

The Problem with Facts

There are at least six constituents which need to be considered when deciding what is a fact, or better still what will be considered by us as facts:

1. The *limitations of the human organism*: the human sensory apparatus determines the range of facts. Note also the relevance of the human life span. Would a race of intelligent animals that live for only an hour be likely ever to discover that glaciers drift? or that a melody is being played on a phonograph record revolving once a century?
2. The scientific *instruments* available. "Fact" is relative to the methods and conditions of observation - to the accuracy of thermometers, yardsticks, and clocks: things do not have a "size" which is independent of the instruments used to measure it. (And of course instruments cannot dispense with the human observer; even a computer print-out must be read at some point by a person.)
3. *Memory*. One can be aware of repetition or of generality only if one now has a sense of what has occurred in the past.
4. The *personality*, aims, and bias of the individual scientist. This factor is usually (perhaps not always?) corrected for by other scientists.
5. *Language*. The observer can describe the world only in the language available to him. Wittgenstein said that "if we spoke a different language, we would perceive a somewhat different world." Waismann's metaphor is "language is the knife with which we cut out facts." There is no "fact of the matter" outside language.
6. Most significantly, fact is relative to *hypothesis*. There are no "raw facts." The human eye is not a camera, unfocused, automatically and unselectively recording impressions. Facts are not found haphazardly, nor in isolation. The scientist is not a passive observer of a self-evident structure. The scientist must know what to look for. He must select; he must evaluate; he works from an implicit theory which determines what he will consider as a relevant fact. To ask for "nothing but the facts!" is to demand a map drawn to no particular scale.

Interestingly, then it seems as if it is the hypothesis that is important in determining what facts we will find out, which seems to be the wrong way round as we usually think of the facts as determining whether or not the hypothesis is true, not the reverse ... and this leads us to some interesting problems. What if a scientist has the wrong theory / hypothesis? Will she miss an important piece of evidence that is vital to her understanding of the world? Malinowski tells of a young anthropologist who went out in the field to record a certain tribal ritual. He dutifully photographed everything in sight, only to realize later that the significant part of the ceremony was taking place somewhere else but he didn't know where to look because he had the wrong theory about what was important

According to Whitehead, science tries "to see what is general in what is particular." But the problem is that the particular thing always has more than one general aspect or property that you could be talking about. Gomperz offers the following descriptions of the flight of a sparrow:

There goes a sparrow.
This bird is flying.
Here is an animal.
Something here is moving.
Energy here is being transformed.
This is not a case of perpetual motion.
The poor thing is frightened.

No description can tell you all that can be told about a particular thing or event; “fact is richer than diction” and so a scientist will have to decide what are the relevant factors to talk about / look at / investigate and that will probably be decided by the particular theory they have which will tell them what is important. So, in the above example the physicist’s theory might tell him that the important thing to look at when investigating why the bird flies is the transformation of energy with the psychological aspect of fear being relatively irrelevant. This makes sense, after all you can’t investigate everything, but what if the scientists have the wrong theory?

As a TOK student it is important to realize that Science is not always the purely objective quest after facts that it is sometimes made out to be. This has had some interesting effects on the way that science has been pursued, particularly when we look at how scientists’ views about what facts need to be explained have changed and developed over time. There are always implicit assumptions about what facts are puzzling and what might be taken for granted and here are a few examples:

1. The Ancient Greeks did not think that how the world began had to be explained.
2. Francis Bacon refused to believe Copernicus theory that the sun is at the center of the solar system because it seemed nonsense to him to group the earth, which is motionless and dark, with the other planets which move and shine.
3. Kepler was puzzled as to why each planet is at a particular distance from the Sun but now we are just happy to accept that the particular distance of the Earth and all of the other planets is just an accident, in our case a lucky one.
4. X Rays were discovered in 1900 when Roentgen wondered why a screen glowed unaccountably but before him no one else had thought that this glowing needed an explanation.
5. No one before Descartes thought that the relationship between Mind and Body was a problem.
6. In current Physics there is no need to explain why the speed of light is constant, it just is!
7. Equally in Nuclear Physics it is believed that there is no need to explain why radioactive decay happens when it does, it just happens.
8. Does the fact that space has three dimensions have to be explained?

As you can see what a scientist feels does or does not need to be explained is strongly influenced by their theory and their position in the history of scientific thought but let us not lose too much heart. Let us also remember The judgment of scientists may be biased, their selection of problems may be whimsical, their assessment of the evidence may be faulty, their determination of the facts may be subjective, their motivations may be suspect, and their observations may be distorted by their values: beware the fisherman who uses a net with two-inch openings and declares that all the fish in the ocean are larger than two inches! But these factors may all be made explicit, and controlled. Science is a social and self-corrective enterprise.

The human element in the progress of scientific explanation cannot be eliminated. The usual image of the scientist is misleading. He is not finding his way through a labyrinth which has one and only one pathway through it (there may be more than one, and there may be none). He is not putting together the pieces of a jigsaw puzzle (that is, pieces which can be correctly joined in one way only). He is not solving a mathematical problem, nor a chess puzzle: both mathematics and chess presuppose specific postulates and rules of inference. Nature proffers no rules, no definitions, no stipulations, no guides, no Ariadne’s thread. We make all these up ourselves. It is not nature which prevents our grouping cabbages with kings, but our own demands for order. And we have no reason to believe that our categories and discoveries and conclusions are the only ones possible.

Our perceptual knowledge is delimited by our characteristic biological capacities, and there are limits to the completeness of our theoretical structures. But our observations and our theories mutually reinforce each other. If we never trusted some sort of evidence, nothing whatever could ever be tested. The structure of our science is pragmatically justified; it is the most reliable knowledge there is; it is in every sense objective.

But it is *our* science; it alleviates *our* puzzlement; it supplies the answers to the questions we have asked. Nature answers - if she answers at all! - only those questions which we put to her. Man is nature

becoming aware of herself, but she might have other children! If there should exist intelligent creatures elsewhere in the universe, will their “science” inevitably be the same as ours? At the court of Louis XIV there was an ongoing debate as to whether two “perfect artists” painting the same scene would produce identical pictures. Would two “perfect scientists” working independently produce identical sciences? Both of these questions imply that regardless of how the problem is viewed, regardless of the human mind, there is only one correct solution. But there is no reason to believe that any such unique solution exists. There is an irreducibly anthropocentric element in knowledge. No observation, no measurement, no thought process ever confirms a hypothesis with absolute precision. We can never be certain in an experiment that we have excluded all extraneous factors, nor what degree of error may be tolerated, nor what other explanations may be possible. Answers to questions have contexts, and presuppositions. We can no more explain everything at once than we can doubt everything at once. The decision as to when to accept an explanation and when to question it is ultimately and idiosyncratically human.

We are thus again referred back to the primal philosophic injunction: Know thyself (Socrates)! Man is the measure.

Adapted from Reuben Abel's 'Man is the Measure' (Chapter 10)