

"On the Meaning of Data: Historical and
Contemporary Perspectives"

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ON THE MEANING OF DATA:
HISTORICAL AND CONTEMPORARY PERSPECTIVES

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ABSTRACT

The meaning of the term "scientific data" is intimately tied to one's (implicit or explicit) philosophy of science orientation. This paper traces the historical progression of the meaning attached to data. Data may be considered the items, things or "stuff" that one is willing to accept as "scientific" evidence. Three basic orientations are reviewed and the implications of assuming a given stance are discussed. Finally, assuming a contemporary perspective, a few basic "data" principles are derived.

INTRODUCTION

...we find certain things about seeing puzzling because we do not find the whole business of seeing puzzling enough (Wittgenstein, *Investigations*, p. 212).

...To see what the aeronaut sees, we would have to know what he knows (Hanson 1969, p. 101)

...what were ducks in the scientist's world before the revolution are rabbits afterwards (Kuhn 1970, p. 111)

While it is generally acknowledged that "data" represent the basic building blocks of science (c.f., Chalmers 1978), too few scholars question either the meaning of the term data or the assumptions that surround contemporary perspectives on data. The purpose of this paper is to critically examine the meaning of, and assumptions surrounding, this taken-for-granted term. Interestingly, perspectives on what constitutes "legitimate" data have undergone considerable evolution over the past century. These changes, while subtle, are rarely examined for their philosophical import. While perspectives on data are intimately tied to philosophy of science orientations, there is currently a poor match between contemporary philosophy of science views of data and the perspectives implied in the marketing literature.

This paper addresses these issues in three sections. The first section provides an overview of the meaning of data from an historical and philosophy of science perspective.¹ The second section addresses the relationship between views of data and knowledge claims that can be made from data. The final section examines the implications of accepting a contemporary "data" perspective.

EVOLUTIONARY PERSPECTIVES ON DATA

The Pre-Received View

Three philosophy of science schools successively emerged in the late 1800's (Mechanistic materialism, Neo-Kantianism and Machian Neo-Positivism). Each viewed data as information derived from the senses (Suppe 1977). However, subtle distinctions on data are apparent in each view. For example, adherents of mechanistic materialism

¹It should be noted that the meaning associated with data is closely tied to one's view of theory construction, form and structure. Thus, although construction and structure issues arise periodically in the current discussion, they are not the focal point of the paper.

viewed data as sensations that had a direct correspondence to "factual" reality. For example, observed structural changes in concrete entities (e.g., water boiling, formation of rust on iron) represented objective reality indicators (data). The neo-Kantian school distinguished between sensation and observation. They argued that "sensations have forms or structures which are revealed when one dips down through the superficialities of a given sensation. These forms are structures of phenomena, not structures of the thing-it-itself" (Suppe 1977, p. 9). According to the Machian perspective, information represented data as long as it could be reduced to statements about the senses. Thus, while each view acknowledged that data needed to relate to sensory representations, considerable differences emerged in the directness with which data were tied to senses.

This perspective gained substantial revitalization in psychology during the 1940-60s with the rise of behaviorism. Behaviorists themselves also differed in the directness with which data needed to be tied to senses. Radical behaviorists (Skinner 1972) were most closely tied to mechanistic materialists, viewing information as data only if it was directly observable. A modified, and less radical form of behaviorism reached the marketing literature (Nord and Peter 1980, Peter and Nord 1982), however this view did not seem to require that all data be observable (see Peter and Nord 1982, p. 103, Nord and Peter 1980, Table 1). Nor did the view have an impact on the marketing field's perspective on data to any significant degree.

The Vienna Circle

With the advent of relativity theory and quantum theory at the turn of the century, a clear philosophical dilemma occurred. Given that these new theories were based upon what are now labelled unobserved constructs, there arose need to reconcile advances in science with the philosophy of science. What emerged during this period was the influential "Vienna Circle" philosophers. Their orthodox perspective assumed that a sharp distinction could be drawn between theoretical and nontheoretical terms. Theoretical (nonobservable) terms are used to represent abstract hypothetical constructs while nontheoretical (observable) terms are used to represent empirical concepts. Correspondence rules formally link the two terms. Data in this view therefore represent nontheoretical (observable) statements linked through correspondence rules to theoretical terms. Like their pre-Received view counterparts, adherents of the Vienna Circle also held that nontheoretical terms be sense oriented (observable). It was assumed that the observational language (nontheoretical term) was complete understood and that it was not "contaminated" by theory. Thus a tape measure can assess that a given distance is inches. On the other hand, when more abstract concepts are employed (e.g., neutron, gravity), it is necessary to formally link the theoretical and nontheoretical terms. When theoretical terms are employed, the scientist can only be confident that the terms are partially understood — that is understood with the help of definitions, correspondence rules and basic postulates (Fiegl 1970).

While the mathematic, axiomatic relationship between theoretical and nontheoretical terms has been dropped in the marketing literature, the view of observables

(nontheoretical) and nonobservables (theoretical) maintains a central rule in marketing theory and research (Bagozzi 1984; Tull and Hawkins 1984; Aaker and Day 1980; Kinnear and Taylor 1979). Terms such as constructs and empirical indicators, operational and theoretical definitions permeate both textbooks and academic journals. Researchers such as Bagozzi (1984) adheres to the distinction between observables and unobservables. Bagozzi specified two types of observables. The first is simple registering of sense data while the second refers to data collected by "sense extending instruments" (e.g., surveys, interviews, physiological recording instruments). The notion that theoretical terms are only partially understood remains central to measurement theory and such concepts as "measurement error," concept validity, etc.

While the distinction between theoretical (unobservable) and nontheoretical (observable) terms represents a modal viewpoint in marketing, recent work by philosophers of science cast doubt on the validity of this distinction (Achinstein 1968; Hanson 1969; Suppe 1977). Reviewing this distinction is important since the debate has yet to reach the marketing literature to any significant degree. This new perspective stems from a relativist philosophy of science. While the marketing literature has seen a shift in perspectives among some marketing scholars (Anderson 1983; Deshpande 1983; Hirschman 1983; Peter and Olson 1983) current marketing scholars have not articulated clearly why a relativistic perspective on data is logically more appealing than the perspective adopted by logical positivists. We explicate this perspective below. The argument stems from logical positivists' perspective on the separation of theoretical vs. nontheoretical terms.

Consider the following list of theoretical and nontheoretical terms which Achinstein (1968, p. 157) derived from writings of logical empiricists (e.g., Vienna Circle philosophers).

<u>Theoretical</u>		<u>Nontheoretical</u>	
electron	mass	red	floats
electric field	kinetic energy	warm	wood
atom	electrical	left of	water
	resistance		
molecule	temperature	longer than	iron
wave function	gene	hard	weight
charge	virus	volume	

An analogous list could be constructed from the marketing literature (JMR, Nov 1982 issue).

<u>Theoretical/Unobservable</u>	<u>Nontheoretical/Observable</u>
Behavioral Intention	All things considered, what are the chances in 10 that you will choose to give blood sometime in the future?
Evaluation	Please indicate the extent to which each of the following would effect your decision to give blood in the future. "If I thought I would faint" (5 point scale).
Performance (of video disc player)	Overall Unit Quality very inferior — — — — — very superior
Formalization of salesforce activities	Most of the normal daily activities performed by salesmen in this branch have rules and procedures stating the way salesmen are to perform them

The first criticism of the distinction between these two lists centers on the concept of observation. The positivist position holds that the theoretical list refers to unobservables while the nontheoretical list refers to observables (Achinstein 1968, p. 158-159). Achinstein, however, argues that "observation" does not accurately distinguish the two lists. A similar argument can be made with respect to the marketing list. To understand the foundation of his argument it is first necessary to review his five basic points/assumptions about observation.

1. To observe means to engage in an activity. The problem is that there is no particular number or set of items which need to be attended to before it can be said that one has observed an item.
2. Observation requires that attention be paid to various aspects or features of an item. However, there is no guarantee that observation will guarantee "seeing" or "perception". In other words, it is possible to "observe" some items and yet have no idea what one is observing. One might observe a consumer examining canned soups in a supermarket. However, it is unclear if the individual is thinking about the soups, shopping or other activities.
3. One does not have to directly observe X to say that one has "seen" X. A forest ranger may observe a fire in a distance although s/he only "sees" smoke.
4. An item may be observed indirectly. For example, one may observe items by using mirrors, microscopes or other lenses.
5. It is possible to describe what one is observing in many different ways. Training and prior knowledge influence the language which is used to describe phenomena.

With these five assumptions/propositions, Achinstein attacks the distinction between theoretical and non-theoretical terms on the grounds of "observation". First he argues that the distinction rests on the assumption that one cannot observe the theoretical items. However, if we consider points 3 and 4 above, then the assumption is invalid. Many theoretical terms can be observed even though the basic item is hidden directly from view. Second, the positivists argue that when one "observes" a given item it is describable in a unique, single way. Thus, if a researcher queried several respondents about the extent of formalization within their organization, it should be possible to agree on a unique description. However, point 5 assumes that a given item may be described a number of different ways. Thus, "formalization" may be "seen" and hence described differently by each respondent. As a result, it is entirely unclear what is gained in multiple informant research when one attempts to remove the "error" associated with each respondent's view. This approach is only valid if one accepts the view that there is a "true" level of formalization waiting to be unearthed.

The second criticism of the theoretical-nontheoretical distinction rests on the notion of data as theory-laden (Hanson 1969). Central to this notion is the imprecision of the term "seeing" (Hanson 1969). For example, we might be sitting at our desk looking directly at a book but thinking about teaching a course. Can it be said that we "see" the book? This basic argument comes down to "distinguishing between the actual impressions the world makes on our sense organs and the intellectual contribution that we make in our appreciation of those sense impressions (p. 72)." Hanson would argue that it does not make sense to refer to "seeing" only as a retinal reaction. Instead, one needs to consider the interpretation of the retinal reaction to understand the meaning

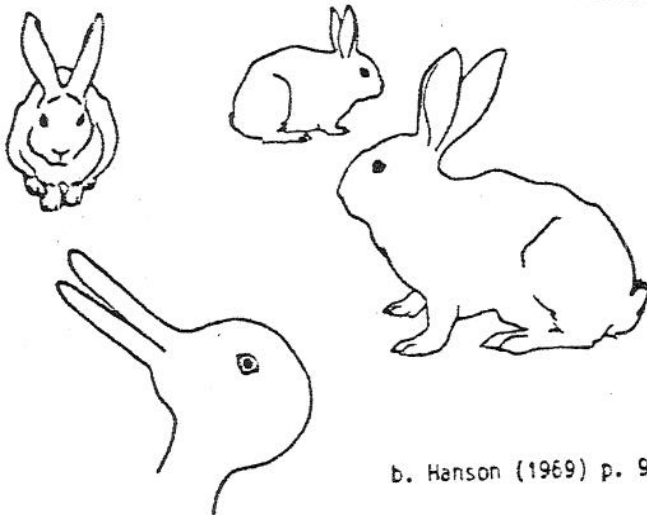
of observation. Equally important, he does not believe that the process is a sequential link of seeing then thinking. Instead he argues that the two processes occur simultaneously (p. 86).

To illustrate this point consider Part A of Figure 1. This figure could either be a rabbit or a duck depending upon how one "sees" the picture. Hanson asks the following questions about the figure: "All normal retinas would react similarly to these, would they not? The visual sense-data evoked in us by these would be likely to be similar, would they not?...Nonetheless some people will see a rabbit, not a duck...Now given two normal observers - normal retinas, relatively normal brains - given that one can only see a duck...the other only a rabbit, do they see the same thing? (p. 90)." The basic point made by Hanson, is that people do not see the same thing. Rather each person actually "sees" different things in each environment. As a result of seeing different things, one records distinct personal interpretations. Hence, different data would emerge from different individuals.

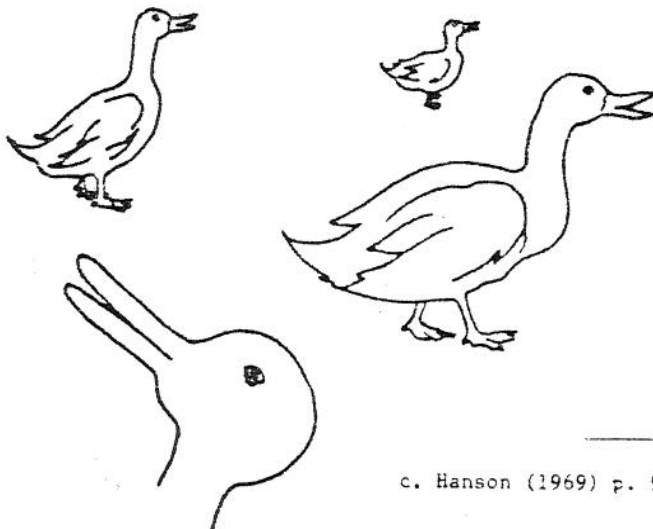
FIGURE 1



a. Hanson (1969), p. 90



b. Hanson (1969) p. 97



c. Hanson (1969) p. 97

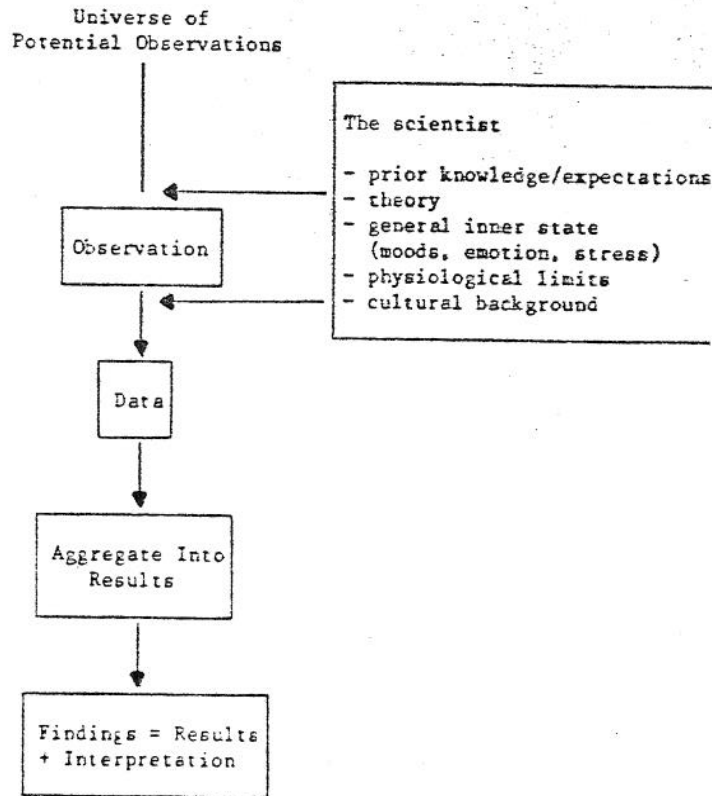
Building upon this argument, Hanson (1969) argues that it is necessary to understand the background and knowledge of the person who is viewing the object. To illustrate:

... consider a new PhD student in marketing. On her first day at school she sees a host of numbers on a computer printout, a Figure which contains boxes, circles and Greek letters, and a short description of a typical series of events at a restaurant. Now, after years of schooling, the student "observes" the same stimuli but "sees" a correlation matrix, LISREL model and "script." Clearly the person has the same retinal reaction, but the person does not "see" the same things.

A simple illustration of the effects of context can be noted if one considers Part B and Part C of Figure 1. If one attends only to part B of the figure, the odds are that one would consider all pictures to be of rabbits. Conversely, if one attends only to Part C of the figure then the odds are that one would consider all the pictures to be of ducks. Hence, the context drives the interpretations of various observations.

To summarize, observation or "seeing" cannot be divorced from the background knowledge or context of the individual. Training, prior knowledge, heritage, experience and other factors all combine to influence how a given individual might interpret sets of stimuli. The implication is that a given group of scientists viewing a set of items might categorize the items distinctly. No one set of categories is "right" or "wrong", it is simply that people see the world differently (see Figure 2).

FIGURE 2



The third general criticism of the distinction between theoretical and nontheoretical terms rests on the ideas of precision and, relatedly, abstraction (Achinstein 1968). Precision is defined as the extent to which a given boundary is concretely or loosely defined. Often this translates into a numeric scale. Thus the term "temperature" is thought to be more precise than the term "warm" since we can measure temperature. However, when we

return to the theoretical-nontheoretical list, Achinstein argues that precision may accurately categorize some of the terms on the list, but in some instances it cannot. Terms such as temperature (a theoretical term) and volume (nontheoretical) can be measured, while an electron field (theoretical) and wood (nontheoretical) do not lend themselves to easy, meaningful measurement. As a result, precision does not seem to be a concept which can distinguish theoretical and nontheoretical terms. A second and related concept is abstractness. Here we can conceive of abstraction as something which is not part of everyday experience—something difficult to understand or comprehend. Thus, with this definition, one would expect more abstract terms to be more difficult to assess and/or measure. The problem here is that the term abstract is context dependent. In one instance temperature may simply be a simple observation, however; in other instances it could refer to complex mathematical derivations.

To summarize, critically examining the meaning of observation, theory-dependence and precision/abstraction results in a serious challenge to the distinction between theoretical and nontheoretical terms. As Achinstein concludes "none of these labels will generate the very broad set of distinction so widely assumed in the philosophy of science (p. 149)."

To this point we have discussed two distinct views of what types of information might be considered to be "legitimate" scientific evidence. The first era could be characterized as the sense-datum era while the second could be termed the theoretical/nontheoretical era. If we accept the arguments about the tenuous distinction between observables/unobservables then what are we left with? Following from Hanson's work, we would propose a move toward personal knowing (Polanyi, in Grene 1969) and social constructions of reality (Berger and Luckman 1966). This position will be discussed in more detail in the next two sections.

HOW DO VIEWS OF "DATA" INFLUENCE VIEWS OF KNOWLEDGE?

Perspectives on data have profound implications for knowledge claims made by scientists. To illustrate, consider the summary proposed in Figure 3. If one accepts the view that sense data provide accurate reflections of an objective world, it follows that one assumes that data are "facts"; objective truths about the world. Findings derived from data are therefore replicable and cumulative. If, on the other hand, one accepts the view that one can locate agreed upon indicators of constructs even though phenomena cannot actually be "seen" one views findings from data as approximations of truth. This is often implicit in LISREL discussions (see JME, Nov. 1982). Both views denote the belief in a reality that can be intersubjectively verified.

If one accepts the view that each person develops their own construction or personal interpretation of reality (Berger and Luckman 1966; Peter and Olson 1983) one must also assume that no single reality exists. Thus the idea of gaining intersubjective verification, controlling measurement error and calculating residual variance becomes meaningless. Adopting this perspective raises some interesting methodological implications. For example, differences in three raters' ratings of a given consumption situation would not be regarded as measurement error. Instead the views of each would be equally valid and legitimate. If data are acknowledged as social constructions, it also becomes possible to regard as legitimate data heretofore ignored in the marketing literature - that of introspection by the researcher. Thus, meaningful, deep understanding of a phenomena might be most readily assessed by the researcher's uncovering of his/her own personal experiences. Introspection by the researcher is diametrically opposed to the logical positivist tradition in which a value free, objective scientist researches the experiences of others to gain understanding.

DATA AND THEORY

If people develop their own social constructions based on individual experiences, history, language etc., it becomes clear that the distinction between theory and data becomes tenuous. Theories are required for observation, and observations continually modify theories. Consider for a moment that certain consumer behavior phenomena have yet to be discovered. At the same time, chances are that researchers have "looked at" this behavior but have not "seen" it in the novel way. That is, everyone was looking at it as a rabbit. However, as soon as someone is able to notice a duck (look at the phenomenon from a different theory), the discipline quickly adjusts to this new perception. Until the theory emerges, however, the data on ducks is uncollectible. Thus, some data are uncollectible, even though they are observable. This point is eloquently stated by Hanson (1969, p. 172-173). "Facts can never again be regarded in the fat, dumb and happy way we looked at them before. We do not see facts; they are not there to be seen."

Conclusion

This paper was designed to review (1) how data have been viewed from an historical perspective, and (2) the implications of accepting a certain school. Given that data represent the basic, fundamental building blocks of science, it seems appropriate to take a step

²This position is different than admitting that a single reality exists but it is beyond our human frailties to understand and record it. This latter position is still consistent with a received view perspective (Mick 1986).

FIGURE 3

<u>View of Reality</u>	<u>Data</u>	<u>Measure</u>	<u>Data as...</u>	<u>Knowledge</u>
Objective Reality	Sense data	x_g	data as facts	Objective truth
	Hypothetical Constructs	x_{hc}	data as approximations of real things	Approximations of truth... "Scientific" truth
Personal Knowledge	Actual measures employed	x		
	Personal Construction	x_p	data as social constructions	Socially constructed knowledge
Social Construction				

back from taken-for-granted assumptions and to examine some different perspectives. A paradox arises when one considers that (1) the current social science literature seems to have adopted a modified Received View stance and (2) that this stance is inconsistent with contemporary work in the philosophy of science (Achinstein 1968, Hanson 1958, 1969). Of course, this problem can be placed in a wider context. That is, the debate between "science 1" and "science 2" (Anderson 1983). The point of this paper was simply to raise the issue, review the concerns/debate and offer some suggestive implications.

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