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Research

The project of research of Alexandra Van-Quynh is somehow the natural consequence of ten years of research in fundamental physics during which she has faced several times the delicate, fruitful and truthful experience of having an intuition.

The desire of broadening here knowledge beyond pure physics, made her start still being a researcher in physics to take an interest in psychology of sciences. In particular, she began to read on psychology of intuition and followed courses in NLP (neuro-linguistic programming).

One of the great consequences of that additional education was to reinforce her high respect for the way important scientific discoveries and ideas emerged or were developed. So, she decided to organize sessions devoted to the promotion of a certain idea of science, in words how science is implemented in our whole life and not only locked in the dark rooms of smart professors. The French-Portuguese Institute (IFP) of Lisbon made it possible through bimestrial casual conferences on scientific themes to the full extend of the term. One of the seminars devoted to the fascinating notion of Time was given by the French philosopher and physicist Etienne Klein. Realizing the intellectual and scientific richness of his work, she decided to reorient her research projects towards philosophy of science.

Mathematics has always been close to philosophy and, for long intuition has interested great minds as Plato, Kant, Husserl, Bergson, Poincaré. These three last years she has had the opportunity to work with mathematicians whose open mind and interest in philosophical, cultural and educational issues made her enthusiastic. These were the elements that have converged to orient the investigation of intuition towards its role in mathematics.

Project of investigations

The project is carried out in the Centre for Philosophy of Science of the Lisbon University (CFCUL. It is included in the project Poincaré, Philosopher of Science (funded by the FCT) and it aims to elaborate a psycho-phenomenological description of intuitive experience in mathematics. This researchis made in close collaboration with the Centre de Recherches en Épistémologie Appliquée (CREA) of the École Polytechnique of Paris where Alexandra Van-Quynh does a Ph. D in philosophy of sciences (for which the scientific programme is that of the project detailed on this page).

This phenomenological investigation will use recent methods, namely the interview of explicitation, allowing for a rigorous analysis of the process of pre-reflexive consciousness in an intuitive experience. The protocol will be focused to the case of the intuitive experience in mathematics. The global unfolding process of the intuitive experience obtained from the interviews will be put in perspective with different philosophies of mathematics. We will consider mostly the opposition between Platonism and Constructivism. According to Platonism, mathematics involves discovery: mathematical objects being objective and ideal entities ready

to be contemplated, whereas according to Constructivism mathematics involves invention: mathematical objects being subjectively constructed.

Is the preference that a mathematician expresses for one of these two philosophies connected with the way he perceives and lives through the nature of his own work? Considering these different kinds of positions and the results of the detailed analysis of the interviews, we hope our work will give a hint of what the mathematician really experiences as his consciousness grabs a new mathematical concept.

We believe that it is worthwhile to draw from the methods used by phenomenology in the description of the different modalities of consciousness (reflexive and pre-reflexive). We also believe that these methods can be used in the description of the experience of scientific findings and in the deeply subjective origin of the objective unfolding of knowledge.

State-of-the-art

Throughout the history of human thought and in every field of knowledge, intuition has played an essential role that has been acknowledged both by scientists and artists. The history of the sciences is full of testimonies of scientists belonging to various traditions of thought, telling about how a new idea came to them in a sudden, unexpected manner without any discursive activity. A lot of attention has been paid to the content of these intuitions and a considerable energy spent on exploring their consequences. But very few studies have been consecrated to describe the subjective experience associated with the intuition and the intimate experience of discovery itself, i.e. to what the scientist is living through at the moment of the intuitive breakthrough.

A reason for this silence around the intuitive experience could be its character of immediacy. Indeed, intuitive knowledge is first of all direct, immediate knowledge, which cannot be reached through an intermediary reasoning process. It is not understood progressively, at the end of a deductive process consisting of the accumulation of middle terms. On the contrary, intuition shows a character of discontinuity: it surges forth, unexpectedly, out of our control. Nonetheless, does the direct character of an intuition eliminate all possibility of description of the intuitive experience?

Many philosophers of intuition agree on the existence of a pre-intuitive gesture: platonic conversion, Cartesian doubt, phenomenological reductions are inner movements that allow for an unlearning process, a break in the usual manner of looking at the world that liberates an interior space for intuition to spring forth. Among scientists, the mathematician Henri Poincaré is probably one of the greatest examples of awareness of the role of intuition in mathematics. In a famous conference given in 1908 at the Société de Psychologie de Paris, he emphasized the role of intuition in mathematics research. In fact, Poincaré dedicated himself to analyze the inner psychological processes that allowed him to discover the fuschian functions. Further, he drew a general model for mathematical discovery consisting in four steps: conscientious preparatory work, unconscious work during a resting or diverting time (incubation), illumination (intuition), and conscientious work on the verification of the appeared idea.

Now, following Merleau-Ponty quoting Bergson, "Suppose that instead of wanting to raise ourselves above our perception of things, we plunged into it to dig it out and enlarge it", we believe that it is now possible to combine philosophy of science with the results of introspective methods in order to get an insight of the role played by the intuitive experience in mathematics and of its correlations with the various philosophies of mathematics.