientific speculation consists of making an imaginary experiment, and with its help reason yourself to a conclusion (thought experiment). You can also look into the future and try to predict what will happen (speculations about the future). To put the same name or label on all of these activities (and some others as well) results in a concept that is imprecise and hard to handle. It may not be as bad as having a concept for, say, "all the things in my garage," but it comes close. For scientific purposes, in brief, it may be better to split up the everyday concept of speculation in a way that makes sense from an analytic perspective.

In order to better understand the phenomenon of speculation, it is also important to bring in cognitive science, especially cognitive psychology. Speculation is clearly related to the capacity to seek reasons which appears to be inborn (e.g., Gopnik, Meltzoff, and Kuhl 2000; Kahneman 2011). Speculation also draws on a mixture of conscious thought and various powers in the subconscious, as well as on powers at the margin of one's awareness. All of these are topics that cognitive psychology is well positioned to study. Still all that can be said today about speculation from this angle is that very little is known and that important advances in research of this type will have to wait until speculation has become the target of sustained research, something that is currently not the case.

It is also important to pay attention to the practical knowledge of how to speculate. As noted earlier, the type of speculation that successfully

challenges the foundations of science is rare, and it is doubtful that it can be taught. Normal speculation, in contrast, is well within the reach of the average social scientist, and it is a type of speculation that can be taught with the help of exercises of the type suggested by Lave–March and others. Speculation, in brief, is one of the many mental tools that are useful to the social scientist when she or he theorizes, and it is important that it becomes easily available, by being incorporated into courses and textbooks.

Finally, what about the more general role of speculation in science such as the idea that all knowledge is speculative in nature (Whewell) and that without speculation there will only be an accumulation of data (Einstein)? While both of these statements testify to the importance of speculation to science, they are extremely broad in nature. The use of speculation is practically equated with the production of knowledge and science in general. And to take this position, it can be argued, is to threaten what is the special about speculation and what makes it into a useful tool.

Proceeding in the opposite direction is also destructive, and just as speculation can be destroyed by having its importance blown out of proportion, the same can be said of the tendency today to ignore speculation, which is what is happening today in mainstream sociology. Being silent about speculation is one way to prevent its legitimate use in social science. To confuse the scientific type of speculation with the old-fashioned metaphysical type is another. Together, these two attitudes block a fruitful use of speculation, and they do this by making social scientists refrain from drawing on speculation in situations where this is not only legitimate but also necessary.

When, then, should speculation be used in social science? This article has attempted to give a precise answer to this question, both when it comes to the more modest type of speculation, which is part of everyday research (normal speculation), and its more spectacular and bold version, which moves science ahead in a dramatic way (extraordinary speculation). It has also been suggested that social scientists may need to speculate not only about the explanation but also about the facts to be explained. It is clear that much more needs to be said on the topic of social science and speculation. Still this article has hopefully been able to show that speculation can play a useful role in social science and that it therefore deserves to be part of the tool kit of the social scientist.

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## Notes

1. In most of the areas I have surveyed (primarily in English), there are no articles to be found that are devoted exclusively to speculation. These include sociology, political science, economics, and psychology (including the cognitive psychology of thinking), all searched via JSTOR and library catalogs type Harvard's HOLLIS. A small number of areas do contain a few articles devoted to speculation such as philosophy and philosophy of science (e.g., Alexander 1963; Taminiaux 1992). There also exist sizable entries on "speculation" in several of the multivolume dictionaries of philosophy in German (e.g., Ebbersmeyer 1987; Oesterreich 2011). These typically concentrate on the use of speculation in the works of Kant, Hegel, and other German idealist philosophers. Recently, there has also been a renewed interest in speculative realism of the Whitehead type, sometimes linked to postmodern thought in social science (e.g., Bryant, Srnicek, and Harman 2011; Latour 2011; Parisi 2013; Somekh 2007; Stengers 2011; Whitehead 1929). In April 2014, a session was, for example, held at the British Sociological Association where some of this type of work was presented (see Wilkie, Savransky, and Rosengarten forthcoming; for a summary, see <http://www.alexwilkie.org/?p¼1216>). For the role of speculation in the arts, see, for example, Dunne and Raby (2013).
2. See also the similar argument in Bourdieu, Chamboredon, and Passeron (1991: 20-24). Durkheim's advice in *Rules of Sociological Method* on how to proceed coincides with the common opinion in social science that you should not begin the research with a definition of what to study; such a definition can only be the result of the analysis and is therefore better presented toward the end (e.g., Weber 1978:399, 2001:75, 106).
3. While Lakatos has developed a well-known theory for how science progresses, centered on the notion of research programs he does not assign a place to speculation in this process, in contrast to the theories of Popper and Kuhn. There do exist some references to speculation in Lakatos' work, and from these, it is clear that he only accepts the kind of speculation that can later be confirmed empirically (e.g., Lakatos 1969:149, 152, 2000:42-43; Larvor 2013).
4. Peirce (1932) attempted at one point to define what constitutes a guess and what sets it apart from other, related activities, including a conjecture: "An imaginary increase of information is an assumption or supposition; but the former word is preferable. An increase of information by induction, hypothesis, or analogy, is a

presumption . . . A very weak presumption is a guess. A presumption opposed to direct testimony is a conjecture, or, if weak, a surmise" (p. 430).

5. There exist three databases with Peirce's work in InteleX Past Masters, which can all be searched for specific words. Some of Peirce's early writings appeared in the *Journal of Speculative Philosophy*. What Peirce termed "speculative rhetoric" and "speculative grammar" will not be discussed in this article, since they address other issues than speculation (see, e.g., Braun 1981; Kevelson 1984). Similarly, nothing will be said on Peirce's indebtedness to the great speculative tradition in the Middle Ages, as exemplified by the works of Ockham and Scotus.
6. For literature on the contested nature of theory and explanation, see, for example, Abend (2008), Merton (1945), and Reed (2011). In this article, I follow Merton's standard definition of sociological theory as explanations of a general nature from which testable hypotheses can be derived (Merton 1968:39 ff.). Explanations, Merton suggests, are based on logically interconnected sets of propositions, and they differ, for example, from description in that the latter is part of establishing the phenomenon and not be confused with the explanation.
7. Elsewhere in their book, Lave and March (chapter 3) add that you should also take beauty and justice into account, not just truth. Beauty consists of simplicity, fertility, and surprise; justice is hard to nail down, they say, but your model should ideally aim at having a humane impact and definitely not the opposite. A little later in their book, Lave and March (1993) present "three rules for model-building": (1) think "process," (2) develop interesting implications, and (3) look for generality (40-43).
8. This way of proceeding is similar to that of agent-based modeling, as one of the reviewers has pointed out, agent-based modeling, in other words, has a speculative element to it which, precedes the actual running of the simulation.
9. I am grateful to one of the reviewers for emphasizing the importance of this type of speculation.
10. Kuhn ([1962] 2012) implicitly argues this by stating that extraordinary science refers not only to "novelties of theory" but also to "novelties of facts" (52-53). As an example of how an explanation is linked to the nature of the facts and how it must change as the description of the facts changes, one can mention the change in the understanding of electrons that came with quantum mechanics. Physicist and Nobel laureate Steven Weinberg (2017) describes this event as follows:

in the 1920s, according to theories of Louis de Broglie and Erwin Schrödinger, it appeared that electrons, which had always been recognized as particles, under some circumstances behaved as waves. In order to account for the energies of the stable states of atoms, physicists had to give up the notion that electrons in atoms are little Newtonian planets in orbit around the atomic nucleus. Electrons in atoms



are better described as waves, fitting around the nucleus like sound waves fitting into an organ pipe.

11. Social facts consist according to Durkheim (1964) of “ways of acting, thinking, and feeling” (pp. 2-3). They are characterized by coercion and exteriority, that is, individuals feel coerced by social facts and compelled to act in accordance to them. They also have an existence outside of the individual’s mind and can most easily be studied in these outer manifestations.
12. Whewell (1860:4).
13. Einstein and Besso (1972:487).
14. For clues, see, for example, Ginzburg (1983) and Polanyi (1966:24), and for hunches, see, for example, Platt and Baker (1931). For the different meanings of the term hypothesis (such as imaginary explanations, guesses, and facts), see, for example, Wootton (2015:385-91), and (Anstey 2005:223-24). Dewey (1910) uses the term “suggestion” as synonymous with speculation (p. 75; for Dewey’s views on speculation, see especially Dewey 1969).

## References

- Abend, Gabriel. 2008. “The Meaning of Theory.” *Sociological Theory* 26(2):173-99.
- Alexander, Jeffrey. 1982. *Positivism, Presuppositions, and Current Controversies: Theoretical Logic in Sociology*. Vol. 1. Berkeley: University of California Press.
- Alexander, Peter. 1963. “Speculations and Theories.” *Synthese* 15(2):187-203.
- Anstey, Peter. 2005. “Experimental Versus Speculative Natural Philosophy.” Pp. 215-42 in *The Science of Nature in Seventeenth Century*, edited by P. Anstey and J. Schuster. Dordrecht, the Netherlands: Springer.
- Aristotle. 1924. *Aristotle’s Metaphysics*. Vol. 1, edited by W. D. Ross. Oxford, England: Clarendon Press.
- Bacon, Francis. 1999. *Selected Philosophical Works*. Indianapolis, IN: Hackett.
- Bourdieu, Pierre, Jean-Claude Chamboredon, and Jean-Claude Passeron. 1991. *The Craft of Sociology: Epistemological Preliminaries*. Berlin, Germany: Walter de Gruyter.
- Bell, Daniel. 1973. *The Coming of Post-Industrial Society: A Venture in Social Forecasting*. New York: Basic Books.
- Braun, John. 1981. “The ‘Speculative Rhetoric’ of Charles Sanders Peirce.” *Philosophy and Rhetoric* 14(1 Winter):1-15.
- Bryant, Levi, Nick Srnicek, and Graham Harman. 2011. *The Speculative Turn: Continental Materialism and Realism*. Melbourne, Australia: re.press.
- Bunge, Mario. 1962. *Intuition and Science*. Englewood Cliffs, NJ: Prentice Hall.

- Cambridge Dictionary. 2017. "Speculation." Retrieved January 26, 2017 (<http://dictionary.cambridge.org/us/dictionary/english/speculation>).
- Chomsky, Noam. 2016. *What Kind of Creatures Are We?* New York: Columbia University Press.
- Cleveland, Timothy. 1997. "A Refutation of Pure Conjecture." *Journal for General Philosophy of Science* 28(1):55-81.
- Dewey, John. 1910. *How We Think*. Boston, DC: Heath.
- Dewey, John. 1969. "The Scholastic and the Speculator." Pp. 148-54 in *The Early Works of John Dewey, 1882-1898*. Vol. 3, edited by Arthur Thurner. Carbondale: Southern Illinois University Press.
- Dewey, John and Arthur Bentley. 1945. "A Terminology for Knowing and Known." *Journal of Philosophy* 42(9):225-47.
- Dunne, Anthony and Fiona Raby. 2013. *Speculative Everything: Design, Fiction, and Social Dreaming*. Cambridge: The MIT Press.
- Dunton, John. 1692. *The Young-students-library*. London, England: Printed for John Dunton.
- Durkheim, Emile. 1964. *The Rules of Sociological Method*. New York: The Free Press.
- Ebbesmeyer, S. 1987. "Spekulation." Pp. 1355-72 in *Historisches Wörterbuch der Philosophie*. Vol. 9, edited by J. Ritter and K. Gründer. Basel, Switzerland: Schwabe.
- Einstein, Albert and Michele Besso. 1972. *Correspondence, 1903-1955*. Paris, France: Hermann.
- Fann, K. T. 1970. *Peirce's Theory of Abduction*. The Hague, the Netherlands: Martinus Nijhoff.
- Ginzburg, Carlo. 1983. "Morelli, Freud, and Sherlock Holmes: Clues and Scientific Method." Pp. 81-118 in *The Sign of Three*, edited by U. Eco and T. Seabeok. Bloomington: Indiana University Press.
- Gopnik, Alison, Andrew Meltzoff, and Patricia Kuhl. 2000. *The Scientist in the Crib: What Early Learning Tells Us about the Mind*. New York: William Morrow.
- Gross, Neil. 2017. "How to Do Social Science Without Data." *New York Times*, February 9. Retrieved February 10, 2017 ([https://www.nytimes.com/2017/02/09/opinion/sunday/how-to-do-social-science-without-data.html?smprod¼nytcore-iphone&smid¼nytcore-iphone-share&\\_r¼0](https://www.nytimes.com/2017/02/09/opinion/sunday/how-to-do-social-science-without-data.html?smprod¼nytcore-iphone&smid¼nytcore-iphone-share&_r¼0)).
- Hacking, Ian. 1983. *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science*. Cambridge, England: Cambridge University Press.
- Hacking, Ian. 1990. *The Taming of Chance*. Cambridge, England: Cambridge University Press.
- Hacking, Ian. 1991. "Speculation, Calculation and the Creation of Phenomena." Pp. 133-58 in *Beyond Reason: Essays on the Philosophy of Paul Feyerabend*, edited by Gonzalo Munévar. Dordrecht, the Netherlands: Kluwer Academic.

- Halewood, Michael. 2017. "Situated Speculation as a Constraint on Thought." Pp. 52-64 in *Speculative Research*, edited by A. Wilkie, M. Savransky, and M. Rosengarten. London, England: Routledge.
- Hogarth, Robin. 2001. *Educating Intuition*. Chicago, IL: University of Chicago Press.
- Holton, Gerald. 2004. "Robert K. Merton." *Proceedings of the American Philosophical Society* 148(4):506-17.
- Kahneman, Daniel. 2011. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux.
- Kevelson, Roberta. 1984. "C. S. Peirce's Speculative Rhetoric." *Philosophy & Rhetoric* 17(1):16-29.
- Knorr Cetina, Karin. 2014. "Intuitionist Theorizing." Pp. 29-60 in *Theorizing in Social Science*, edited by R. Swedberg. Stanford, CA: Stanford University Press.
- Kuhn, Thomas. 1964. "A Function for Thought Experiments." Pp. 306-34 in *Mélanges Alexandre Koyre. Vol. 2*, edited by Fernand Braudel. Paris, France: Hermann.
- Kuhn, Thomas. [1962] 2012. *The Structure of Scientific Revolutions*. 4th ed. Chicago, IL: University of Chicago Press.
- Lakatos, Imre. 1969. "Criticism and the Methodology of Scientific Research Programmes." *Proceedings of the Aristotelian Society* 69:149-86.
- Lakatos, Imre. 2000. "Lectures on Scientific Method." Pp. 19-112 in *For and Against Method*, edited by Matteo Motterlini. Chicago, IL: University of Chicago Press.
- Larvor, Brendan. 2013. *Lakatos: An Introduction*. London, England: Routledge.
- Latour, Bruno. 2011. "Foreword: What Is Given in Experience?" Pp. ix-xv in *Thinking With Whitehead*, edited by Isabelle Stengers. Cambridge, MA: Harvard University Press.
- Lave, Charles and James G. March. [1974] 1993. *An Introduction to Models in the Social Sciences*. Lanham, MD: University Press of America.
- Lieberson, Stanley. 1985. *Making It Count: The Improvement of Social Research and Theory*. Berkeley: University of California Press.
- Lowe, Victor. 1964. "Peirce and Whitehead as Metaphysicians." Pp. 430-54 in *Studies in the Philosophy of Charles Sanders Peirce*, edited by E. Moore and R. Robin. Amherst: University of Massachusetts Press.
- Merton, Robert K. 1945. "What Is Sociological Theory?" *American Journal of Sociology* 50: 462-73.
- Merton, Robert K. 1968. "On Sociological Theories of the Middle Range." Pp. 389-72 in *Social Theory and Social Structure*. 3rd ed. New York: Free Press.
- Mills, C. Wright. 1959. *The Sociological Imagination*. New York: Oxford University Press.
- Oesterreich, Peter. 2011. "Spekulation." Pp. 2053-63 in *Neues Handbuch Philosophischer Grundbegriffe. Vol. 3*, edited by P. Kolmer and A. Wildfeuer. Freiburg, Germany: Verlag Karl Alber.

- Oxford English Dictionary. 2000. "Speculation." Oxford English Dictionary [Electronic Resource]. Oxford University Press. Retrieved February 19, 2017 (<http://www.oed.com.proxy.library.cornell.edu/view/Entry/186113?redirectedFrom¼speculation#eid>).
- Oxford Living Dictionary. 2017. "Speculation." Retrieved January 26, 2017 (<https://en.oxforddictionaries.com/definition/speculation>).
- Parisi, Luciana. 2013. "Speculation: A Method for the Unattainable." Pp. 231-44 in *Inventive Methods*, edited by Celia Lury and Nina Wakeford. London, England: Routledge.
- Parsons, Talcott. 1963. *Essays in Sociological Theory*. Rev. ed. New York: The Free Press.
- Pearson, Karl. 1892. *The Grammar of Science*. London, England: Charles Scribner's Sons.
- Peirce, Charles S. 1929. "Guessing." *The Hound & Horn* 2(3 Spring):267-85.
- Peirce, Charles S. 1932. *Collected Papers of Charles Sanders Peirce*. Vol. 2, edited by Charles Hartshorne and Paul Weiss. Cambridge, MA: Belknap Press.
- Peirce, Charles S. 1958. *Collected Papers of Charles Sanders Peirce*. Vol. 7, edited by Arthur Burks. Cambridge, MA: Belknap Press.
- Peirce, Charles S. [1992] 1998. *The Essential Peirce*. Vol. 2. Bloomington: Indiana University Press.
- Peirce, Charles S. and Joseph Jastrow. 1885. "On Small Differences in Sensation." *Memoirs of the National Academy of Sciences* 3:73-83.
- Platt, Washington and Ross Baker. 1931. "The Relation of the Scientific 'Hunch' to Research." *Journal of Chemical Education* 8(10):1969-2002.
- Polanyi, Michael. 1946. "Science and Reality." *Synthese* 5(3-4):137-50.
- Polanyi, Michael. 1962. *Personal Knowledge: Towards a Post-critical Philosophy*. Chicago, IL: University of Chicago Press.
- Polanyi, Michael. 1966. *The Tacit Dimension*. Chicago, IL: University of Chicago Press.
- Polya, George. 1950. "Let Us Teach Guessing." Pp. 504-11 in *Collected Papers*. Vol. 4, edited by George Polya. Cambridge: MIT Press.
- Polya, George. 1979. "More on Guessing and Proving." *The Two-year College Mathematics Journal* 10(4):256-58.
- Popper, Karl. [1934] 1959. *The Logic of Scientific Discovery*. New York: Basic Books.
- Popper, Karl. 1962. *Conjectures and Refutations: The Growth of Scientific Knowledge*. New York: Basic Books.
- Popper, Karl. 1992. *Unended Quest: An Intellectual Autobiography*. London, England: Routledge.
- Popper, Karl. 1994. "Philosophy and Physics: The Influence of Theoretical and Experimental Physics of Some Metaphysical Speculations on the Structure of

- Matter." Pp. 112-20 in *The Myth of the Framework*, edited by Karl Popper. London, England: Routledge.
- Popper, Karl. [1934] 1999. *The Logic of Scientific Discovery*. London, England: Routledge.
- Putnam, Hilary. 1992. "Comments on the Lectures." Pp. 56-102 in *Reasoning and the Logic of Things*, edited by C. S. Peirce. Cambridge, MA: Harvard University Press.
- Radnitzky, Gerard. 1987. "Knowing and Guessing: If All Knowledge is Conjectural, Can We Speak of Cognitive Progress? On Persistent Misreadings of Popper's Work." *Zeitschrift für allgemeine Wissenschaftslehre* 13(1):110-21.
- Reed, Isaac. 2011. *Interpretation and Social Knowledge: On the Use of Theory in the Human Sciences*. Chicago, IL: University of Chicago Press.
- Rescher, Nicholas. 1976. "Peirce and the Economy of Research." *Philosophy of Science* 41(3):71-98.
- Somekh, Bridget. 2007. "Last Word: Speculative Knowledge." Pp. 197-207 in *Knowledge Production*, edited by B. Somekh and T. Schwandt. London, England: Routledge.
- Stengers, Isabelle. 2011. *Thinking with Whitehead: A Free and Wild Creation of Concepts*. Cambridge, MA: Harvard University Press.
- Stinchcombe, Arthur. 1968. *Constructing Social Theories*. Chicago, IL: University of Chicago Press.
- Swedberg, Richard. 2014. *The Art of Social Theory*. Princeton, NJ: Princeton University Press.
- Taminiaux, Jacques. 1992. "Speculation and Judgment." *Journal of Speculative Philosophy* 6(3):171-85.
- Tetlock, Philip. 1999. "Theory-driven Reasoning about Possible Pasts and Possible Futures: Are We Prisoners of Our Preconceptions?" *American Journal of Political Science* 43:335-66.
- Tschaeppe, Mark. 2013. "Gradations of Guessing: Preliminary Sketches and Suggestions." *Contemporary Pragmatism* 10(2):135-54.
- Weber, Max. 1922. *Wirtschaft und Gesellschaft. Grundriss der verstehenden Soziologie*. Tübingen, Germany: J.C.B. Mohr.
- Weber, Max. 1978. *Economy and Society an Outline of Interpretive Sociology*. Berkeley: University of California Press.
- Weber, Max. 2001. *The Protestant Ethic Debate: Max Weber's Replies to His Critics, 1907-1910*, edited by David and Austin Harrington. Liverpool, England: Liverpool University Press.
- Weinberg, Steven. 2017. "The Trouble with Quantum Mechanics." *New York Review of Books* January 19. Retrieved February 2, 2017 (<http://www.nybooks.com/articles/2017/01/19/trouble-with-quantum-mechanics/#fn-1>).

- Whewell, William. 1858. *Novum Organon Renovatum*. 3rd ed. London, England: John W. Parker.
- Whewell, William. 1860. *On the Philosophy of Discovery: Chapters Historical and Critical*. London, England: John W. Parker.
- Whitehead, A. N. (1929). *Process and Reality. An Essay in Cosmology*. New York: Macmillan.
- Wittgenstein, Ludwig. 1969. *On Certainty*, edited by G. E. M. Anscombe and G. H. von Wright. New York: Harper.
- Wootton, David. 2015. *The Invention of Science: A New History of the Scientific Revolution*. New York: Harper Collins.
- Young, Michael. 1958. *The Rise of Meritocracy, 1870-2033: An Essay on Education and Inequality*. London, England: Tames and Hudson.
- Zetterberg, Hans. 1965. *Theory and Verification in Sociology*. 3rd ed. New York: Bedminster Press.

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