On the Role of Unconscious Thought in Mathematical Discovery

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Abstract: Unconscious thinking plays an important role in the process of mathematical discovery. However, the controversy about unconscious has never stopped, but a lot of facts have proved the existence of unconscious since ancient times. In the whole process of mathematical discovery, because the unconscious mind is not bound by the rules of reason, it is often more profound and effective than the conscious thought process. In the process of Poincaré's mathematical discovery, a large number of unconscious thoughts are applied, from which we can feel the exquisite cooperation between unconscious and conscious, and realize the important role of unconscious thoughts in the process of mathematical discovery.

In the discovery and creation process of mathematics, there is often a creative inspiration, which we call the phenomenon of "enlightenment." The emergence of this kind of epiphany can not be simply summed up in the opportunity, nor can it be described as the logical jump of "the jump to the intermediate stage". This phenomenon is undergoing a very complicated one, and it is the result of a very complicated process of "unconscious thinking" that has not yet been fully understood by us.

Here, unconscious thinking, by definition, refers to a thinking process in which the thinker himself is not aware of its existence and is not controlled by consciousness. There are plenty of examples of this thought process throughout history.

1. Controversy Over the Unconscious Phenomenon

Although there are many examples in our daily life that indicate the existence of unconsciousness, and its existence has long been recognized by masters such as Leibniz, there are still some people who don't know it, even some scholars regard this unconscious process as a matter of identity loss, forcibly demystifying the unconscious process that they have already experienced. Some scholars are stubbornly opposed to the unconscious phenomenon. Even in the research on the phenomenon of the unconscious has been underway for several centuries of 1852, there are also found in discussing the problem is so said: "The mechanism of this previous stage that produces a clear conclusion or prophecy can be known by the law is naturally explained: thinking is carried out entirely by analogy and habit, and thoughts jump in the middle stage."For this kind of discussion, the famous French mathematician Jacques Hadamard is even more unacceptable. This is like a jump in this intermediate stage. People can not say know or don't know, but it is actually an unconscious process in the strict sense. Here, we can't help but think of an experiment done by the French psychologist Pierre Jeanne. He drew an "X" on the card and asked it to be erased without looking at it. Obviously it can't be done, but this experiment actually shows the existence of the unconscious state, and Pierre does not deny it.

However, in order to make every effort to deny the unconscious existence, the philosopher Alfred Foye has come up with two contradictory and relatively extreme attitudes. He even believes that in any case there is only conscious,but sometimes this conscious is weak and unclear; and when this theory is not able to stand still, Alfred goes to the other extreme: he explains all the conscious activities with conditioned reflex. Of course, we never deny the existence of conditioned reflex, which has long been confirmed in Ivan Pavlov's experiments with his dogs.

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For these two extreme views held by Alfred, Jacques Hadamard also used his personal experience to refute. He mentioned the case of “automatic writing” and believed that many of us in life have similar experiences. When Jacques Hadamard was in high school, once he was doing something uninteresting, his hand with a pen was unconsciously doodled on paper. When the consciousness returned, he found him in this The word "Mathématique" (mathematics) was written at the top of the paper. Jacques said that such behavior cannot be explained by conditioned reflex. Conditional reflection can never make such a complicated action - for example, immediately after "t" writes an "h". Therefore, the statement of conditioned reflex This cannot be explained. At the same time, Jacques also said that we can't admit that this is his conscious intention to write the word, because at that moment, even if he is a little bit conscious, he will immediately stop such a move, because he himself is very clear about the paper. It is used to write other content.

It is undeniable that although the unconscious has proved its existence time and time again, we did not really understand it, which seems to have covered it with a mysterious veil. Even because of this mystery, it seems to have been given the supreme ability, some people think that the unconscious is not originally from our own. This kind of thought is quite popular with metaphysician at all times, just as Aristotle thinks it is divine. And Leibniz even believes that it can make humans talk to God, and without it, we will have nothing. Through our research, we found that there are many scholars with such ideas. After an analysis of their discourse, we found that some people are actually afraid to hear the unconscious, and even as mentioned above, they are unwilling to admit his existence. Here is an example of the German philosopher von Hartman. Hartman believes that unconsciousness is a force of the universe, a ghost, a harmful thing attached to us. His strong fear of unconsciousness made it a pessimistic argument: he believed that believing in the unconscious was not only a personal suicide but also a collective suicide of the universe. He even predicted that this unconsciousness is enough to destroy our entire planet, and that we humans must quickly get rid of this devastating thing.

This may be a rebellion against some indulging in unconscious illusions, because it is not difficult to imagine that if such illusions are given such mystery, it will immerse people in it and not be able to extricate themselves. However, it is not difficult to understand that the unconscious is not a special mysterious thing. What is really mysterious is actually the function of our brain, that is why our brain can think? What is this spiritual process? Although humans have a history of thousands of years, we know very little about these issues.

Although some philosophical schools still deny the unconscious, today its existence has been widely accepted.

2. The Relationship between Unconsciousness and Discovery

First of all, we must know that discoveries or inventions are carried out in a new combination of ideas, whether in mathematics or in other fields. The number of such combinations is quite large, but a considerable part of them are of little use, or rather, only a very small part of them are useful and effective, and usually, our reason is just to care about the very small part of the effective things, and then to a larger point, we may also care about what might be effective.

In order to find a combination of effective ideas, we must build a variety of combinations, and then find out what is effective, then, in the process, we will inevitably have a certain degree of randomness, so in thinking Above this step, the opportunity is very important, but it must be pointed out here that this opportunity only works in the unconscious. Then here, the unconscious versatility is manifested, because it is not only to construct a combination of various ideas, but also to compare them with each other.

Obviously, the combination of constructing a variety of ideas is only to discover the initiality of creation, as the famous mathematician Poincaré said, discovering that creation is to eliminate those useless combinations and then retain those useful combinations. The useful combination is only a handful. Therefore, Poincaré concluded that the invention is to distinguish, that is, to choose. For the relationship between unconsciousness and discovery, Poincaré believes that the unconscious is not only responsible for the complex tasks of constructing various combinations of ideas, but also to

make the most detailed and essential choices according to our aesthetic principles. This kind of discussion can also be proved in many mathematics discovery activities in Poincaré.

And this kind of unconscious thinking often appears in our daily life. For example, sometimes we can't remember the name of a person or a place, so we have to give up, but after that we will suddenly remember at some point.And in the process of discovery, this situation occurs more often. Remy de Gourmout once said that words used to correctly express ideas often appear like this, that is, when you look for it for a long time, it has no effect, but when you think about other things, It suddenly appeared in an incredible way. This situation is of great interest to us because although this is still within the scope of daily life, this feature is clearly within the scope of discovery.

For a long time in the past, we always said that the unconscious is automatic. This is of course unquestionable because it is not affected by our will, or it is not directly affected by our will. It is even Beyond the scope of our knowledge. But Poincaré later pointed out that the unconscious is not purely automatic, it is discriminating, even very dexterous, knowing how to make choices, how to speculate, Poincaré even thinks it is more adept at speculation than consciousness itself, because It is not afraid of setbacks, is not afraid of difficulties, and even turn failure into success.“In short, is subconsciousness not more advanced than consciousness itself?”

Then,the unconscious and conscious which is more advanced? This question does not have any meaning in itself. It is like when we are riding a horse, we cannot judge who is more advanced than anyone. Obviously, the horse is strong and runs. It is faster than people, and we as human beings can make it do what we want it to do. In the same way, we can't judge the higher level of hydrogen and oxygen. So for the relationship between unconsciousness and consciousness, they are actually like our left and right legs working together in walking, as is the unconsciousness and consciousness. Instead of arguing about unconsciousness and realizing which one is more advanced, let us look at how the two work together and achieve results in mathematics discovery!

3. Exquisite Cooperation between Unconsciousness and Consciousness

After a lecture by Poincaré, literary critic Emile Fageut wrote: "A problem. When you stop thinking about it, the answer will suddenly appear in your mind. It may be because you are no longer Think about it, or say, I want to relax." This passage proves that rest is a necessary condition for work, but on the other hand, it seems to give excuses for lazy people to slack off. In fact, each of us is very clear. When we are faced with a problem, we don’t think about it. We just have the desire to find the answer. We hope that when we wake up, the answer will appear in front of us. This is undoubtedly quite absurd.

In fact, any problem can only be a leap after careful consideration. For example, Poincaré research on Fuchs group and Fuchs function theory.

It took Poincaré half a month to try to prove that there is no function similar to what he later called the Fuchs function. During these 15 days, he sat alone at his desk for 1-2 hours a day, tried a lot of combinations, but ultimately did not achieve any results. Until one night, he violated his usual habits and drank a cup of black coffee, which prevented him from falling asleep for a long time. At this time, various ideas came to him; he felt that they were in conflict with each other until they were paired together to form a stable combination. So the next morning, Poincaré confirmed the existence of a class of Fuchs functions, which come from hypergeometric numbers; and he only needs to write the results in just a few hours. Next, he wants to represent these functions with two levels of quotient; his idea is completely conscious and well thought out, and there is an analogy of elliptic functions to guide him. And he began to think about the nature of these series if they existed. Of course, he succeeded quite easily and formed what he called the θ-Fuchs function.

At this time, Poincaré participated in a geological survey tour. The beautiful scenery along the way made him completely forget his mathematics work. When he arrived at the destination, he was preparing to take a public carriage to somewhere. The moment when his feet stepped on the pedal, there was an idea in his mind that Poincaré realized that this was what he usually defined: the transformation of the Fuchs function is equivalent to the transformation of non-Euclidean geometry. However, according to Poincaré, before this, nothing has paved the way for this

conclusion.Poincaré did not immediately and did not have time to confirm the idea until he returned to Caen and took the time to confirm the result.

Later, Poincaré turned his attention to studying some arithmetic problems, but these studies did not seem to have achieved much practical results. He did not think whether there was any correlation between these studies and his previous research. Just in Poincaré, he was annoyed by his failure. He wanted to go to the beach to spend a few days thinking about other things. One morning, when he walked on the edge of the cliff, an idea emerged in his mind. This is an arithmetic transformation of the indeterminate ternary quadratic form equivalent to the transformation of non-Euclidean geometry.

Examples such as this are quite numerous in the field of mathematics discovery in Poincaré. He pointed out that at first, the most striking thing was the manifestation of epiphany, which is a clear sign of long-term unconscious work. In mathematical discovery, the role of this unconscious mind is undeniable, including in other cases that are less noticeable. Just like in people's lives, when people are studying a difficult problem, they often cannot achieve the desired results in the first attack. So people will take a break and then work again. At the beginning of this period, as before, there may be no results, and then unpredictable, a decisive idea will suddenly appear in my mind. So here, we find a subtle combination of unconsciousness and consciousness. It can be said that conscious work is more effective because it is interrupted, and a short break can make people's minds full of energy and full of energy. This kind of rest is actually full of unconscious work, and the results of such work often reveal results that have not been confirmed in conscious work. But the act of "revelation" does not occur under the work of unconscious thinking, but occurs in conscious work, but it has nothing to do with conscious work. Conscious work may just be a stimulant, just like Some stimuli, which provoke the results achieved at rest, although it takes a conscious form, it is still unconscious.

In addition to the mathematical findings in Poincaré, we can feel the important role played by unconscious thinking. This is also the case in the research activity of the famous German mathematician Gauss. Gauss spent a few years demonstrating an arithmetic theorem but found nothing. However, as Gauss himself said: "But two days ago, I suddenly proved it. This is not the result of my own efforts, but because of God's gift - suddenly appeared in my mind like a lightning. And the problem is solved in this way, and Gauss himself said that he could not tell the connection between his idea at the time and what he thought was a successful idea.

However, it is not difficult to see through the above examples that it is conditional to want unconscious work to achieve results. It also requires the subtle cooperation of conscious work, as Poincaré said: only after a long period of voluntary efforts, these Inspiration will only appear, although the previous efforts have made people feel useless, and we may not be able to get any practical benefits from it. But in fact, it is precisely these efforts that drive unconscious machines and keep them running. In other words, it is the subtle cooperation between conscious and unconscious, which makes the whole mathematical discovery activity alive and well, and has achieved quite a lot of mathematical results.

4. Conclusion

From the previous narrative, we can conclude that the unconscious self, or the subliminal self as we say, plays a very important role in the process of mathematical creation or mathematical discovery. And as we argued in the previous article: There is always a lot of conscious work to be done before a productive, unconscious work is achieved. I believe that after our in-depth study, we will find that unconscious thinking is an indispensable part of the process of mathematical discovery.

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