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Among philosophers of science, such writers as Hanson, Feyerabend and Kuhn have advanced revolutionary new views concerning the relation between theory and observation. What all these views have in common is that the observations that are supposed to confirm the theories are determined by the theories themselves, or as Feyerabend puts it, what is perceived depends upon what is believed.¹ This view that scientific theories determine how it is that things are perceived should be distinguished from the view that scientific theories determine the natures of the things observed. The distinction is important because while it is true that the ways in which we perceive things are affected to a considerable extent by our beliefs and inferences, and for that matter by our hopes and fears, it is not true that any of these affect the natures of what is observed, nor is it true that our perceptions do. It may be that the official position of these writers is to accept only the first of these propositions. Nevertheless, there is a tendency, as their language amply illustrates, to accept the second as well, and the acceptance of the second may result from a faulty analysis of what perception is.

I will try to locate some of the difficulties of this new way of looking at science by examining what Hanson has to say about the heliocentric-geocentric controversy in the first chapter of his book, *Patterns of Discovery*.² He imagines Tycho Brahe and Johannes Kepler sitting on a hill at dawn seeing the sun coming up in the east. He says that the two scientists see different things when they look from the same point in the same direction.³ Tycho sees the sun beginning its journey around the earth, while Kepler sees the horizon of the earth dipping away from the sun. Carl Kordig has attempted to summarize Hanson's argument.⁴ While I am not sure that Kordig's interpretation is correct, and it is likely that Hanson would not have approved of this way of putting his argument, the interpretation may nevertheless reveal some links in Hanson's thinking that led him to his conclusion. Other interpretations will be considered later, but Kordig's interpretation provides a good starting point for the discussion. The premises in Kordig's version of the argument are as follows:

- (1) Tycho sees the sun Tycho sees.
- (2) Kepler sees the sun Kepler sees.
- (3) If someone sees the Tycho sees, he sees that it is mobile.
- (4) If someone sees the sun Kepler sees, he sees that it is static.

From (1) and (3) Hanson is supposed to obtain

- (5) Tycho sees that the sun Tycho sees is mobile
- And from (2) and (4) Hanson is supposed to obtain
- (6) Kepler sees that the sun Kepler sees is static.
- Under the assumption that nothing that is static is mobile Hanson would obtain
- (7) Kepler sees that the sun Kepler sees is not mobile.
- Under the assumption that the same object cannot possess inconsistent properties, Hanson would then conclude from (5) and (7) that
- (8) The sun Tycho sees is not the sun Kepler sees.

Hanson may have believed, or may have believed at times, that seeing *x* as *p* entails seeing that *x* is *p*. The evidence is mixed. On the one hand he tells us that seeing contains two elements, seeing as and seeing that, and this recognition of two elements might suggest that seeing as is a necessary though insufficient condition for seeing.⁵ On the other hand, he gives examples which suggest that seeing as may be sufficient. One such example is the following: "Tycho and Simplicius see that *the universe is geocentric*; Kepler and Galileo see that it is *heliocentric*."⁶ What is common to the perceptions of Tycho and Simplicius, on the one hand, and Kepler and Galileo, on the other, is the seeing as component. Evidently seeing *x* as *p* is sufficient for seeing that *x* is *p*. Tycho and Simplicius see that the universe is geocentric because they see it as geocentric.

If Hanson believed, or sometimes believed, that seeing as entails seeing that, his line of reasoning might be captured in the argument that is given below. The argument is like Kordig's interpretation, except that it is more explicit. The premises of the argument are:

- (1) Tycho sees the sun Tycho sees.
- (2) Kepler sees the sun Kepler sees.
- (3) If someone sees the sun Tycho sees, he sees the sun Tycho sees as mobile.
- (4) If someone sees the sun Kepler sees, he sees the sun Kepler sees as not mobile.
- (5) If someone sees the sun Tycho sees as mobile, he sees that the sun Tycho sees is mobile.
- (6) If someone sees the sun Kepler sees as not mobile, he sees that the sun Kepler sees is not mobile.
- From (1) and (3) Hanson could obtain
- (7) Someone sees the sun Kepler sees as not mobile.
- From (5) and (7) Hanson could obtain
- (9) Someone sees that the sun Tycho sees is mobile.
- From (6) and (8) Hanson could obtain
- (10) Someone sees that the sun Kepler sees is not mobile.
- From (9) Hanson could get
- (11) The sun Tycho sees is mobile.

And from (10) Hanson could get

(12) The sun Kepler sees is not mobile.

Therefore

(13) The sun Tycho sees is not the sun Kepler sees.

This more explicit rendering of what might have been Hanson's line of thinking will be criticized in terms of the relations between seeing, seeing as and seeing that. The relations hold when "see" is used in its primary sense.

1. Seeing x entails x . A person does not see a skunk unless there is a skunk there to be seen.

2. Seeing x does not entail seeing x as p even if p is an essential characteristic of x . A person does not have to see a skunk as a skunk in order to see a skunk. If the animal is a skunk, then he sees a skunk even if he sees it as something else. Perhaps all seeing is seeing as, and it may even be the case that seeing x entails seeing x as something or other, but seeing x does not entail seeing x as any particular thing.

3. Seeing x does not entail seeing that x is p even if p is an essential characteristic of x . A first person utterance in the present tense by a person that he sees a skunk is a claim that the person sees that the animal is a skunk, but that fact merely serves to confuse the issue. There is not an entailment in either direction between the facts of seeing a skunk and claiming to see a skunk.

4. Seeing that x is p entails that x is p . If a person really does see that the animal is a skunk, then the animal is a skunk.

6. Seeing x as p does not entail that x is p and so does not entail seeing that x is p . Seeing x as p does, however, entail x , and under the assumption that x is seen as p because x is seen, seeing x as p will also entail seeing x . A person sees a skunk but sees it as a pussycat or that he sees that the skunk is a pussycat. On the other hand, the occurrence of this event does entail the existence of the skunk and the fact that he saw the skunk.

The logic of the primary use of "see" is very much like the logic of other perceptual verbs, except that the language employing these other verbs is much less developed. For example, a person hearing a police siren does not entail he thinks or knows that he is hearing a police siren. He may think he is hearing an ambulance siren when what he is really hearing is a police siren. "Hearing that as" is analogous to "seeing that as," but "hearing that" by itself, without the "as," is not analogous to "seeing that." Seeing that x is p entails x is p , but hearing that x is p does not entail that x is p . A man hearing that his wife has been cheating on him does not entail that she has. In general the word "hears" is much less entangled in our language with the words "thinks" and "knows" than is the word "sees," and "smells" is less entangled than "hears," though even with "smells" a residual confusion remains. The way the first person present works may cause someone to believe that there is an entailment relation in one direction or the other between the facts of smelling a skunk and claiming to smell a skunk, but there is not.

I turn now to a brief criticism of the argument adapted from Kordig that was intended to capture some of the links in Hanson's thinking. First, note the startling nature of the conclusion. If the conclusion is true, Tycho and Kepler have not been arguing about anything. If they are observing the same object, that object cannot be both mobile and static. But if they are observing different objects, one object may be static and the other mobile. Neither need be wrong.

The argument, however, though valid, is unsound. (1) and (2) are trivially true, but the other premises are false. The third premise is false. It is not true that if anyone sees the sun Tycho sees he sees the sun as mobile. Kepler sees the sun Tycho sees, but he does not see the sun as mobile. The singular conditional obtained from (3) by taking Tycho as the substitution instance is indeed true, but the conditional is not a logical truth. It does not follow from the fact that Tycho sees the sun he sees that Tycho sees the sun as mobile. The fourth premise is false. Tycho sees the sun Kepler sees, but he does not see it as static. On the other hand, the singular conditional obtained from (4) by taking Kepler as the substitution instance is true, but again it is not a logical truth. It does not follow from the fact that Kepler sees the sun he sees that he sees it as static. The fifth premise is false. Tycho sees the sun he sees, but he does not see that this sun is mobile. (6) is less obviously false (2) - (5), but even it is false if there is somebody who sees the sun as static but does not have good reasons for thinking so. The singular conditional obtained from (6) by taking Kepler as the substitution instance is true, but it is not a logical truth. Kepler may have been mistaken. Summing up, the faults in this line of reasoning are evident. No one would believe that (3) and (4) are true unless he mistakenly believed that Tycho's seeing the sun he saw entailed he saw it as mobile and Kepler's seeing the sun he saw entailed he saw it as static, and no one would accept (5) and (6) as true unless he mistakenly believed that Tycho's seeing the sun as mobile entailed that he saw that it was mobile and Kepler's seeing the sun as static entailed he saw that it was static.

Kordig and I could be accused of attacking a straw man, and perhaps we are. Hanson admits that in one sense, though not the important sense, Tycho and Kepler do see the same sun. When Hanson says that Tycho and Kepler do not see the same sun, he means that they do not see the same sun in the important sense of "see," but Kordig and I refuse to take his word in the sense intended. There is some excuse, though, for our stubbornness. "Seeing," "seeing as" and "seeing that" have several meanings and are ambiguous in certain contexts, but there does not seem to be any ambiguity in the sentence "Tycho and Kepler do not see the same sun." In one very clear sense of "see"—the primary sense of "see"—the sentence is false, and I do not see (in another meaning of "see") any sense in which the sentence is true. Difficulty may arise, however, in the *analysis* of the meaning of sentences of the form "A and B did not see the same thing," but the difficulty is more in the meaning

