Collective Emotions in Cyberspace
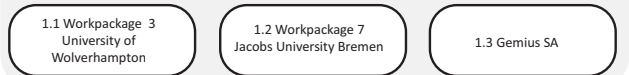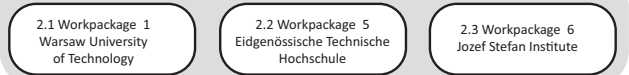EU FP7 funded IP project, Grant agreement no. 231323

Abstract

CYBER**EMOTIONS** is an EU Large Scale Integrating Project within the 7th Framework Programme in FET ICT domain Theme 3: 'Science of complex systems for socially intelligent ICT'. The project associates nearly 40 scientists from Austria, Germany, Great Britain, Poland, Slovenia, and Switzerland.

Emotions are an important part of most societal dynamics. As with face-to-face meetings, Internet exchanges may not only include factual information but also emotional information; how participants feel about the subject discussed or other group members. The development of automatic sentiment analysis has made large scale emotion detection and analysis possible using text messages collected from the web. The main objectives of CYBER**EMOTIONS** is to understand the role of collective emotions in creating, forming and breaking-up ICT mediated communities and to prepare the background for next generation of emotionally-intelligent ICT services. Project Partners collect data on emotions in e-communities and psycho-physiological data on emotions evoked by on-line discussions, develop data-driven models of CYBER**EMOTIONS**, and create emotion-related software.
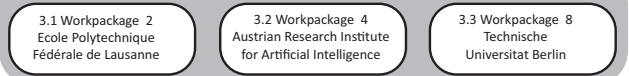
1. Data collection layer
1.1 WP3 – webometrics
Large-scale corpora have been collected and analyzed from a diverse set of online social communication networks and state-of-the-art sentiment detection algorithms developed. An analysis of top Twitter events in a month showed that even positive popular events normally generate increases in *negative* sentiment strength. On the picture you can see Twitter volume (top) and sentiment (bottom) *Sandra Bullock* posts around the Oscars. Thick black line: average negative sentiment strength; thick grey line: average positive sentiment strength. Thinner lines: subjective texts.
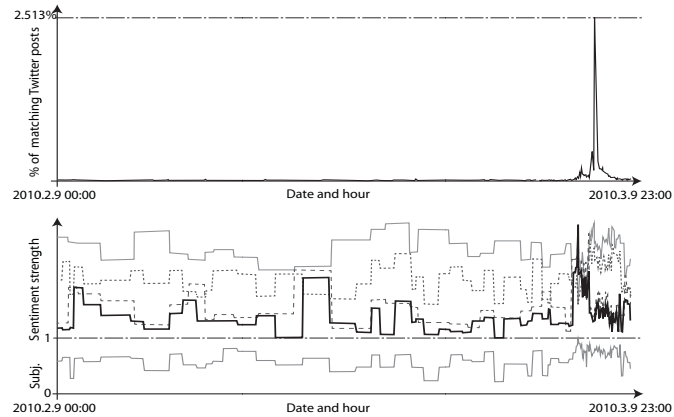
1.2 WP7 – emotional reaction and interaction assessment
The Jacobs University team collects live data on participants' responses to, and interactions with, emotionally charged Internet materials. Our approach emphasizes a multi-level perspective on subjective and physiological (e.g., facial EMG, EKG, Skin Conductance) reactions while participants are reading, writing, or responding to emotional online discussions as they occur. These data are available to partners for modeling purposes, as well as for cross-validating text-based automatic classifications.


1.3 Gemius SA– online research agency
Another interesting and important issue is the possibility of using online qualitative research. During the study, respondents can be found in their natural environment - a place where they usually use the Internet, making them more receptive. They feel safe and speak freely, they are spontaneous. It is also possible to reach hard to reach groups of participants, distributed, or niche, making them interact between each other. This is achieved using many multimedia presentations and the use of various projective techniques.

2. Theory layer
2.1 WP1 – statistical physics of emotions

Sample discussion from "Eastern Religion" BBC forum in September 2005
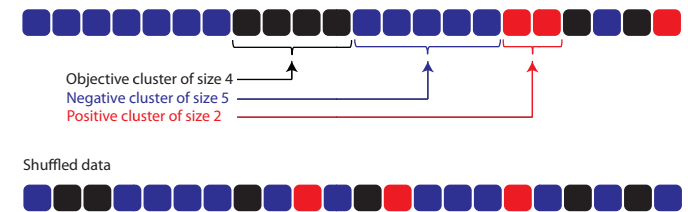
We show, for the first time, the collective character of affective phenomena as observed in four million posts from on-line media. To test emotional influence among community members, we group posts into clusters with similar emotional valences. The frequency of long clusters was much higher than that predicted by a random allocation of emotions (see Figure). Our results (i) prove that collective emotional states can be created and modulated via Internet communication, (ii) are used for simulating bot-human interactions in the discussion forums.

2.2 WP5 – agent based models of emotions
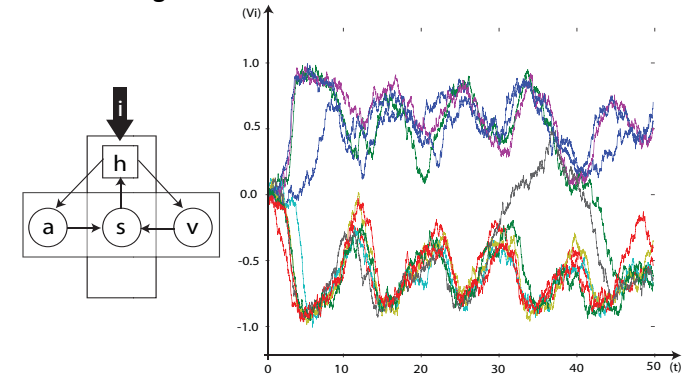
The CYBER**EMOTIONS** modeling framework provides a theoretical tool to model different kinds of emotional interaction online.

Agents represent Internet users with an emotional state composed of valence (v) and arousal (a), which determine the expression of the agent (s). These expressions aggregate in a field (h) which might receive external influences (i). Under particular circumstances, this model has shown the emergence of transient collective emotional states, in which agents' emotions polarize and relax to a non-emotional state.

2.3 WP6 – complex networks
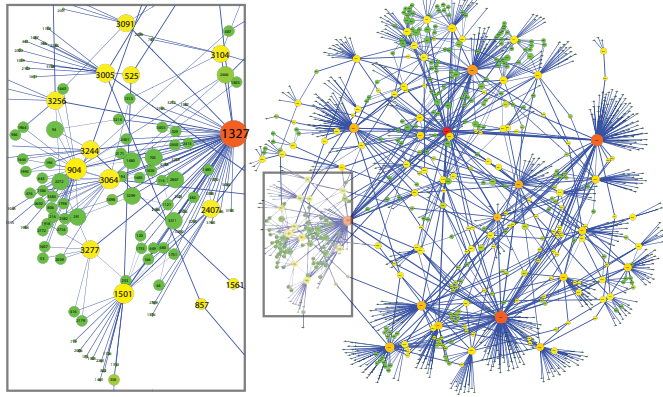
Combining approaches of statistical physics of complex networks with machine-learning methods of text analysis we study emergence of the emotional behavior among Web users on Blogs and in the dialogs on social networks (Figure: An example of dialogs network in MySpace). We develop a methodology for quantitative analysis of user communities and their dynamic behaviors related to emotions expressed in the texts of comments.

3. ICT output layer
## 3.1 WP2 – virtual Reality
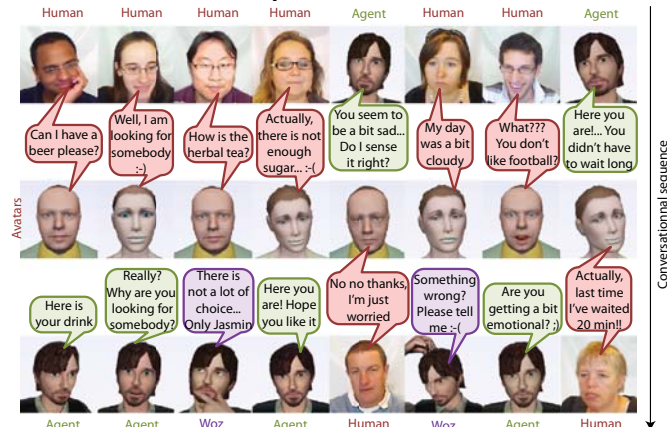
To make our first step towards a virtual society composed of virtual human (VH) capable of "emotion", we have elaborated two models and respective 3D software with verbal and non-verbal communication between VH. The resulting interpersonal micro virtual societies were tested by multiple user-tests: first at individual level with avatar-to-agent relationships; second, at social behavior level using 3D {v,a,d} ETH emotional model and multiple avatar relationships. This work involved the direct collaboration with workpackages 3, 4, 5, and 7.

3.2 WP4 – affective dialog systems
Affect Listeners are dialog systems applied for studying communication processes. These tools are used to investigate the role of emotions in online, synchronous natural-language-based communication. Experiments demonstrated their capability to conduct dialogs as realistic and enjoyable for users as in a Wizard of Oz setting and to establish an emotional connection. Further, users' ratings of the emotional connection to the system correlated with its affective profile (e.g. positive, negative, and neutral).

3.3 WP8 – event-based network discourse
The theoretical foundation of the dynamic analysis of sentiment propagation in social networks is an event-based network data model, capable of accommodating direct as well as indirect interaction data of any kind, such as online fora or e-mail, together with attributes such as topics, sentiment strength, and time stamps. After the transformation and extraction of networks, the data is analyzed with special focus on the sentiment dissemination, metrics of underlying sub-networks and the occurrence of dynamic effects.
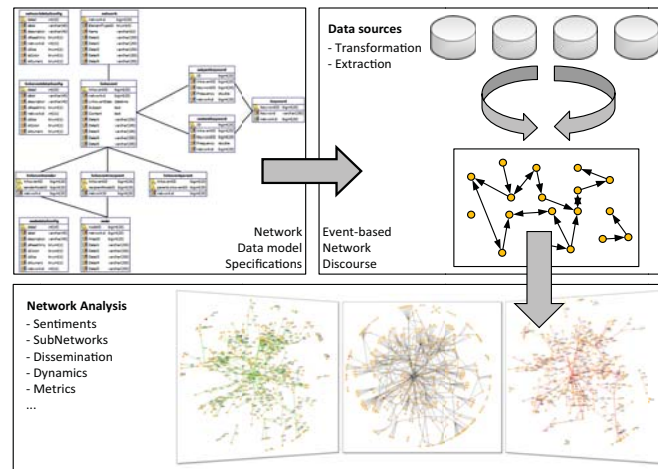
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More information at www.cyberemotions.eu