

The Family and Mathematics.

Abstract: The influence of family upbringing on the mathematical ability of children. Phylogenesis of reasoning and its parallel in ontogenesis of family upbringing. Distortion of reasoning caused by family upbringing.

Key words: family, family upbringing, mathematics, reasoning.

The Family and Mathematics are two different terms whose mutual interactions are not only interesting but also instructive. It is often posited that family upbringing is essential for the development of a child. It is less discussed about how to conduct this upbringing. Often we talk about the bad upbringing of offenders and on the other hand upbringing is credited for high achievers. Everyone can feel the influence of their upbringing, but it is difficult to evaluate this impartially and objectively. I wish to analyse how the family contributes to mathematics. To do so we shall concentrate on the development of mathematics itself.

Of course there are opponents of the idea who say that Mathematics is as old as the first results of the deliberate actions of mankind, which needed to be quantified. The argument seems to be good, because a lot of mathematical knowledge has been known for many thousands of years, for example the relationship of squares drawn on the sides of a right angled triangle was known in ancient China, although not as a relationship between sides which we learn of today as Pythagoras's theorem. In ancient Egypt they knew how to measure and calculate various areas and volumes.

Is therefore Mathematics as old as mankind? Although the question seems unclear we can answer it easily. Mankind had many answers to 'how?' questions which later became part of Mathematics. They however didn't study fundamental answers to the questions 'why?' They didn't know the mutual relationships of phenomena. They didn't know causality.

The argument can be supported by an example from the third millennium B.C. From that time we know perhaps the oldest written story recorded on clay. It is Gilgamesh. It is assumed that there were many writers of this and it took several centuries. The Sumerian hero experiences many dramatic events. It's full of passion, emotions, deadly blows of destiny and a search for immortality. But from the point of view of causality there are no internal connections. Events happen randomly, people act spontaneously and everything is in the hands of destiny.

The next example is from ancient Greece c.8th century B.C. Notice how Homer describes the dramatic events of his time. Who was he? It appears that he was a direct participant of the events, because he is very faithful to the events. He wasn't a main character but he knew of the suffering of the participants. Was he a healer of some kind? In particular he seems to have plenty of life experience and knowledge of the greatness and strength of the human spirit.

Let us remind ourselves of how he describes the beginning of the Trojan War. Zeus, the highest of the Greek gods, was interested in Thetis, the most beautiful sea nymph. An omen however prevented him from pursuing his interest as the prophecy said the son of Thetis would be greater

than his father. So instead she was married to the most beautiful mortal, Peleus. The gods prepared a grand and beautiful wedding. Many gods attended but Eris wasn't invited because she was the goddess of discord and bound to cause trouble. Angry at being excluded she decided to disrupt the wedding banquet. She threw a golden apple marked 'for the fairest' among the guests. The goddesses Hera, Athena and Aphrodite were there and each bickered for a while about who deserved the apple and then asked Zeus to decide the matter. But Zeus didn't want to get involved so he sent them to Paris, the son of King Priam of Troy, in Anatolia.

Despite his royal heritage Paris had been raised as a shepherd after his mother learned in a vision that he would cause the destruction of Troy. The goddesses tried to bribe Paris. Athena promised to help him lead Troy to victory in war against the Greeks. Hera promised to make him king of all Europe and Asia. Aphrodite, the goddess of love, promised to give Paris the most beautiful woman in the world. The beautiful woman sounded better to Paris than power and glory so he awarded the apple of discord to Aphrodite. But there was a problem, the most beautiful woman in the world, Helen, was already married to Menelaus. When Paris turned up in Sparta, Menelaus and Helen welcomed him as a guest. Then Menelaus left Sparta for a while. When he returned Helen was gone. She had eloped with Paris. Menelaus was furious. Determined to win his wife back he summoned the other Greek leaders and they agreed to help him attack Troy.

We have chosen this example to better understand causality at that time. At the beginning of the story it says:

“And which of the gods was it that set them to quarrel? It was the son of Jove and Leto (Apollo); for he was angry with the king and sent a pestilence upon the host to plague the people, because the son of Atreus had dishonoured Chryses his priest.”

There are two causal links here. The first is the reason of Apollo's anger. The second is the reason of the plague. Each is a typical example of one of two causal links.

- social causality, that reflects relationship man to man
- natural causality, that reflects the link man to nature.

Let's compare these two links. Why was Apollo angry? It was because Agamemnon dishonoured Chryses. We can understand his anger as each of us would get angry if our close friend would be dishonoured. This is social causality as there is a link man to man. In this case one is a god. The social interactions between the Greek gods were the same as between mortals. They fell in love, envied, chased enemies, protected their favourites etc. These relationships are described truly. In this social sphere, causality works well, as it was well developed in the minds of the Greeks.

The second causal link is related to the plague. Why did the plague begin? We now know that the cause is infection. Homer made the gods responsible. Hence Homer doesn't know natural causality well. Science is not developed yet. They didn't know much about biology, meteorology, physics, geology etc. To explain a storm, famine or plague they personified these phenomena and related them to the gods.

It follows that reasoning in the natural sphere originated and evolved on the foundations of a well developed social causality. This process was far from easy. We have said that the Greeks had

developed social causality. So far they didn't know the natural one. Lightning, famine, plague was explained by the god's characteristics such as anger, envy and jealousy. How could such a state withstand the contradictions of experience? It must have been the case that often offerings did not work. Offerings were made to the gods and natural disaster struck anyway. How didn't this weaken the faith in the gods of Olympia?

The gods, however mighty and immortal, were not the supreme master of life and death. The Moirae, the three sisters of fate, personified the inescapable destiny of man. Even the gods feared the Moirae. They controlled the tread of life. The Moirae didn't explain their actions. It is not in the power of any man or god to influence fate. If the Moirae didn't allow something all the offerings would be pointless. However within the limits set by the Moirae there is causality in Olympia. That's why the faith in Olympia remained unshaken. Successful offerings confirmed the faith but the unsuccessful do not contest it, as it's the Moirae's decision. The Moirae were the main barrier to developing reasoning in natural science and mathematics. Thales was the first who crossed this barrier as he was looking for reason beyond Olympia. He famously said that "all arose from water". Thales is considered a materialist which to say the least is not accurate. Even though his statement seems foolish it was in fact a significant discovery of main importance because it moved the thinking of mankind towards a new direction. This time can be described as the beginning of a new cognition this step is going to be the understanding that there is a causality of man-nature. It happened a century later through Pythagoras of Samos.

There are many uncertainties about Pythagoras and his followers. What is certain however is the fact that Pythagoras discovered causality. Today we would say he discovered implication – the tool that confirms or refutes a claim; given some other claims are true. Pythagoras was so enthusiastic about his discovery that he very much overrated it. He thought he had found a way to calculate and therefore determine the fate of people. His excitement was so strong that he was convinced he had discovered the 'logos' of the universe. The name he gave to this discovery clearly demonstrates it. It was (μάθησις κατ'έξοχήν) Mathe-mata which means knowing everything.

Such an over valuation of a discovery is not an isolated phenomenon, neither in history nor in the development of an individual. The over valuation is bigger the greater the discovery. It is related to school education, when there is a creative atmosphere in the classroom. It significantly contributes to the motivation of pupils. However we can boldly say that with the discovery of implication mathematics as a deductive science was created, and Pythagoras named it. Pythagoras's findings were used by Euclid. He wrote the first mathematical textbook 'The Elements' which used the deductive principle. This book influenced the development of western mathematics for more than 2000 years.

History shows that the ability to reason developed from social causality and therefore we can say that mathematical reasoning also developed from social causality. This relationship shown in history has an immediate application in the development of an individual. The psychological ability of cognitive thinking originates and develops in the sphere of interpersonal relationships in which the family plays an important part. If the pre-school child has not yet developed social reasoning there is no real basis for developing natural causality and mathematical reasoning. In a case like that the family needs to start by a non-mathematical forming of social causality.

Social causality is developed first as the relationship man-man gives immediate feedback. If someone deceives me I know what to do to avoid the future repetition of the situation. I will not trust the person. If the relationship man-man doesn't give the immediate feedback, the child is not able to find the causes of its own illness by his experience. This causality in the natural sphere is given to the child as knowledge. The pre-school development of a child determines his/her future development and it is at that time when the family plays a vital role.

It may sound improbable, weird or even absurd that feelings played an important part in developing maths. We supported this by analysing some historical events. By understanding that natural causality developed on the basis of a well established social causality we can appreciate the great influence of family upbringing on an individual. A well functioning family upbringing is building a basis for the development of thinking and the psychological abilities of a child that are responsible for not only pure maths but other logical abilities such as analysis, synthesis, deduction, modelling, hierarchy, parallelization, induction and many more.

Christianity teaches us that man has a free will. This means that he has options to decide. That decision making needs to be learned, so it is not based only on intuition or some dubious ethical values, but is based on an understanding of causality which is needed for the development of the whole of society.

Try to observe the behaviour of adults to their children in a public place, such as a park. In the majority of cases we would hear parents' orders, demands and restrictions. We often see such authoritarian behaviour of adults towards children. Attitudes that prevail in education, school or family are refusal and mentoring. A lot of parents choose methods which quickly teach children to listen and follow orders without understanding. Is obedience the goal of education? Blind obedience is definitely not. It is much more valuable if parents teach children how to make correct and independent decisions. This can only happen on the basis of them making their own mistakes, which can be appropriately regulated. Often we observe that older people are complaining that pupils are not behaving well, they shout, fight, annoy each other and so on. Blame is often placed on schools, that they didn't teach them how to behave, they should tell them. But is mentoring the right way of upbringing? Many educational resources are inherited from generation to generation and it can happen that two parents have two strong diverse views, based on personal experiences.

Building causal cognitions is one of the most neglected areas in the education of the mind. The basic conditions of this thinking are two areas, emotional and rational causal learning. Emotional causal learning develops first. Both are developing in the pre-school age of children and therefore this learning takes place in the family. If both of these are well developed there are the conditions for the child to be successful in school. If not there are some distortions. The first is when a child has developed emotional cognitive thinking but the parents are not behaving sensibly, or if there is another strong emotional element that is eroding the already established experiences of the child. I had a neighbour who was bringing up her three daughters by the varied intonation of her voice. She claimed not to have 'maths genes' so her daughters had nothing to inherit in that area. The daughters were very good in languages, but their 'maths genes' could not develop because she wasn't developing their rational causality. This distortion is called Disorientation. The main diagnostic sign of this condition is disbelief in one's own ability and strengths; an inability to make decisions and the seeking of authority. In a nursery a teacher asks Ann to bring her a blue pen from

the table. Ann is happy to do it and when she has the pen in her hand asks the teacher whether it is that one. In a maths lesson a pupil is solving a problem on the board, which he is able to do individually, but he waits for the teacher's approval before he writes down the final answer.

Let us look at two different ways of adult behaviour. Five year old Michael wants to play outside. His parents agree that he has to tidy up his toys first. In the first scenario Michael comes to Dad who is watching a football match and asks to go out, Father agrees if he tidies up his toys. Michael doesn't want to tidy up so he asks again. The order comes with a strong voice "Tidy up your toys". Michael keeps asking, his father slaps his bottom and the boy cries. His mother comes in, soothes the boy, lets him go out and tidies up the toys herself. In this scenario the parents behaved to the boy as the gods to Gilgamesh, erratically. None of them shows direction to the child, they don't teach him the cause-action connection. They only give him emotional experiences such as longing to go out, hate to tidy up, pain of punishment and the happiness of soothing. They are giving him emotional experiences but are neglecting his rational development.

In the second scenario the father says "Tidy up your toys and I'll read you a bedtime story". The boy chooses one of the options and the father accepts his decision. In the evening he sticks to his word. The father in this situation is not a god but an informant and an advisor. He is giving him rules and consequences and lets him, by his own experiences, to find out that the rule works. He teaches him the link – consequence.

In the case of the Disorientation condition, the stabilisation of the child's life is needed. The child should know when the examination is set, what material is needed and how it is going to be assessed. We should encourage self-confidence; eliminate randomness, uncertainty and irrationality from the child's life. It is harder in the case of children who don't have a well developed emotional causality. We can talk about the mystification of his/her psychological abilities. There are a few causes of this condition. One of these causes, probably the most common is a strict authoritarian upbringing, based on direct orders, when a child has no other option than to obey. Other reasons can be conflicts in the family that ends up by separation with the child as a bargaining tool. Sometimes parents don't pay attention to the child and so don't develop their emotional experiences.

Diagnosis is relatively easy; it is mainly the child's failing logical abilities. Other external displays can be rudeness, arrogance, antisocial behaviour and non-sensitivity. The amendment of this condition is much harder. The missing emotional causality needs to be formed. This should be done in cooperation with the family, whose climate needs to be changed. Maths tutoring alone would not help. Emotional causal links need to be built by giving a child enough of these types of experiences. A good example would be to create an atmosphere of play for the child; various board games are especially useful; involving the child in family situations and giving them some responsibility; giving the child an opportunity to read various literature.

We had a case of a mother who had a strong disagreement with her daughter. We talked to the girl's grandmother and she started to emotionally attach to the girl instead. When the mother realised that she decided to change her strategy. There is a group of alcoholic families; socially undeveloped families where the emotional or rational reasoning is not developed. Children from these families cannot fully develop either of the two causalities and therefore, not by their own fault, they cannot

progress in their personal development. Society tries to solve these problems in court and in most cases the children end up in social care, where at least some rational causality can be provided.

Maths is for the mind of a young person what PE is for his/her body. Plato had an inscription over the entrance to his academy 'Let no one ignorant of geometry enter here'. That was not for geometry by itself but because geometry provided mental ability and logical thinking. School mathematics often prefers various definitions and algorithms as opposed to progressing a pupils thinking. If however maths education provides rules of thinking and the beginning of mathematical thought then it is an invaluable tool for providing such psychological ideas which are helpful not only for the mathematician but for everyone who is doing something worthwhile.

Often we believe that a child does not understand things. We want to achieve our goal as quickly as possible and therefore we use lies, orders, bullying or force. Even if we achieve our goal we are often not realising that the child is paying a big price for it; we are not benefiting the child in the long term. A few examples of administering bitter medicine:

- "Jan I will buy you a toy car when you eat this". Jan knows that he will not get the promised car and concentrates on the intonation of his mother's voice.
- "Jan, if you don't eat this a wicked witch will take you."
- Jan will get a slap on his bottom and starts crying so the mother can give him medicine into his open mouth.
- Mother: "The doctor sent armour to your soldiers so they can fight the enemy- bacteria, which are making you ill. When you eat this medicine they can win easily."
Jan: "Can I have that medicine?"
Mother: "I cannot give it to you."
Jan: " Why?"
Mother: "The enemy sent a spy to your tongue and they will tell you that the medicine is bitter."

Very often we see the wrong attitude to punishment. We can all agree that we cannot bring up children without punishment. Children do mischief. It is understandable that they are testing boundaries, seeing what they can get away with, without thinking about consequences. These are their personal experiences. For good ones they should be rewarded and for bad ones, punished. These have an even bigger importance in school. It can be said they are public. By all this process the ethical structure is built.

A few examples of punishment that we collected from university students:

- I was smacked because I didn't wash dishes.
- I wasn't allowed to do my favourite activity.
- When I was little I had to stand in the corner when I came home late.
- I was shouted at and my mother didn't talk to me for two days.
- When I didn't have homework I had one hour's detention.

None of these examples is developing rational causality. It is important to teach children causality even in these situations. It is important to talk about the incident to make sure you have all the facts and that the child understands the consequences of his behaviour. Then give him the choice to redeem himself. We don't have to agree with his choice. It is important to lead choices so that something positive is done for the child. For example a pupil chose to do 20 questions and his teacher suggested which ones.

In every dialogue with a child, whether it is pleasant or not, we should try to be honest, always try to explain the reason for actions or decisions. By doing this we can hasten the development of a child's thinking in maths but also all of his psychological abilities necessary for his future life.

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