

## SOE 13: Communication and Language

Time: Wednesday 14:00–15:45

Location: H 0110

SOE 13.1 Wed 14:00 H 0110

**Rhythms in mobile-phone data** — ●PHILIPP HÖVEL<sup>1,2</sup> and ALBERT-LÁSZLÓ BARABÁSI<sup>2</sup> — <sup>1</sup>Technische Universität Berlin, Germany — <sup>2</sup>CCNR, Northeastern University, Boston, USA

We present an analysis of temporal and spatial regularity of empirically obtained network data. The source of data is given by anonymized mobile-phone traces that include information about time and place of the connections between two mobile phones. Therefore, it contains next to temporal and spatial information an additional social component. This makes it a versatile tool to enhance our understanding of human dynamics. Based on the anonymized mobile-phone data, we investigate patterns of human behavior by a detailed mobility analysis on various timescales. We identify, for instance, rhythms of daily routine and deviations from it during weekend activities. This contributes to a general theory of synchronization in complex, real-world networks.

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SOE 13.2 Wed 14:15 H 0110

**The role of emotions in on-line communication** — ●ANTONIOS GARAS, DAVID GARCIA, and FRANK SCHWEITZER — Chair of Systems Design ETH Zurich, Kreuzplatz 5, CH-8032 Zurich

Internet has changed the way we communicate over the last years. With people engaged in ever growing number of on-line interactions, questions about the nature of this new form of communication are of particular interest. Is our on-line communication different from other, more traditional, means of communication? How we express our emotions through written text exchange on-line? We show that the frequency of word use is closely related to its emotional content. More precisely, we show that words with a positive emotional content are more frequently used, and they create a bias in human expression. This finding is validated across three different languages, and is related to established psychological hypotheses. Furthermore, we show that people are very persistent in the way they express their emotions on-line. This comes as a surprise, given the high degree of anonymity, but is a hint that social norms are applicable in on-line interactions. We created a model based on simple psychological assumptions, that is able to reproduce the observed stylized facts of on-line communication. Our results can be important for understanding the dynamics of on-line social communities, and allows us to test different hypothesis regarding their emotional impact in on-line communication.

SOE 13.3 Wed 14:30 H 0110

**Sentiment Classification in Social Media - an exemplar study in the micro-blogging platform Twitter** — ●RENÉ PFITZNER, ANTONIOS GARAS, and FRANK SCHWEITZER — Chair of Systems Design, ETH Zurich, Switzerland

Social Mediae are changing the way people communicate and stay in touch. One particular case, the micro-blogging platform Twitter, has gained much scientific attention in the last one or two years. This attention is justified by its inherent openness that allows public accessibility to user profiles, and to user contributions expressed through short texts (called "tweets"), leaving researchers with valuable datasets. Here we study the "tweeting" behavior of users, by distinguishing between the pure act of "tweeting" as *information creation* mechanism, and the practice of "retweeting" as *information distribution* mechanism. Especially, by determining the emotional value of a tweet using SentiStrength, an automated sentiment classifier for short and informal text, we consider the influence of the *emotional* value of a tweet on its chances of diffusion in the network.

SOE 13.4 Wed 14:45 H 0110

**Group-structured speech community and language change** — ●CRISTINA-MARIA POP and ERWIN FREY — Arnold Sommerfeld Center and CeNS, Ludwig-Maximilians-Universität München, Theresienstr. 37, 80333 München, Germany

The processes leading to language change are manifold. The need to reduce ambiguity in the transmission of informations favors agreement on a conventional sign for a recurring problem. On the other hand, speakers tend to use particular linguistic variants associated with the social groups they identify with. Innovations and the influence of other groups propagating across the speech community as new variant forms

sustain the competition between linguistic variants.

With the Utterance Selection Model, an evolutionary description of language change, Baxter et al. [1] have provided a mathematical formulation of the interactions inside a group of speakers, revealing the mechanisms that lead to or inhibit the fixation of linguistic variants. Taking the Utterance Selection Model one step further by describing a speech community consisting of multiple interacting groups allows us to gain more understanding about the way in which linguistic variants propagate and how their distribution depends on the interaction strength between groups.

[1] Utterance selection model of language change, G. J. Baxter, R.A. Blythe, W. Croft, Phys. Rev. E **73**, 046118 (2006)

SOE 13.5 Wed 15:00 H 0110

**Burstiness and long-range correlation in natural language** — ●EDUARDO G. ALTMANN — Max Planck Institute for the Physics of Complex Systems

Recent temporal analysis of different large-scale databases of human activities show that two ubiquitous patterns are the intermittency in the occurrence of events (burstiness) and correlations on arbitrarily long times. Natural language is a prominent human activity that not only creates these temporal patterns but also reproduces the patterns of external events. Here we perform a detailed analysis of the burstiness and correlations of literary texts. We show how these two phenomena relate to each other on different linguistic scales. In particular, we explain the correlations observed in different low-level encodings (ASCII, letters, vowels, etc.) by tracing their origin to the burstiness of specific words. We discuss how this burstiness depends on the semantics of the words and on the authors of the texts, and can be used in practical applications such as document classification and authorship recognition. Our framework of analysis is general and can be applied also to other hierarchical systems.

SOE 13.6 Wed 15:15 H 0110

**Personnel Portfolio and Communication** — ●MAGDA SCHIEGL — Cologne University of Applied Sciences, Köln, Germany

Most of the successive companies develop employee strategies. They perform empirical studies to learn more about the employees they will have and they need in the future to meet upcoming challenges of their business.

We model the personnel portfolio of a company as an agent based model. The agents correspond to the employees of the company. They are characterised by several internal parameters as for instance age, sex, seniority, salary, motivation and the level of education. The agents interact with each other on hierarchical levels. There are deterministic rules for the time dynamics of some internal variables and others are changed in a rule based probabilistic way. Depending on the values of their internal parameters the agents will change their motivation, leave the company, retire or stay with the company. New agents can be hired. The focus in our model is on the interaction of the single agents, groups and the whole company that influences the motivation via communication and collaboration on different levels of the organisational structure. The agents' motivation is spread across the organisation: Its time dynamics is modelled via the concept of fields. This concept is often used in the field of socio-economic-physics. We investigate the dynamics of the personnel portfolio: The number of employees and the distribution of the internal parameters. On this basis communication and personnel strategies are evaluated and discussed.

SOE 13.7 Wed 15:30 H 0110

**Using social network analysis to explore narrative structure** — ●ANDRZEJ JARYNOWSKI<sup>1,2</sup>, STEPHANIE BOLAND<sup>1,3</sup>, ELVA ROBINSON<sup>1</sup>, RICHARD WALSH<sup>1</sup>, DAN FRANKS<sup>1</sup>, and JOHN FORRESTOR<sup>1</sup> — <sup>1</sup>YCCSA, University of York, UK — <sup>2</sup>Smoluchowski Institute of Physics, Jagiellonian University, Cracow, Poland — <sup>3</sup>English, University of Exeter, UK

Network theory is useful when it comes to studying nature from a systems perspective, and social network analysis has been already applied to human societies. We want to make a cross-disciplinary leap, and use the tools of network theory to understand and explore narrative structure in literary fiction, a still under-utilized approach. However, the systems in fiction are sensitive on reader's subjectivity and at-

tention must be paid to different methods of extracting networks. The project aims to investigate the different ways social interactions are "read" in texts by comparing networks produced by automated algorithms-natural language processing (NLP) with those created by surveying more subjective human responses. Conversation networks from fiction have been already extracted by scientists, but the more

general framework surrounding these interactions was missing. We propose several NLP methods for detecting interactions, and test them against a range of human perceptions. In doing so, we uncovered some limitations of using network analysis to test literary theory (e.g. interaction, which correspond to the plot, do not form climax).