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The spread of information in society depends on communication networks between people. These networks are characterized by both structure, i.e. who is connected to whom, and by temporal patterns, i.e. the times when communication actually occurs. The increasing availability of large high-resolution data on human behavior revealed that these networks follow non-trivial structural and temporal patterns.

To study the impact of these patterns on human communication, previous research has treated them as different phenomena, even though they are equally originated from communication. From the physics perspective, we address a fundamental question that is to find a unified process able to reproduce both phenomena simultaneously telling us more on the nature of human dynamics. We propose a model based on a feedback between communication of information and adaptive network behavior that explains the emergence of structural and temporal patterns as observed in real-life.

In statistical physics, particles interact with each other and exchange energy. Our intuitive model, motivated by kinetic theory, considers that many interacting individuals exchange hypothetical resources that in turn regulate their activation rate. We show that this model exhibits distinct behavior, reminiscent of real-life communication, by simply varying a control parameter, similarly to changes of temperature in kinetic theory.

We show that the patterns spontaneously emerges in the so-called rich-club-like systems where the active people typically communicate with other active individuals, but occasionally connect and communicate to non-active individuals, just like in online web-forums or snail mails.

This relatively simple and theoretically tractable physics model of stochastic processes opens up several opportunities to better understand human communication by using methods of statistical physics