

# Mathematical cognition in everyday life

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**Summary:** We try to isolate the cognitive skills which a mathematician can borrow from mathematics and use them in everyday life. This will show how a mathematician has advantage in solving everyday life problems.

## **Introduction:**

Learning and doing mathematics develops cognitive skills in a mathematician in a way that is different from other intellectual carriers. The core of these developments is the concept of structure. This concept is first developed in the realm of mathematics and then transported to other fields of cognition through linguistics and sociology. There is no surprise if mathematicians are in advantage while dealing with this concept. The concept of structure is the key for mathematical cognition to grasp control on the subject of study. This is the main tool for a mathematician to solve problems. Everyday life problems and understanding many aspects of social life and social concepts and also understanding history and prediction of future are all in the realm which mathematicians are in advantage. We will try to give a few examples of these advantages.

## **The concept of mathematical structure and mathematical modelling**

There are two cognitive aspects in the concept of structure. One is that a structure is independent of the realm of time. This mean that one can't deform structures in time. In other words, deforming can be in a larger solid structure. This means that time can be replaced by space. The second aspect is that a mathematical structure can be defined exactly as it is. It means that it is in such a way that, one can make sure, when definitions are given, the exact same structure is created in the mind of audience. This means that, any understanding of a mathematical structure can be transported to the audience with absolute certainty. This is why we could afford the concept of mathematical proof. This is why mathematical modelling is so effective in understanding any subject of study. One can approximate any subject of study with a mathematical structure and then by studying this model one gains an understanding of the subject which approximates the truth. One can always work with a better approximates by finding a better mathematical model investigating it.

## **Recognition of isomorphic structures**

The skill of recognition of isomorphic structures is similar to the skill of approximating a phenomena by a mathematical structure. This skill allows you to find other situations which could be modeled by the same mathematical structure, which is used for modeling given phenomena. Study of simple models can be used to solve several unrelated problems in everyday life. The first instance where isomorphic structures were discussed in science is when this idea was introduced by Plato who was in turn influenced by Zoroastria that the universe has an isomorphic cognitive structure as that of human being. Therefore, universe should have spirit, and soul, as well as body, and is able to think the same way that human being thinks. This idea was developed later on in history of thought to assume the same structure of cognition for every social structure. The art of a mathematician to recognize isomorphic structures gives him advantage in understanding natural and human phenomena.

## **Summarizing structures**

One of the properties of the truth is that it can be summarized. The same happen to mathematical structures. In mathematics, this fact is hidden in the concept of structures. When one finds a morphism from structure A to structure B one loose some information and the second structure would appear as a summary for the original structure. This is where the concept of simplifying model is good enough to understand a certain aspect of a phenomena. For example, the structure of human cognition has been modelled by having three layers as considered by Plato: body, spirit and soul. Three layers model serves as a simplifying model. In fact, Plato's isomorphism says that although the universe and human both have complicated structures of cognition, both structures can be simplified by the three layers of body, spirit and soul. Mathematician's ability to summarize structures gives him an advantage of being able to simplify his knowledge about phenomena.

## **The concept of patterns in time**

The concept of the pattern is a special case of the concept of structure. Pattern in time is a tool for a mathematician to imagine infinite time. These patterns could be patterns of numbers, patterns of shapes, or patterns of other mathematical structures. These patterns in time can be used by a mathematician to predict in time, which in common language is called predicting the future. Of course, predicting the future needs mathematical modeling of the past, and has the concept of recording phenomena it. Mathematical objects are also a good tool to record the current state

of a phenomena which is living in time. The ability to record implies the ability of writing the history of civilization which has helped humans to accumulate their experience through the history. The concept of patterns in structures moving in time gives advantage to mathematicians to understand history and predict future even better than other disciplines.

### **The concept of patterns in space**

The concept of patterns in space is a tool for a mathematician to imagine infinite space. For example, when you know how to expand the pattern of a space, it helps you to move from a local understanding of space to a global understanding of space. A mathematician can understand the whole society by modeling the local structures hidden in it. In the same way, an understanding pattern of a moving patterns in space are similar to moving patterns in a society. Like how the local structure of society affect changes in the whole society. Of course, this approach is local to global, and gives an analytic perspective to understanding the universe. Mathematicians also have holistic tools for understanding social structures. The concept of patterns in space gives advantage to a mathematician in modeling complicated objects like the whole society.

### **The cognitive structure of a person**

The most important phenomena that one can try to model using mathematics in human cognition itself. As we mentioned before, Plato considers three layers of abstractness. We consider seven levels. These layers consist of body, spirit, heart, soul, wisdom, light, and essence. One can go on with Plato's isomorphism and assume the same levels of cognition for a society or even for the universe. One can also model the relations between these layers which are called abstraction and simplification. These models give advantage to a mathematician to understand the structure of knowledge of any person and model the differences in cognitive structures of different people, and use these models to communicate with them more efficiently.

### **Isomorphic social structures**

Is it true that the structure of family and the structure of a school are isomorphic? Certainly not! The structure of a school as a social structure is much more complicated than the structure of family. At most, a simplifying model of a school could be isomorphic to the structure of a family. Or both structure could have the same simplifying models. But structures of two families could be isomorphic and

this can be used in categorization of the structures of families. By categorization, one can study a single family and then generalize the result of the study to the whole category. Mathematicians are in advantage in recognizing the isomorphic social structures and studying of them. People with weak mathematics training are not good in understanding the structures within small and large societies. For example, the question that in what ways the managements of social structures are similar and in what ways they are not, appears very difficult to them.

### **Morphisms between social structures**

One can consider the structure of cognition of the parents and compare the two within the structure of the bigger family: the families of grand parents and also one can compare all these with the structure of all relatives. One can see that in a way all these structures can be simplified in the society of parents: the husband and wife. This simplification can be made abstract using the concept of morphisms between social structures. For example, the family of the father could serve the role of husband and the family of the mother could serve the role of wife and children play the same role. Mathematicians seeing these structures have advantage in understanding how the grandparents of the father side and grandparents of mother side could take role in the small family consisting of parents and children or even in personal relationship between parents.

### **The social study of objects and category theory**

In the mid of the twentieth century, Eilenberg and McLane introduced the concept of a category. As this concept developed there was a new perspective towards the study of objects in the world of mathematics. In this new language, an object is understood using its relations with other objects, and the internal structure of the object is ignored. We call this method the social study of objects and structures. For example, the structure of a family, in this language should be understood and studied only via the relations of this structure with other structures. And if we are careful to consider all these relationships, that would be enough for complete characterization of the internal structure of the family. So is the case for other social structures and also it is the case for the cognitive structure of a single person. If one records all morphisms between structures in a society, which involve the cognitive structure of a person, this completely characterizes the internal structure of the person's cognition structure.

## **On the concept of counting**

In category theory there is a concept called universal property of objects which leads to universal objects. Wiles was the first person who called the process of association of universal objects as counting. For him, counting means summarizing a family of mathematical objects in a simple object. This universal structure can be summarized in different ways to give us all single structures we started with. For example, the cognitive structures of members of a family can be unified in a single structure which can be thought of as the universal cognitive structure of the family. Understanding universal objects and universal structures and universal properties gives the cognition of a mathematician an advantage which is the ability of summarizing several structures in a single structure and understand them by understanding the totality.

## **The structure of power**

Now, we continue by understanding a social concept by means of mathematical structures, namely the concept of power. How can we approximate the concept of power by a mathematical structure? Power in the society is based on many personal and social deals. Under these deals people and social structures have gains and losses, but the totality of the deals gives advantage to several people and social structures layer by layer. People and social structures can take advantage of the power they obtain in direction of their personal and social interests. In order to protect the structure of power which is made of many just and unjust deals, people and social structures of power, try to make leaving the deals expensive for people and social structures in the system. Many of the times the terms of the deals are unknown to both sides and people respect the deals because they are afraid of the consequences. Mathematician who understands the structures have advantage in understanding the structure and deals of power in social structures.

## **The concept of freedom in a power structure**

People and social structures which take part in the deals of power loose parts of their freedom on parts of the loose and gains of the deal. People and structures of the society which are oppressed by the structure of power also loose aspects of their freedom as a result of being oppressed. But in real life many aspects of the freedom that people and social structures have are untold. They have to try their will so that the structure of power decides if their will is against their interests or not. Mathematicians who understand the structures have advantage of understanding the benefits of the structure of power and therefore gaining more freedom. Most of the

people and social structures limit their own freedom because of being afraid of power structures. But mathematicians understand their limits better.

### **The concept of harassment in a power structure**

There is this phenomena that people and social structures who have power, try to abuse their power in a way that is not predicted in the deals of power. This makes them able to harass people and structures which are weaker than them and have expectations from them which are unpredictable even knowing the deals of power. This makes the men of structures of power to oppress in ways that are not predicted in the power structure. This will lead to harassment. Mathematicians who understand structure of power, know better how to fight with abuse of power. They try to use the structure of power itself to fight the unnecessary taking advantage of power. This makes life under the shadow of power easier and more predictable. This is a kind of limiting the power of powerful people and provides a better environment for people living in the society. This is a way that mathematicians can serve their society.

### **The concept of discrimination in a power structure**

Discrimination on the other hand is part of the deal of power. The layers which have power discriminate against the others to keep this position. They have to pay and discrimination is part of this price. The nature of power is based on the concept of discrimination. In other words, there is no power if there is no discrimination. What would be the advantage of understanding the structure of power if discrimination is inevitable? When you know the price paid for the power system, you know how much is gained by accepting to be part of the structure of power. This means that the mathematician understands exactly how much the structure of power is powerful. This is the most strategic information against the fact of discrimination. Fighting discrimination is the same as fighting the structure of power. This is why the structure of powers fights as hard as it can against those who fight against discrimination.

### **The social concept of cognition**

We generalized the isomorphism introduced by Plato to the cognitive structure of human being and that of universe to the point that, we came to the believe that, social structures also have cognition. Then we used universal objects to find the universal structure which can be summarizing all cognitive substructures, and all people involved in these structures. Now, this question is raised that how these social

cognitive structures communicate? These are abstract objects and their communication is not in words. A mathematician who understands abstract objects has the advantage of understanding this abstract communication. He can approximate data in words, in a language which can be grasped by everybody, so that everyone can understand the cognition of social structures and their communication. Of course, this is an approximation, and the communication of these abstract objects is in the language of their definition using universal properties. Understanding the cognitive structure of the whole universe is too abstract to be grasped by a usual mathematician. Such an understanding is a spiritual gift.

### **The economical structure of a society**

The concept of economy in eastern and western cultures goes back to material needs of human being. In the cognition of a mathematician economy goes back to material and metaphysical needs both. And also goes back to metaphysical needs of people and social structures both. The needs of people and social structures are correlated and the material and metaphysical needs are correlated. The mathematician who has access to abstract knowledge of understanding structures, understands better the health of economic structures. This is an important service to the society that the mathematician lives in. there are rules in religious culture about the health of a material deal. These rules can be interpreted in the metaphysical context by mathematicians. Mathematician has the advantage of understanding the abstract layers of economic structures of the society which gives him the ability to criticize the harmful patterns in economic life better than others. It is important that this ability of cognition is acknowledged by members of the society and he is appreciated.

### **On the structure of culture in a society**

The concept of culture is a material concept, but the mathematician has the advantage to understand it in the language of structures. These structures are used and overused in several different perspectives in the society. If one understand these key structures and the relationship between them, one can have a deeper understanding of culture. A mathematician who thinks in the language of structures has advantage in grasping the structure behind the cultural phenomena in the society. This give mathematicians the ability to control the natural changes happening in the culture of the society. For example, if one want to fight against foreign cultural influence, these are the mathematicians who can give the best consultation to the corresponding representatives in the government. The most important duty of

mathematicians is to guide the culture of the society towards the advancement by education of the cognitive structures of people and social structures. This is the subject of the next section.

### **On the structure of education in a society**

The concept of education in the mind of a mathematician means development of cognitive structure and for him the most effective tool for this development is mathematics education. In real life, education revolves around education of body and mind. But a mathematician is worried about educating the whole cognitive structure of his students. This is one reason why a mathematician thinks differently about the concept of education. Another reason is that a mathematician has advantage of understanding the structure of educational systems. He can define the health of an educational system more efficiently and guide the changes in such a system more carefully and develop the educational system towards the benefits of the society as a whole and benefits of students and social structures as part of it. Mathematics education with emphasis on development of cognitive structure of students is something different from the traditional meaning of this term among the experts of this field. The point is, traditional experts of mathematics education are not mathematicians and they do not understand structures as well as them.

### **The concept of government in a society**

The structure of power is much larger than the structure of government, and the structure of government as it is understood by the society is just a sub-structure of the real structure of the government, which we call here meta-government. Meta-government is part of the structure of power; but not all of it. The structure of power is the union of meta-government and democratic power. It is a fake dream to unify meta-government and power. It is simply impossible. The distinction of these two poles of power make a healthy cooperative and criticizing atmosphere which does not let the totality of power to get ruined. This bipolar structure of power guarantees the health of the totality of the power structure. Mathematician who understands the structure of meta-government, has the advantage that he can help the society to keep the balance of power between these two poles. A mathematician can set the two sides of scales in a balance that guarantees health of the structure of power in the society.

### **The social concept of problem solving in a society**

Problem solving in its current form is not a social concept. Only people can solve problem which are personal or social. But social problem solving means that



some everyday problems could be solved by the social cognition of social structures. Let us explain how. Some problem in the society have different incarnations in many levels and many social structures. It is the mathematician who can recognize these problems in the isomorphism level. It is the mathematician who can recognize that two isomorphic social structures have the same problems. He can observe that in some particular social structures the same problem is solved and he can understand how to use the same solution in isomorphic social structures. This is what we call social problem solving which is borrowed from the cognition of a social structure who solved the problem for itself. Mathematician uses advantage of understanding the abstract structure to help a social solution find its way through the isomorphic social structures within the society.