Empirical evidence should be used to make progress philosophy essay

Empirical evidence is defined as evidence relying on experience or observation alone often without due regard for system and theory[1]. The meaning of the word empirical derives from the ancient Greek word for experience (ÎµÎ¼Ï€ÎµÎ¹Ï)Î¯Î±), which means knowledge based on direct perception of things or events through our senses. Empirical evidence is necessary in all areas of knowledge, where empirical methods are generally used to a theory or derive a conclusion. Contrary to the theoretical method, the empirical method uses a large amount of observed data[2]. It applies mainly to the study of empirical sciences, namely the natural sciences but also, as it will be seen, to that of other areas, as well, that may apparently have no relation to the tangible world of empirical experience.

In the natural sciences, for example, empirical evidence is crucial and scientists can count on this to continue experimenting and make progress explaining the various phenomena and discovering new sights. During biology labs at school, I had the opportunity to observe – among others – the passive movement of water and other solutions through permeable membranes, explaining the osmosis phenomenon. Moreover, in chemistry labs I used titration method to find the concentration of ethanoic acid in white vinegar and examine whether the experimental value agreed with the theoretical one. Indeed, despite small percentage errors, the values were similar. The core skill of a scientist is to make observations and receive knowledge of the outside world using sense perception. Darwin, who formed his Theory of Evolution, was based on the works of other naturalists but mainly on personal observations during his voyage to chart the coastline of Patagonia, Tierra del Fuego, Chile, Peru, and some Pacific islands, a voyage

that lasted almost 5 years, during which Darwin made natural history collections[3]. His findings, which were sent to England (Cambridge), brought great interest, and till today his work and ideas on evolution are taught in biology classes around the world and constitute a basis for further research.

However, while observation of the natural world is necessary for gathering important data for the formulation of hypothetical conjectures, it does not suffice to verify them. Because, basically, human perception is fallible and thus scientists must record, compare and measure their data with the help of accurate scientific instruments such as microscopes, chromatographs, barometers and radio scopes. Louis Pasteur proved that the most infectious diseases are caused by microorganisms. He wouldn’t have successfully discovered the connection between bacteria and disease without the use of light microscope, which later also helped him in his studies of fermentation[4]. Further, since in many cases observation depends on the theory or hypothesis a scientist has chosen to believe[5]and his/her expectations can influence what he/she sees. For instance, if a microbe was to grow in a media under certain conditions, since researchers theoretically know that some tested media are suitable for a certain organism, they would choose those media and conditions for that microbe and then subsequently expect some result out of it. In what may be called pathological science, the data are biased towards the researcher’s most prized and preferred hypothesis. Polywater, for example, was thought to be a “ hypothetical polymerized form of water that was later found to be ordinary water”[6]. Empirical data should then be approached with a mind akin to discovery and free from the load of previous theories or attachment to a dominant

paradigm. In order for empirical data to be fully evaluated, I believe that every time, they have to be viewed under a new light. In this case an intuitive approach to the interpretation of this evidence might be more fruitful than a strictly reasoned one. Moreover, a good scientist should be always guarded against his personal biases. Perhaps it was this attitude of detachment towards the analysis and interpretation of empirical evidence that Charles Darwin had in his mind when he said: “ A scientific man ought to have no wishes, no affections, — a mere heart of stone”[7]. To ensure appropriate use of empirical data, experiments should be repeated so that other scientists, researchers, as well as students can observe the results. Peers review can always ensure reliability of the scientific process and appropriate use of empirical evidence.

In other areas of knowledge, such as Mathematics, the methods used to verify knowledge are independent of experience. Of course, Mathematics involves an objective, careful and systematic study of an area of knowledge, but facts depend on reasoning alone as in the equation 1+1= 2 for example. For many, Mathematics is an area of knowledge where empirical evidence cannot be used to make progress. It is considered to be the science of rigorous truth and an island of certainty in an ocean of doubt. However, geometry, which is one of its main branches, started mainly as an empirical science, and has been questioned widely as regards its mathematical certainty. More specifically, the axioms, which Euclid used to derive the theorems of Euclidean geometry, have been proved insufficient and have therefore been revised and supplemented in modern times[8]. David Hilbert, made important contributions to both axiomatic geometry and to general

relativity. Also, Bernhard Riemann replaced some of Euclid’s axioms with their contraries and developed his theory that the structure of the physical universe is characterised as a generalisation of elliptic geometry. And thirty years later, Einstein concluded that space conforms to Riemannian rather than Euclidean geometry. Of course, although it is very difficult to validate a geometrical theory, it is possible to confirm it by testing it experimentally. Let’s take the example of the theorem about the sum of the angles in a triangle. This theorem is accessible to experimental test, and Carl Friedrich Gauss carried out an experiment considering a large triangle determined by three mountaintops. Using optical methods (paths of light rays), and, within the limits of experimental error, he found that the sum of the angles in a triangle equals to two right angles[9]. Nonetheless, “ the demand for mathematical certainty in empirical matters is misguided and unreasonable, since mathematical certainty of knowledge can be only attained at the price of analyticity and thus of complete lack of factual content”[10]. This is also summarised in Einstein’s words: “ As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality”[11].

The only purpose of art, many people believe, is to give pleasure. Doubtless, art does give us pleasure, however, it also contributes to our knowledge of the world. Thus if I can consider a work of art as a piece of empirical evidence of the artist’s creative urge, this should not be seen only in view of the pleasurable emotions it creates but also for the truths they convey. While reading through someone else’s adventures in Paolo Coehlo’s The Alchemist I became aware of situations I had never the chance to experience so far.

And, many movies have given me inspiration, have moved me and even changed my attitude towards life. There is no surprise that art plays a major role in education and is included in the curriculum of almost all schools.

In my opinion, empirical evidence in the form of observation, experience, or experiment should be used in almost all areas of knowledge in order for progress to be made. But, however well it may have been confirmed by careful tests, the possibility can never be precluded that it will may have to be discarded later in the light of new and disconfirming evidence. Thus, all the theories and hypotheses of empirical science share the provisional character of being established and accepted " until further notice"[12]. After all, certainty cannot be found in any area of knowledge and discoveries and findings proved by experiment or observation may turn out to be false after some years. Observation, in particular, can be influenced by expectation, advances in technology, as well as psychological factors. Thus, every scientist should question and analyse any findings in the most objective way and not allow prejudice influence his thoughts and his results. As we saw, even " mathematical certainty" has been questioned. And as Einstein said: " The important thing is not to stop questioning"[13].

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