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To the Editors at EPJ Data Science,

We are very pleased to submit our manuscript for consideration at EPJ Data Science:

"Allotaxonometry and rank-turbulence divergence: A universal instrument for comparing complex systems."

We introduce and frame the concept of allotaxonometry: The comparison of complex systems which have broad internal variation in component type and structure.

We argue against the mismeasurement of complexity by single numbers, that we must instead put forward instruments and tools that embrace complexity. Just as we need dashboards to fly planes, we need dynamic dashboards for comprehending complex systems in general.

We start from the longstanding but misleading observation that Zipf distributions for language may vary little across texts. We show that while the overall form of Zipf's distribution may be conserved, the ordering of words (or n-grams) can vary greatly, a phenomenon we have previously dubbed 'lexical turbulence'.

For general complex systems, we build a general 'allotaxonometric instrument' that shows a map-like histogram for Zipf distribution changes along with a ranked list of the most 'important' components according to whatever instrument we use to measure and hence distinguish two systems (e.g., Shannon's entropy).

In our manuscript, we introduce 'rank-turbulence divergence', a pragmatic, tunable instrument for comparing any pair of complex systems where components can be ranked according to some criterion (e.g., frequency of words or species, sizes of cites or companies).

We provide a series of four main case studies in the paper, all comparing systems evolving in time: Word usage on Twitter, species abundance, baby name popularity, and market capitalization for publically traded companies in the US.

In online supplementary material, we expand on these system-system comparions with pdf flipbooks, and add more examples including changes over time for causes of death in Hong Kong and advertised job titles in the US.

See: http://compstorylab.org/allotaxonometry/.

Our paper is the first in a series of related papers which will present allotaxonographs for probability-based measures such as the Jensen-Shannon Divergence (and generalizations) as well as our own probability-turbulence divergence. As is, the figure-making code contains all of these options.

We note that we are in fact separately submitting our second paper to EPJ Data Science: **"Probability-turbulence divergence: A tunable allotaxonometric instrument for comparing heavy-tailed categorical distributions,"** which is available online at https://arxiv.org/abs/2008.13078).

We believe our paper will be of great benefit to a broad academic audience.

Finally, some possible reviewers we have listed are: Simon Dideo, Sune Lehman, Y.-Y. Ahn, Yu-Ru Lin, Neil Johnson, and Johan Ugander.

We also suggest: Jake Hofman, Martin Gerlach, Dashun Wang, and Luis Amaral.

We look forward to hearing of your decision.

Yours sincerely and on behalf of the manuscript's authors,

Prof. Peter Sheridan Dodds
Prof. Christopher M. Danforth