

1

Some Cogitations on Interpretations

Peter Machamer

Department of History and Philosophy of Science, University of Pittsburgh

What Is Interpretation?

Interpreting “things” is an activity that people (and maybe some animals) engage in. Sometimes we call this activity of interpreting trying to understand or trying to make sense of something. In some sophisticated circles, interpretation is called the search for meaning. What results from interpreting is an interpretation or, perhaps, some degree of understanding. Some people might say the interpreter has found out what the meaning of something is or has constructed a meaning.

The use of the word *interpretation* itself carries an ambiguity between the process of interpreting, the activity, and the product, an interpretation that results from that process — a basic process-product problem. However, since the activity, typically, is undertaken with the goal of producing the product, the process and the product are inextricably linked. Still, it is good to keep these different meanings in mind, for conflation may cause confusion in some circumstances. Not everything we may say about the act makes sense when said about the product (and conversely), so one must be clear on how one is using the word *interpretation*.

These simple reflections lead to more questions. What kind of activity is interpreting? When do we interpret? What do we expect as a result of an act of interpretation? What kinds of things do we interpret? Intuitively one might say that interpreting something is trying to

make sense or trying to *understand* that thing. This intuition then leaves us with the job of trying to interpret *understand* or *making sense*. *Making sense* is an interesting phrase that may well have its roots in the belief that experiences that are tied closely to perception and the senses are more intelligible than those that are more distant, more theoretical, or inferential (see Thom 2000). In this view, sense experience is supposed to underlie (stand under) all understanding,¹ and somehow be the basis for justifying our state of having come to an understanding. This view is often identified as some form of empiricism, yet even medieval scholastics had similar doctrines. Aquinas (*Summa Theologica* I, 84, 85, 86) said, “There is nothing in the intellect that was not first in the senses.” On such an etymological (and justificatory) view, *non-sense* would be the result one gets when trying an interpretive action that cannot be tied or attached somehow to sensible experience, when one somehow departs too far from sense perception or sense experience. This connection to the senses is interesting both in cases of art and science, for both of these practices are supposed to be connected with and somehow founded on sense experience, though in different ways.

Notice that above I explicated “tied to the senses” by using the word *intelligible*. Making something intelligible is just making sense of it, though the concept of *intelligible* allows one to deal with more abstract things, things farther from the senses, without negative connotation. This distance from the senses is necessary because, first, we need to speak about things in general and not just in particular. Also, we interpret mathematics, philosophy, and abstract objects. Prima facie, these latter are as far removed from the sensible realm as can be. So it is that one may ponder the various interpretations of *justice as fairness* or *right action*, or the changes in style and substance when in the eighteenth century physics moved from using geometry to algebra. These terms are abstract, so perhaps “intelligible” (or “intelligibility”) is a better word to describe the goal of giving an interpretation. *Intelligible*, though less common, is clearly semantically tied to understanding, and understanding, in turn, is tied to knowing. Both understanding and knowing are much discussed philosophical and psychological concepts. Recall etymologically what “stands under” means, and then look literally at *under-standing*. What stands under or grounds supports or justifies one’s knowledge, and inferences made from it; and knowledge, in traditional epistemology, has as one of its conditions

that the belief is justified, that reasons must be given. So both of these concepts, understanding and knowing, take us back to conditions of justification. The concept of *intelligible*, at least, avoids implications that there is some necessary basis or foundation that is necessary.

Intelligibility does get us somewhere. Most times when we interpret we are trying to bring about or achieve some cognitive or, note the addition, some experiential state (in some one—maybe oneself). The cognitive dimension is captured by the phrase “making something intelligible.” This is what allies *interpreting* with other cognitive goals such as *making sense*, *understanding*, *knowing*, and *explaining*. So to interpret something may be, at least in part or on some occasions, to find an explanation for some aspect of that thing; for example, to find out how it is coherent or how it fits into some structured whole. To interpret some person’s action, very often, is to find an explanation for it, and so to find out why it occurred given the context and background of the person acting. So if we want to know why you shrieked “Eeek!” we will look for the mouse that might explain it.

This way of thinking about interpretation seems to imply that we interpret something only when sense or intelligibility is lacking. Indeed, many interpretations are constructed on such occasions. However, in many other cases, we already do understand something about what we are going to interpret. Here the interpretation is constructed in order that we may go deeper. *Making sense*, *making intelligible*, and *knowing* are not all-or-nothing states. We can find events more or less intelligible, or know more or less about some thing. Having these as goals is to place them on a continuum of degrees (or intensities.)

Interpreting has also been spoken about in terms of ways of knowing. One interprets a poem, a social structure, or a physical event and thereby gains knowledge about what has been interpreted. However, some people think that in each type of case (the art, the human science, or the physical science) that the kind of knowledge gained is different. Or, to put it more succinctly, the ways of knowing in these cases are not always the same. Clearly, there are obvious differences among the objects and practices involved in the different domains of knowing, but exactly how these differences relate to different ways of knowing needs to be explored at some length.

Also importantly, the word *know*, if this results from interpreting, needs to be used in a way that allows for more or less. You and I may both know about jealousy, but you having read and studied Freud may

well know more than I do. Having experienced painful jealousy during many of my relationships, I know it differently and in some way more deeply than you, who have never been jealous. We must eschew the typical epistemologist's use of *know*, where one either does or does not know. Knowledge, in this sense, is not all or nothing. It is more like understanding and it comes in different degrees. An interpretation, too, may be more or less deep, more or less convincing, more or less insightful.

I will argue later that a part of all interpretations, even those that result in emotions, contain some sort of cognitive content, which regardless of domain or subject matter comes from important similarities and differences, by implicit or explicit comparisons, with the object being interpreted. These differences among objects or events in a domain, or among those in different domains or environments, need to be registered by the interpreter. Often the most fruitful comparisons are clear exemplars or prototypes of the domain. So, for a cinematic example, what we say about Stanley Kubrick's *The Killing* (1956) will be different from what we say about his *Eyes Wide Shut* (1999), even though both belong to the domain of film, the same genre film noir, and were made by the same director. Or, to take an example from physics, Carl Anderson (1933) compared tracks made by particles in a bubble chamber as part of his strategy for discovering the neutrino. Noting these differences allows us to better understand by way of comparison, so comparisons lead to more or less understanding. Furthermore, there may be no final or complete state that constitutes ultimate understanding. I shall argue that this is true, but that this does not entail that all partial understandings are equal or that all understanding is relative.

Further, it may seem as though I am only referring to individuals as the locus of interpretation. We often lapse into such individualistic modes of speech, perhaps as a reflection of the individualistic form of capitalism in which we were raised. Yet, individuals do not constitute closed systems; they are part of and constitutive of physical, human, and social environments. Every individual functions as part of physical, personal, and social systems, which may not always be separable, even in an analytic or abstract sense. Hopefully, further discussion about the parts of an interpretation will make this clearer.

Here it is important to introduce yet another qualification. Interpretation is not just one unitary kind of process or activity. In different interpretations various neural, cognitive, and social mechanisms may be,

and most often are, involved. Despite these differences, and further distinctions concerning the levels of processing (for example, conscious-nonconscious; physiological-personal; or personal-social), it is salutary to consider interpreting at an abstract level in order to see how it functions in many of our activities. More importantly, we look at interpretation as a neuro-cognitive-socio activity regardless of the mechanisms involved or the level of processing, all of which are somehow necessary to our being humans in a rational way. This is true despite, as we shall consider in detail, the wide variety of individual and cultural differences that may enter into any given interpretation. Individual and cultural differences may lead some people to think interpretation is personally or culturally relative. And, in some sense, it obviously is so. But this does not preclude claiming that the activity, considered in general and abstracted away from such differences, is necessary for all persons. Indeed, making intelligible or making sense of the physical and social worlds around us is part of what constitutes our rationality.

However, none of these concepts, *intelligible*, *knowledge*, *understanding*, or *making sense*, when seen as the *only* goal for interpretation, even of individual persons, will suffice, for the goals that people have when they give interpretations are many and varied. Many of the goals or purposes are not even clearly cognitive or epistemic. For example, one can interpret a musical performance or a professor's remarks solely for the social purpose of impressing one's friends or for the emotional aim of creating a feeling. Further, cognitive aspects of interpretation do not exhaust the features of the interpreting activity nor are they sufficient to explain all the aspects of the produced interpretation.

Certainly not all human activities, including reasoning, have an interpretive goal, or even an interpretive component. But there are many that do, and sometimes in surprising or unexpected ways. One goal in making love to another person is to lose one's sense of self and "turn off" any intellectual reflection so that one may just attend to the bodily sensations themselves. "Don't think, just feel" can be very good advice. Yet such an action reflects how the lover has learned to make love. And, for good lovers, interpretative cognition was needed to refine performance and to come to know how and when to move one's body effectively. Good lovers are made, not born. Of course, feeling and acting, in a deeper sense, are never completely divorced from cognition.

Interpretation also involves many ways of doing, many ways of acting and has two aspects: first, the activity of interpreting, of produc-

ing the interpretation, has seemingly noncognitive or practical aspects. In this sense, often the interpretation product itself exhibits features of the procedural act of interpreting. Second, most often the interpretation, the act and the product, leads to important action or behavioral consequences. Interpretations lead to doing things differently, and doing includes perceiving and feeling, as in the making love case above or in learning how to feel or see properly. Much of what we call intuition or tacit knowledge is the result of learning how to attend, respond, and reflect differently than we had before. (Hercule Poirot says, upon discovering a clue and being queried as to how he figured out what it meant, that what he used was not intuition, but just the result of his having trained though experience to use his “little gray cells” in the proper ways [Christie 1936, 231].)

Some things I shall call an interpretation even though there is no clear independent act of interpreting nor any identifiable conscious procedure that the interpreter may recognize as an act of interpreting. When one sees a grape-colored Volkswagen Bug and recognizes it as a VW Beetle of the grape color, it is not clear that you are interpreting (in any conscious sense). Nor are you interpreting when you see your friend at close range and recognize her. The interpretation in these cases, as in the examples in the last paragraph, came with the learning —the discriminations, categorizations, and differential actions that were acquired by practice, and that now constitute how your seeing proceeds at this point. Some philosophers, such as Wittgenstein (1953) and Hanson (1958), restrict the use of *interpretation* to discussing episodes when one is presented with an object that is puzzling, or complex, or whose meaning is not straightforward, and where one consciously sets out to figure out what it is. Similarly, others, such as Gibson (1966) and the direct perception theorists, refuse to use the word *interpretation* for perception that is direct and immediate. Whatever may have happened in the past, they say, is not part of what is happening now. Again they focus on interpretation as conscious process. Such conscious puzzling through is a good and proper use of *interpretation*, but the scope in this book is broader and more inclusive and will include unconscious cognitive processing.

A broader use of interpretation is due to a longer time-scaled view, which we can illustrate with children who are puzzled by many things that they later come to understand. Similarly, many things are complex to them that later in their lives they will find as simple. So in that sense,

even things we do not consciously interpret now were interpreted earlier in our life histories. Of course, to say we once consciously interpreted is not to say we now do so. Further, even with regard to children's learning, *interpretation* is not always the most accurate description. Many of the things we have learned are not things we have interpreted, even at an earlier time. We learn as young children to see pictures and photographs as three-dimensional objects, but have we interpreted something, the data of sense, in order to learn this? Sometimes brain stem action results from hearing music and produces a level of arousal that we feel as an exhilarating emotion. No conscious learning process took place in such cases, and no data of sense were first given to us. Similarly, there may seem to be no interpretation in learning to ride a bicycle. So, perhaps, one ought not to talk about interpretation in such cases. Yet such events often have great meaning in our lives, and if we apply an analysis of interpretation to them, we may explicate the whys and wherefores of that meaning.

By *interpretation* in a cognitive sense, we mean that certain cognitive strategies are followed, whether or not we are conscious of them. In fact, many of the same processes are involved now as were involved when we first learned, and it is these processes that may constitute the interpreting. It seems a matter of indifference whether one is conscious of them. Yet there are some important differences as to what one may do when conscious of something or when one entertains it in the imagination. In such cases the object being interpreted remains in front of the mind's eye and can be referred to and reinspected, and one may draw inferences from it. There are some difficulties with the exact nature of such conscious or imaginary objects, which we will discuss later.

What Interpretation Is Not

Interpretation is often contrasted with explanation. In the hermeneutic tradition (Gadamer 1965, and originally Wilhelm Dilthey, and see the essays in this volume by Parrini, Gjesdal, and Gethmann-Siefert), hermeneutics or interpretation are thought to be keys to the human sciences, while explanation is reserved for what happens in natural science. Often this distinction is explicated further by claiming that natural science explains by using laws, while this cannot be what happens in other domains of inquiry, for there are no such laws. Often upholders of this distinction provide additional suggestions concerning proper methods in

each of these domains. The human sciences, some scholars say, rely on some sort of individual understanding (*verstehen*) of concrete particular instances, which they contrast with the universalist “scientific” methods of empirical inquiry. This is an unhelpful dichotomy for many reasons. Most simply, it is not clear in most natural sciences (biology or neuroscience, for example) that there are many or any universal laws. Second, in all sciences one deals with particulars as evidence. These two points mean the differences between the natural and human sciences do not exist as characterized. Finally, no one has made clear what the difference in cognitive processing is among domains.

There is a distinction that is somewhat useful between Henri Bergson’s two ways of knowing, by acquaintance and by description. Bergson (“Essay on Metaphysics,” 1903) held there are two ways to learn about the streets of Paris. One is to walk about them and learn them by experiencing the “lay of the land.” The other way is to study a map and internalize it, so that one may follow it in one’s head. But there are probably other ways to learn the streets. Someone, for example, learned some of the streets of London by reading the novels of Charles Dickens, who gave quite accurate descriptions; Immanuel Kant is reputed to have done the same. This is not the same distinction as that between knowledge by acquaintance and knowledge by description that was a little later used by Bertrand Russell et al. (1912) to erect a bad foundationalist epistemology. The Bergson distinction is somewhat similar to the common sense distinction between experiential learning and book learning.

In short, many of these traditional distinctions are misleading if not downright incoherent. These positions misrepresent both the natural sciences *and* the human sciences, and how they both work. It is only by maintaining an inadequate and mistaken view of disciplines that these claims for different types of inquiry or knowing get off the ground. On the one hand, one might begin to appreciate the problems with these views by pointing out that in biology, a quite respectable natural science, there are no clear instances of causal universal laws (as traditionally described). This would be a step toward undercutting this mistaken characterization of natural science. On the other hand, one could begin to show that explaining how a person keeps promises, and why this is a useful social institution, is like explaining how baroque painters innovated new ways of using hard curved lines, and why this was an effective change when set against the classical forms. Both of

these examples could then be shown to be similar to what is involved when explaining some phenomenon by using a particular scientific theory, say, using a certain form of neo-Darwinian evolution to explain how human sight became limited to the visible spectrum as opposed to vision in other animals. But rather than arguing directly against this tradition, any good theory must show the similarities (and differences) among interpreting and explaining in natural science, human science, and the arts. Understanding this theory will then allow for understanding how the human intellectual operation of explaining and interpreting are similar, despite important differences in types of subject matter in the various domains. Yet I have to acknowledge that these positions that advocate the *sui generis* nature of the human sciences have found something that has been neglected by the more natural scientific types. What they focus on is the experiential, ineliminable, subjective element that is crucial for understanding human action.

Domains of Interpretation

Interpretation is always of something, the object of the interpretation. Objects of particular interpretations may be almost any kind of thing, or not even a thing. These could include a sight that arouses interest, hearing of an event, reading about an experiment, or even watching a spider mend a broken web. There is probably nothing that under certain circumstances cannot be interpreted. This suggests that even *object* may be too rigid a term for describing what may be interpreted. We also, for example, interpret our feelings — was it love or only lust that I felt last night? Sometimes it is most important to understand the answers to such questions. Making this even more complex is the fact that objects of interpretation may include events or processes. *Phenomenon* is a broader, less substantive term for what interpretation is about. Such objects or phenomena of interpretation may be quite complex and extend over time; for example, why did the American Revolution occur when it did? How did the dinosaurs become extinct? Furthermore, we do not talk only about particular objects, events, or phenomena; we often interpret kinds, classes, genres, and other general types.

Fortunately, objects of interpretation (or phenomena) break into classes or kinds (what we call domains or fields) that often share certain characteristics (compare Shapere 1977; Darden 2006). A first ap-

proximation of adequate characterization is to break objects or phenomena into separate domains or fields by academic discipline. These are not historically fixed, exclusive, exhaustive, or even very precise; however, they do provide a starting point. Here is one such list:

- Natural science, for example, natural phenomena such as optical phenomena, electricity, matter theory, or chemical bonding.
- Psychological science, or more broadly, cognitive science, for example, human problem solving, visual processing, emotional responses.
- Social science (or human science), such as human actions, social institutions, cultural practices.
- Humanities, for example, humanly constructed objects, texts, and historical narratives.
- Arts, such as painting, films, musical performances, novels, plays.

Within each domain, an important distinction needs to be drawn between (1) interpretation as it involves those who *do* natural, psychological, or social science or create literary or artistic works (the actors, producers, or practitioners in the domain), and (2) interpretation as it involves those who respond to the products made by those who produce or practice in that domain (the audience, spectators, evaluators, or consumers). Of course, some persons may perform both roles at once. Interpretation is involved in both processes, though often in different ways and with different goals.

Another historically important way of dividing domains is by the typical or paradigmatic purpose for which interpretations are given in each domain. So, following Aristotle (*Metaphysics* 1025b25), we may divide purposes in general into

- Purpose 1. Theoretical: providing explanations or finding mechanisms.
- Purpose 2. Practical: inculcating ways of acting or of experiencing.
- Purpose 3. Productive: producing a product; for example, a scientific paper, a critical review, a peer group review, an artifact.

These are not exclusive or exhaustive.

This last tripartite distinction does not always pick out domains or phenomena that are distinct from one another. A scientific experiment,

for example, most often involves using a number of scientific theories and beliefs, acting to set up and run the experiment, and hopefully obtaining results in the production of data that may then be used to test one of the theories used, and arguing that the data has external validity vis á vis the phenomenon one sought to make intelligible.

Another nonexhaustive, nonexclusive way of distinguishing domains is by types of product produced by the interpreting: an exposition as in a scientific theory or paper; a particular way of acting as in a behavior or a painting, or creating an internal state such as a feeling of sadness. Yet another way to describe the domain would be to take physiological, neural, personal, and social events as the kinds of things that need to be interpreted.

None of these ways is ultimately helpful for all the cases I wish to consider, but each of them in their own way can help us to fruitfully start thinking about the objects of interpretation and the different environments in which they have their being.

Components of an Interpretation

Perhaps it will be useful to present an outline of the components or parts of an interpretation and identify them analytically. What this means is that, for the purpose of theoretical understanding, one may separate and discuss each of these parts, but they will not always be so identifiable in actual interpretations. The parts of an interpretation are not usually identifiable because they are not distinct temporal episodes, even when we consciously interpret something. Further, they are not discrete events in that they interact with one another, and sometimes one part comprises some of the content of another part or is an element of another part. Worse yet, all of these components have subparts composed of different entities and activities, and one component may include another as a subpart. And, as noted above, the overall functioning of each of these parts may be carried on by different neural, cognitive, and social mechanisms in ways that reflect many individual and cultural differences. But despite such problems, I believe that presenting the outline will be useful for understanding what counts as an interpretation, and for beginning to isolate and describe the mechanisms at work and where these distinctions make a difference.

Interpretation is taken here in its fundamental sense as the act of interpreting, not merely the product itself. As I mentioned above, inter-

preting is a cognitive and social act. A complete and total interpretation contains, implicitly or explicitly, the following components:

(1) An *object* (what is interpreted).

Objects of interpretation belong to domains. Objects of interpretation are not just entities, but also activities, events, or phenomena. They may be particular or general, concrete or abstract. They may be physical, personal, or social.

The object of interpretation, or what we may call the content of the object, is the main source of evidence that an interpretation is viable, adequate, or good in some sense. But objects exist in historical and cultural contexts, so many if not all objects require the interpreter to have or assume historical and cultural information to understand the object and be able to break it into appropriate elements. Of course, how relevant such information is will depend, as noted below, on the purpose of the interpreter.

(2) An *interpreter* (who does the interpreting).

The interpreter is usually an individual person, but the concept may be extended to include some animals, dialogic group activities, or even social institutions.

(3) A *purpose* (the reason or cause for engaging in the act of interpretation).

This is clearly a teleological component that is specified in terms of the purposes, goals, and desires of the interpreter. A person's purpose provides the reasons or causes why an interpretation is being given. The interpreter need not be aware of his or her purpose. The purpose is the goal that the end product (the interpretation) is supposed to satisfy or fulfill.

(4) *Prior experiences, learning, and memories of the interpreter* (the interpreter's background knowledge, beliefs, and practices).

Episodes in the interpreter's *personal history* play a role in selecting what interpretations are sought and how those interpretations are presented. They also function to direct the interpreter's intention, or to select the goal he or she is pursuing when giving the interpretation. To be effective these life episodes must bring about changes in the person. Many episodes in our lives, even ones that may register with us for a short while, very soon evaporate and leave us basically unchanged.

However, others do not and remain, in some form, in us after the event has passed. Those changes in our mind and/or central nervous system are often called *background knowledge* and *past experiences*. Relevant aspects of experience include the things a person has learned, what she has come to believe, how he has been trained to act, and how and in what ways experiences and emotions make a difference. These changes constitute one's various forms of memory.

But it is not just personal, idiosyncratic history that is important here, because many of our memories and all of our learning are culturally affected, and so inevitably involve *social dimensions* and socially normative constraints or forms.

(5) A *method* (a procedure that is used in performing an interpretation).

Every interpretation may be represented in terms of the above analytic components and the links that tie them together. This means there are statelike or stagelike components that may be identified as parts of the interpretation, and there is a procedural strategy or a systematized procedure by which these are accomplished. One must start somewhere and then close the act of interpreting at some point. These strategies or procedures are learned and constitute the method or procedure utilized in interpreting. Such a method is not always explicit or conscious to the interpreter, nor must the interpreter be able to reflect on the act of interpreting. In addition, there is not always a chronological separation among the stages or parts.

(6) A *context* (the social or environmental conditions that obtain when the interpretation is given).

This is the environment — physical, cultural, and social — in which the act of interpreting occurs. It includes the physical, environmental, social, and cultural conditions in which the act is performed and that affect how it is carried out. It also may include the histories of what typically is done in such conditions, or the rituals or traditions associated with such a practice. In some cases the relevant context can be about the interpreter's frame of mind, mood, or emotional state.

(7) A *product* (what the act of interpreting produces).

Interpretations come to an end, as do all overt acts. The end state is the product of the act. The product may be concrete, such as a painting or

research paper, or it may be a state of the interpreter, such as a degree of understanding or an experience.

- (8) *Criteria of success* (satisfaction of conditions that determine the degree of success or failure of the act of interpretation or the product of interpretation).

Since performing interpretations is a learned ability, the performance and/or the product must be able to be evaluated as to its success or failure *relative to the goal of the interpretation* and the normative criteria that are in place for such kinds of evaluations. What is learned, and how it is accessed and used, are all subject to critical evaluation. This is to say, interpreting is a normative activity, and such norms ought to be articulated. Many disputes about interpretation actually turn out to be disputes about the adequacy, validity, or reliability of what is produced. There exist criteria, albeit often implicit, for whether or not learning has taken place adequately or correctly. These normative criteria are not absolute, but they are not person relative. They are subject to historical change, and they may be justified, though not with any certainty.

The data that provide the reasons that can be produced for the legitimacy of an interpretation are, for the most part, drawn from the contents of the interpreted object. That is, we must look to parts of the objects to back up or support our interpretative claims. The effectiveness of an interpretation, by contrast, is supported by seeing how well the interpretation works, insofar as it affects or brings about changes in ourselves or others. Data in support of effectiveness is drawn from the people affected.

I hope that this essay will aid in understanding the range, scope, and goals of interpretation. Interpretation is no longer a hot topic in contemporary philosophy, but I hope to have argued above, and show by demonstration in the essays that follow, that it ought to be.

NOTE

1. *Verstehen* in German has the same etymology. Heidegger also tries to tie the idea of uncovering (foundations) to the origin of the idea of *aletheia* or *truth* in ancient Greek.

REFERENCES

- Anderson, Carl. 1933. *Physical Review* 43: 491.
- Aquinas, Thomas. *Summa Theologica* 1.84, 85, 86.
- Aristotle. 1924. *Metaphysics* 1025b25. Revised text with introduction and commentary by W. D. Ross. Oxford: Oxford University Press.
- Bergson, Henri. 1903. "Essay on Metaphysics." In *The Creative Mind: An Introduction to Metaphysics*, 1946. (La Pensée et le mouvant, 1934) Citadel Press 2002.
- Christie, Agatha. 1936. *ABC Murders*. Reprint, Black Dog and Levinthal.
- Darden, Lindley. 2006. *Reasoning in Biological Discoveries: Essays on mechanisms, Interfield Relations, and anomaly Resolution*. Cambridge: Cambridge University Press.
- Gadamer, H-G. 1965. *Wahrheit und Methode. Grundzüge einer philosophischen Hermeneutik*. 2nd ed. Tübingen. J. C. B. Mohr, 1965, p. 373; *Truth and method*. 2nd rev. ed. (first English edition, 1975). Translated by Joel Weinsheimer and Donald G. Marshall. New York: Crossroad, 1991.
- Gibson, J. J. 1966. *The Senses Considered as Perceptual Systems*. Boston: Houghton Mifflin.
- Hanson, N. R. 1958. *Patterns of Discovery*. Cambridge: Cambridge University Press.
- Jachmann, Reinhold Bernhard. 1968. "Immanuel Kant, geschildert in Briefen an einen Freund." In *Immanuel Kant: sein Leben in Darstellungen von Zeitgenossen. Die Biographien*, by von L. E. Borowski, R. B. Jachmann, and A. Ch. Wasianski. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Kubrick, Stanley. 1956. *The Killing* (film). United Artists Release of a James B. Harris Production.
- . 1999. *Eyes Wide Shut* (film). Warner Brothers.
- Russell, Bertrand. 1912. *The Problems of Philosophy*. Oxford: Oxford University Press.
- Shapere, Dudley. 1977. "Scientific Theories and Their Domains." In *The Structure of Scientific Theories*, ed. Frederick Suppe. Urbana: University of Illinois Press.
- Thom, Paul. 2000. *Making Sense. A Theory of Interpretation*. Rowman and Littlefield.
- Wittgenstein, Ludwig. 1953. *Philosophical Investigations*. Trans. G. E. M. Anscombe. New York: Macmillan.