Why 7 ± 2? A Possible Geometric Explanation

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Abstract

It is known that, in general, a person keeps in mind between 5 and 9 objects – this is known as the 7 ± 2 law. In this paper, we provide a possible simple geometric explanation for this psychological feature.

1 Formulation of the Problem

Phenomenon. There is a known phenomenon in psychology called a 7 ± 2 law (see, e.g., [1, 2]), according to which each person can directly keep in mind only a certain number of classes; depending on the person, this number ranges from $7 - 2 = 5$ to $7 + 2 = 9$ elements.

Why? A natural question is: why between 5 and 9? There have been some attempts to explain this phenomenon (see, e.g., [3]), but they are rather complex and not very intuitive.

In this paper, we provide a possible geometric explanation for this phenomenon.

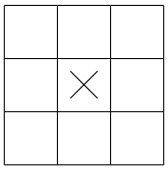
2 A Possible Geometric Explanation

Main idea. The above phenomenon is about our biological nature, so it has to be explained based on how it helped our ancestors survive. In order to survive in situations when there are dangerous and skilled predators around, it is important, for each person, to be aware of what is happening in the nearest vicinity.

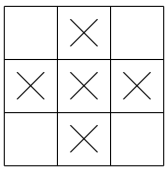
Let us show that this natural idea indeed seems to explain the 7 ± 2 phenomenon.

Grid model. For simplicity, let us consider a simplified "grid" model of the environment, when the whole area is divided into square-shaped cells. In this model, instead of listing the exact spatial location of each object, we only describe in which cell this object is.

From this viewpoint, the space looks like this, with a person in the central cell marked by an X:

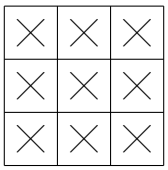


Awareness of nearest neighbors. For each person, it is vitally important to be aware of what is happening in the neighboring cells – so as not to miss a tiger or another dangerous predator nearby. From this viewpoint, it is important for a person standing in the middle of the above configuration to be aware of what is happening not only in the cell containing the person, but also in all the directly neighboring cells:



This requires keeping track of exactly five cells.

A better strategy. An even better strategy is to take into account not only directly neighboring cells, but also cells which are attached to the cell-where-we-are even by a single point – i.e., to take into account even the diagonally connected cells.



This requires keeping track of exactly nine cells.

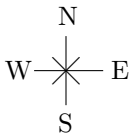
Conclusion. To survive in a harsh environment, our ancestors had to keep track of the contents of between five and nine spatial cells. And this is exactly what we observe in the 7 ± 2 law – that we can keep track of between $7 - 2 = 5$ and $7 + 2 = 9$ objects.

3 Auxiliary Observation: How All This Is Related to Our Understanding of Directions

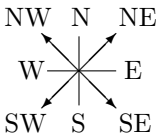
How do we describe directions? In principle, we could divide the 360 degrees into 3, 4, 5, 6 parts.

How we actually navigate is that we use four main directions: South (S), North (N), East (E), and West (W).

This usual description of directions is related to the 5-neighboring-cells image. Together with the option to say in the same place and not to move anywhere, we get the same 5-component picture as above:



A more detailed description of directions is related to the 9-neighboring-cells image. A more detailed description of directions involves considering intermediate directions: Southwest (SW), Northwest (NW), Southeast (SE), and Northeast (NE). Together, we get the same 9-component picture as above:



Acknowledgments

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