The Brain Network when solving Mathematics

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Abstract

The human is honored among the other species by his brain. This brain took a lot of scientist's attention for a lot of years passed and others still to come. New technologies helped scientists to learn more about the brain which led them to achieve a leap in neuroscience gathering a lot of information. Every day our brains are introduced to different problems that are required to be solved. It is not important what level of difficulty these problems are as your brain will respond the same. Solving problems take place through a series of four steps of encoding, planning, solving, and responding. In these stages, different far regions should collaborate to solve them. This collaboration is done by forming networks between these meant regions. So, the stronger the network between these regions results in more success in solving everyday problems. Math problems with their four domains differ from normal non-math problems according to the active sites in the brain.

I. Introduction

The human is distinguished by his brain. This small organ that is unique for humankind is a mystery until now and this is because of its contributions in almost every action you do. This mysterious organ is a mystery. Even when you are at rest, it is very active. After the introduction of new technologies like magnetic picturing and others, it became possible to take pictures of the brain monitoring it during different actions for a better understanding of what happens in it. And this is what helped in the flourishing of neuroscience getting some information about the brain. From this information is a mechanism for an action your brain can do almost every day which is doing mathematics.

Doing mathematics is introduced to everyone's brain regularly. These problems vary in their difficulty from simple arithmetic operations to advanced problems. Scientists have wondered a lot about what happen during solving these problems and can solving simple problems be done by the same regions of the brain responsible for solving more advanced ones, and by exploiting new technologies in neuroscience the brain was photographed to pass a four steps process reaching to a solution for the problem. [1]

II. Stages of solving problems

Relying on functional magnetic resonance imaging scientists captured four images four the brain reflecting the four stages it passes by during solving a problem as illustrated in figure 1.

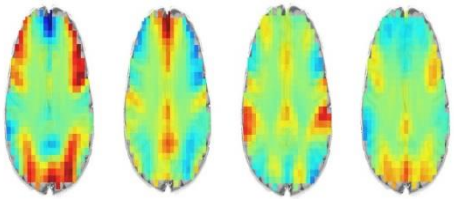

Figure 7: Four scans showing the brain activity during the four steps of solving a problem

Furthermore, John R. Anderson and his team from this study found how different regions of the brain work in four stages solving the problem. These stages according to this study are encoding, planning, solving, and responding. [2]

The four stages are done by different places of the brain, so the completion of this process is done by a connection of certain regions forming a network to solve problems. It doesn't depend only on how effectively each region did its work, but the success in solving mathematics problems can be measured by how well these certain regions form a network collaborating with each other. [3]

III. Your brain's response to doing mathematics

It was found from brain scans on doing mathematics regions like bilateral intraparietal sulci (IPS), bilateral inferior temporal (IT) regions, bilateral dorsolateral, superior, and medial prefrontal cortex (PFC), and cerebellum seems to be very active. It doesn't depend only on one of these regions, but it needs all these regions to collaborate together to solve a problem, no matter what this problem is as it turned out that the brain reacts the same on solving the four domains of mathematics as shown in figure 2. [4]

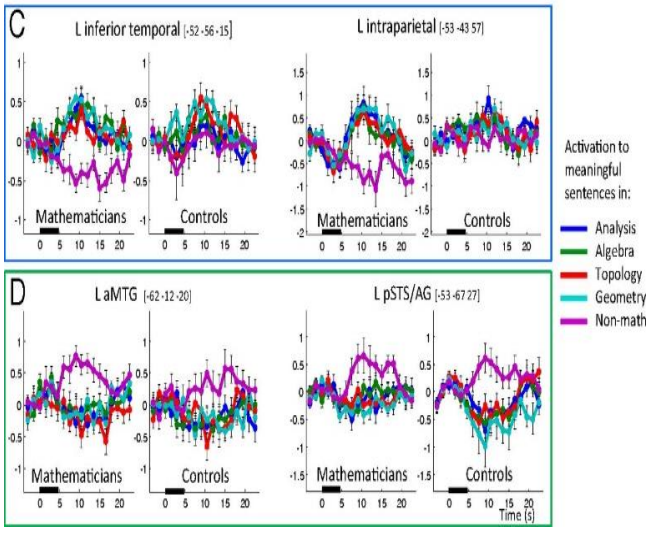

Figure 9: Mathematical expertise effect: Interaction indicating a greater difference between meaningful math and non-math statements in mathematicians than in controls.

IV. The difference between the various level of problems on brain

Solving problems scales from simple arithmetic operations to difficult ones. For instance, it can be simple as solving $1 + 1 = 2$, or hard as solving Euler's formula $e^{i\pi} + 1 = 0$. Although a lot of people find the first problem easy that they can solve, while only a few can solve the difficult one, solving both problems activate the same areas of solving an ordinary problem without any difference. And it was found that the difficulty of the problem doesn't influence what regions needed to solve the problem

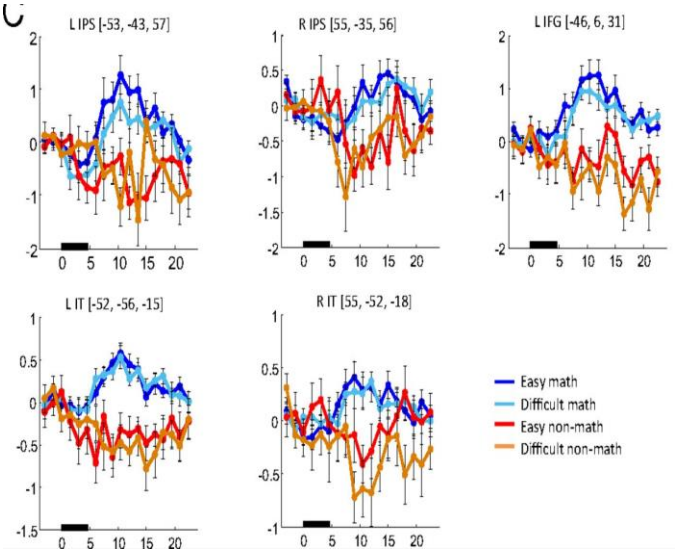

Figure 8: This figure shows the effect of subjection to difficult and easy math and difficult and easy non-math.

as illustrated in figure 3. [4]

V. Conclusion

Mathematics and non-math problems differ a lot according to the brain's reaction to each one. It doesn't matter the difficulty of each question as difficulty didn't affect your brain's reaction. The two types showed a great difference in the response from the brain as each type has certain areas required for solving them. What makes this brain mysterious is how the certain regions that are set to do a certain task, for example, solving a mathematics problem collaborate together forming a network that can be responsible for solving this problem.

VI. References

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[3] K.Hartnett, "This is your brain on math," Brainiac, 2015.

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