Universal patterns in information ecosystems

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Humans are generating data through communication networks as never before. This causes a bottleneck in our ability to tackle pieces of information, the so-called memes. As a consequence, online communication systems become an environment where memes compete for users' attention. Thus, it is crucial to understand the complex dynamics taking place in these information ecosystems because our vision of the world is partially obtained through the lens of these digital environments. All this depict a complex scenario that cannot be easily understood with classical tools. If we want to characterise the mechanisms that shape our social ecosystems, a starting approach is to study the statistical regularities or organisational patterns that arise in them. Although some statistical relationships already exist in social networks but it is in ecology where emergent patterns have been exploited for a long time and proven to be universal [1, 2].

Exploiting the similarities between natural and information ecosystems –competition for resources/attention, maximisation of abundance/visibility, etc... – we can map the quantitative characterisation of information systems into the study of variation in ecological communities. In recent years, several works [3, 4, 5] have applied this approach to disentangle a particular macroscopical property of a social system. However, they have focused only on specific aspects. On the contrary, to gain a fulfilling insight, we need an integrated view that characterise our system as a whole. Thankfully, during the last decade, researchers in theoretical ecology have developed a wide range of analytical tools that can be applied to social systems with the proposed bridge: representing users and memes in online social networks as species of an ecological community, the attention problem turns to species competition for resources.

Here, we have systematically analysed 7 major macroecological patterns [2] in the online platform Twitter: the relative species abundance (RSA), species area and time curves, daily abundance changes, distribution of abundances across communities, distribution of mean abundances across species (MAD), Taylor's Law and the variation of the mean number of species against the innovation rate. These patterns exhibit similar characteristics in very different communities. For example, the RSA reflects how the species are distributed in a given region. We have analysed Twitter streams relative to 11 different events, and we have found that the same functional forms predicted for ecological communities [1, 6] hold for online social systems. This universality suggests that, although inherent differences, the dynamics of information and natural ecosystems may be shaped by similar main drivers.The fact that as many as seven patterns coincide between the systems gives us robust support for a stable bridge and pave the way for a fruitful

co-fertilisation of the two fields.

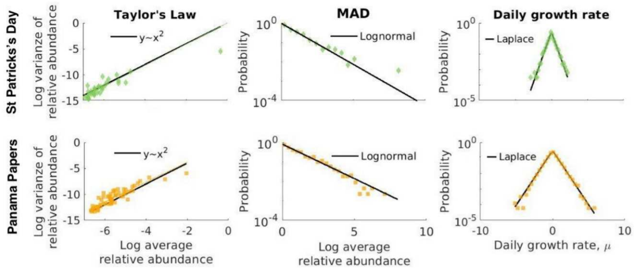

Fig. 1. Three of the patterns for two datasets. Solid lines represent fits to the data.

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