CHANGING INTERPRETATIONS OF THE SCIENTIFIC OBSERVATION: OBSERVATION WITHOUT SEEING

Kemal Yurumezoglu

Secondary Science and Mathematic Education Department, Mugla University College of Education,
48000 Kotekli-Mugla TURKEY
k.yurumezoglu@mu.edu.tr

Abstract
In this article, we studied the paradigm of observation which has been restructured since the beginning of modern sciences. In order to interpret this observation paradigm, an expression, "observation without seeing" was formulated. It was noticed that our interpretation of the observation depends on our knowledge and experiences. Finally, it was emphasized that the coincidence between our intellectual structure and the structure of the scientific knowledge and scientific thinking accompanied are essential to better interpret the world. This compatibility makes our scientific and daily activities more understandable and easy.
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Introduction

Learning science and teaching science should be structured in their own formation and mentality of development, taking into consideration the individuals of every age. In other words, science education should be in compliance with its own formational paradigm (Kuhn, 1962; Lakatos, 1976). Perception, observation-experiment and an organized way of thinking, which are always in relation, provide a balance and meaningful data flow between the world, we live in and human beings. The essence of knowledge is formed by giving a true meaning to this data flow, by passing the data through the process of trial and error, electing the error (Yıldırım, 1997) and by interpreting it. Due to the fact that the elements, which have a role in this process, are basically the same elements approximately in every era, they have been under the effect of different paradigms in their structuring and implementing. In this article, the role of observation in modern science, which goes beyond the borders of seeing and reaching a new dimension will be discussed.

The Meaning of the Scientific Observation

Scientific knowledge and scientific activity are understood correctly only when their elements are defined accurately. Considering this fact as a focal point, observation, which is located in the centre of scientific activities, is realized by human beings having a direct interaction with facts, or a direct or indirect interaction with the objects creating these facts and sometimes with characteristics that define these facts. In effect the significant thing hereby is to perceive the characteristics of an object or objects. Whereas "observation" as a word has a connation of seeing by eyes, in meaning it should be mostly interpreted as to perceive with a direct or an indirect interaction in our modern science. The expansion of observation limits, particularly by the invention of telescope and microscope, has encouraged human beings to make researches always on smaller things or bigger ones. Yet the deficiency of these instruments in describing human beings' boundaries of curiosity put forward that it is impossible to analyze the world we live in by merely seeing it. Now from this point on, view of observation, which is shaped by seeing, has given way to perception by our other sense organs or to the secondary perceptive organs assisting the former.

To discover the different kind of characteristics that define the objects and to design technological instruments, which will able to access them, to gather more information about the object and to expand the borders of them, to view the data coming from different senses and instruments, which assist the senses as a whole and implement the data, to integrate

objects and facts, to visualize and to give meaning to every data obtained from the object based on mathematics in the conceptual frame constitute the basic milestones of present day scientific paradigm of observation.

Observation without Seeing

The below examples given by different scientists with different arguments will help us to explicate the subject in a more concrete and large frame. If we understand the systems of thought and the methodology of science, science education, learning science or any of our activity realized in the frame of science will be more meaningful and permanent.

Firstly let's begin with the view point of Levy-Leblond (2003), theoretical physician and science historian. "From the cognition of our own selves on, we observe without seeing. This fact is also true out of the context of science. Seeing is only one of the senses that help us in recognition of our world, the most basic one without a shadow of doubt; yet other senses should be taken into consideration. Techniques (i.e.; metallurgy) in most times refer to the sound. Chemistry has marked a significant improvement by smell and taste. Mechanics is the first field of science, which is shaped on the feeling of force and weight. In modern sciences many direct observations are recorded by using complicated electronic instruments. These are mostly interpreted electronically without being visualized. In a deeper sense "to see" is not a neutral perception. Interpretation based on indirect definite or indefinite theoretical data always follows it. That's why the existence of atom on its own was defined long before it was observed."

Secondly, let's go on our review with the views another scientist Changeux (2003), in his discussion of "seeing atoms". "Can we see atoms? Technology has recently given an affirmative answer to this question. Yet what does 'seeing atoms' mean? The answer is rather easy. As in the macroscopic object, by detecting the light radiating from the object, we see this object. When we look at a macroscopic object, our eyes collect the photons which are radiating from a light source and are reflected from different parts of the object. The data carried by photons are interpreted by our brain and the image of the object is formed in our mind. To see an atom the object is lightened with a laser light. Atom, which is stimulated by the laser light, distributes photons into different directions. These photons are gathered via the appropriate optical instrument and lastly they are detected by a sensitive photo-detector (sometimes by a naked eye). Atom appears as a very small illuminated spot. The length of the light wave and the size of this spot is approximately one micron. This diameter is ten thousand times bigger than the diameter of the atom. The optical observation does not give us information about the structure of the atomic object, whereas it gives information about the approximate place of the object. This is sufficient for distinguishing the atoms from another group. "

We can overview, from above examples, how observation mentality has been shaped in present day science, which is emphasized by the above views of two scientists, one of them is explicit, whereas the other is implicit. In most of the science activities our sense organs, other technical instruments assisting these sense organs, our intellectual activities which provide a theoretical and conceptual frame work together. We will make our thoughts clear by giving two good examples showing that how significant this conceptual frame in making observation is.

The four inseparables

The first example is the view of a researcher, who studies on displaying and image. "In science there is no image for the sake of image. These are always related to a process. The Project Director, Monique Sicard, from CNRS (Centre National de Recherche Scientifique) - Images Media talks about "*the four inseparables*" composed of *an instrument* (or a technical process), *a referent* (a fact or an object to be observed), *image* and *scientific thought.* Scientific displaying processes cannot be reduced into some instruments that help to improve displaying; instead they follow totally a different process. If there is not any theoretical field accompanying a unique vision, a vision is neither sufficient nor does it mean anything. Sicard says that in other words the image is not seen. One example out of many; in the seventeenth century Robert Hooke from England and Antoine Van Leeuwenhoek from Holland, were two naturalistic scientists, who examine the plant cell. Yet due to the fact that there was not a cell theory which reveals the fact that animals or plants are composed of organized cells researched in the same basic frame, their observation could only be understood only after a decade later. In other words they could not understand their own observation. They were looking but could not see (Mentre, 1995)."

Changing Interpretations of the Scientific Observation

In the second example Michael Polanyi (Chalmers, 1987) describes how a medicine student's interpretation of observation changed based on increasing in her experience and knowledge. "Think of a medicine student, who joined a course about the x-ray diagnosis of lung cancer. She watches the shadowy traces on the screen placed in front of the patient's chest in a dark room, hears the statements about the significant characteristics of these shadows made by the radiolog to her assistants. First the student is amazed because she can only see shadows of the heart and the ribs with some thin spots in between on the x-ray of the chest. She thinks that they are talking about the images in their dreams and she may not see anything other than the doctors' talk. Later on while the listening process continues for one or two weeks and she looks at the new pictures of the different states, this will reveal a comprehension like experience for her. In the course of time she will forget the rib bones and she will start to see the lungs. If she reaches an ingenious distinction in advance, she will see a wide panorama made up of rich details. This panorama is composed of physical differences with pathological differences, injuries, infections and symptoms. Now that she has entered into a new world. Nevertheless, she can still see the some part of the things that the doctors see. The pictures are now absolutely meaningful and she will be able to comment on these pictures through a wide perspective."

We come across with two ways of thinking style in the scenery formed until now. One of them is that we can obtain a comprehensive data about our research object without seeing it directly, which is the status that we summarize in the "observation without seeing" formula, which determines the frame of observation paradigm of the modern science. The other is without a conceptualized frame that accompanies the stated data the impossibility of scientific observation and interpretation of the collection of data (in some cases visualized images) constituted of directly seeing by our eyes or sensed by our other sense organs or by the assisting instruments.

From the Artist's Eye

Merleau-Ponty (1964) states in the work "*L'oeil et L'esprit*" that If the artists had seen everything, they could not have created pictures. They have an aptitude of making the objects, which can not be seen by every one, be seen. That is the point which creates an artist. We are trying to make the world we live more visible and meaningful due to this shared aptitude by the artists and the scientists. Our experience and background knowledge, which is shaped by

our perception and conceptual frame help us to understand the environment and to make the world more meaningful. It is just enough to aware of these facts.

Science Education in Schools

Especially in schools we try to understand the events happening in the world by the help of science education. In other words we try to analyze the facts or integrity of the facts. The method applied hereby is the repetition of knowledge and experience gained until now. For many cases we have to say that we are far even from imitation. The reason is that although investigation, observation, experiment and the conceptual frame accompanies to them are sine qua non in the formation of scientific knowledge, we try to understand the existing scientific information not taking into consideration one or two of these facts.

Conclusion

The volume of scientific information nowadays is so extensive that it is far away from even our dreams to learn all these information in present school classes. Yet this accumulation of information has a shared characteristic, which s the fact that all of them are the product of scientific processes. At our schools during science education, we should focus on the examples of science history and on the systems of thought accompanies. So we can study and comprehend the scientific knowledge which is formed in definite periods through definite thought movements in its formational mentality. This can only be realized when history of science and philosophy of science courses are integrated in the other courses in the early stages of education. In order to make the society realize the wellness of the scientific way of thinking, we should act in a very creative way. This will make us to give direction our common sense, which has a significant role in our lives and which is with us in every stage of our lives, and use it in more efficient and productive fields.

Resources

Levy-Leblond, J. M. 2003. A Series of Question-Response Processes with Jean Marc Levy-Leblond. Professor in the department of Theoretical Physics at the University of Nice, France.

Chalmers, A. 1987. Qu'est-ce que la Science ? Récents Développements en Philosophie des Sciences : Popper, Kuhn, Lakatos, Feyerabend. Paris : La Découverte. Cited in Polanyi, M. 1973. Personal Knowledge. London: Routledge and Kegan Paul.

Changeux, J. P. 2003. La Vérité dans les Sciences. Paris : Odile Jacob.

Kuhn, T. S. 1970. The Structure of Scientific Revolutions. 2nd Edition, Chicago: University of Chicago Press.

Lakatos, I. 1976. Proofs and Refutations. Cambridge: Cambridge University Press.

Merleau-Ponty, M. 1964. L'oeil et L'esprit. Paris : Editions Gallimard.

Mentre, M. 1995. L'image Scientifique : Voir l'Invisible. *Textes et Documents pour la Classe* 699: 6.8.

Yıldırım, C. 1997. Bilimsel Düşünme Yöntemi (Scientific Thinking Methods). 1st Edition, Ankara: Bilgi Yayınevi.