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Zipf's law unzipped

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The outcome of a random process is often well described by a bell-shaped curve, the normal distribution. Some hundred years ago, it was noticed that things like the richness among people, town sizes, surnames, and the frequency of words have different broader distributions. Many, more or less system-specific, proposals for the deviation from normal have been suggested under names like "rich gets richer", "principle of least effort", "preferential attachment", and "independent proportional growth". Here, it is argued that the phenomenon is connected to a more ubiquitous random group formation. A group is like a soccer team with positions to fill. You want the right player in the right position. Thus, unlike for the normal distribution where you pick a player for the team, you now try to pick a player for a position in the team. Information theory is used to find the most likely distribution of group sizes given the number of objects, groups and the number of objects in the largest group. The agreement between data and predictions speaks for itself. We suggest that this gives a new starting point for the understanding of Zipf-type phenomena and fat-tailed distributions in general.

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