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80/20 Rule Partially Explains 7 Plus Minus 2 Law: General System-Based Analysis

Griselda Acosta
The University of Texas at El Paso, gvacosta@miners.utep.edu

Eric Smith
The University of Texas at El Paso, esmith2@utep.edu

Vladik Kreinovich
The University of Texas at El Paso, vladik@utep.edu

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Griselda Acosta[1], Eric Smith[2], and Vladik Kreinovich[3]
[1]Department of Electrical and Computer Engineering
[2]Department of Industrial, Manufacturing, and Systems Engineering
[3]Department of Computer Science
University of Texas at El Paso
500 W. University
El Paso, TX 79968, USA
gvacosta@miners.utep.edu, esmith2@utep.edu, vladik@utep.edu

Abstract

The 80/20 rule and the 7 ± 2 law are examples of difficult to explain empirical facts. According to the 80/20 rule, in each activity, 20% of the people contribute to the 80% of the results. The 7 ± 2 law means that we divide objects into 7 ± 2 groups – i.e., into 5 to 9 groups. In this paper, we show that there is a relation between these two facts: namely, we show that, because of the 80/20 rule, the number of classes cannot be smaller than 5. Thus, the 80/20 rule explains the lower bound (5) on the 7 ± 2 law.

1 Formulation of the Problem

Difficult-to-explain empirical facts. There are several difficult-to-explain empirical facts.

- For example, there is a ubiquitous 80/20 rule, according to which, in each human activity, 80% of the results come from 20% of the participants. For example, 20% of the people own 80% of all the wealth, 20% of researchers publish 80% of all the papers, etc.; see, e.g., [1, 2] and references therein.

- There is a known phenomenon in psychology called a 7 ± 2 law (see, e.g., [4, 5]), according to which each person usually classifies everything into a certain number of classes C; depending on the person, this number ranges from $7 - 2 = 5$ to $7 + 2 = 9$ classes.

We cannot explain these facts, but we can at least find the relation between them. There have been many attempts to explain these two facts; see, e.g., [3, 7]. However, in general, we are still far from fully understanding them.

Meanwhile, maybe we can have at least some relation between the two facts: e.g., maybe we can show that one of them explains another one – at last partially. This is what we do in this paper: we show that the 80/20 rule partially explains the 7±2 law.

2 Our Explanation

Consequences of division into C classes. If we, in the first approximation, divide everything into C classes, this means that any proportion which is smaller than $1/C$ will be, in this approximation, simply ignored. For example:

- If $C = 9$, this means that any proportion smaller than $1/9 \approx 11\%$ will be ignored.

- If $C = 5$, this means that any proportion smaller than $1/5 = 20\%$ will be safely ignored, etc.

What happens if $C < 5$. If $C < 5$, i.e., if $C \leq 4$, then any proportion smaller than $1/4 = 25\%$ will be, in the first approximation, ignored.

How this is related to the 80/20 rule: wealth example. Let us see how this is related to the 80/20 rule. As we have mentioned, in general, 20% of the people own 80% of all the property, so the property owned by the remaining 80% of the people amounts to 20% of the world's wealth.

When $C \geq 5$, we can still see that: in the division into at least 5 categories, at least one of the categories is the wealth owned by the majority of the people – exactly one category out of 5 if we have $C = 5$, but still at least one such category.

If $C \leq 4$, this means that this proportion will be ignored and people will get an impression that they own nothing – that everything is owned by a few rich folks. This impression is not a recipe for social stability – it is a recipe for a violent revolution.

How this is related to the 80/20 rule: case of research productivity. In a less violent consequence, 20% of researchers publish 80% of the papers. Thus, the remaining 80% of researchers publish the remaining 20% of the papers.

When $C \geq 5$, we can still see this proportion and thus, conclude that even the least productive scientists have a chance to contribute to the world's body of knowledge.

However, if we had $C \leq 4$, then, in the first approximation, we would simply not see any possibility for anyone who is not a top researcher to publish – and this would clearly very much discourage the scientists' activity.

Another example: 20% of the letters from a text carry practically all information. An even more extreme example come from Claude Shannon's estimate that the redundancy rate of the English text is about 80%: crudely speaking, only one in five letters carries any information; see, e.g., [6], p. 152.

With $C \geq 5$, we can still notice this informative part.

However, if we had $C \leq 4$, then, in the first approximation, we would not notice any meaningful information at all – and we would thus be able to erroneously conclude that all communications are non-informative.

Conclusion. Based on these examples, we can make the following general conclusion:

Due to the 80/20 rule, the number C of clusters on which we divide objects must be at least 5.

This explains the lower bound for the seven plus minus two law.

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