

# 80/20 Rule Partially Explains $7 \pm 2$ Law: General System-Based Analysis

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## Abstract

The 80/20 rule and the  $7 \pm 2$  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  $7 \pm 2$  law means that we divide objects into  $7 \pm 2$  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  $7 \pm 2$  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  $7 \pm 2$  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  $7\pm 2$  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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