Investigating and Modeling Online Social Environment and Psychological Traits

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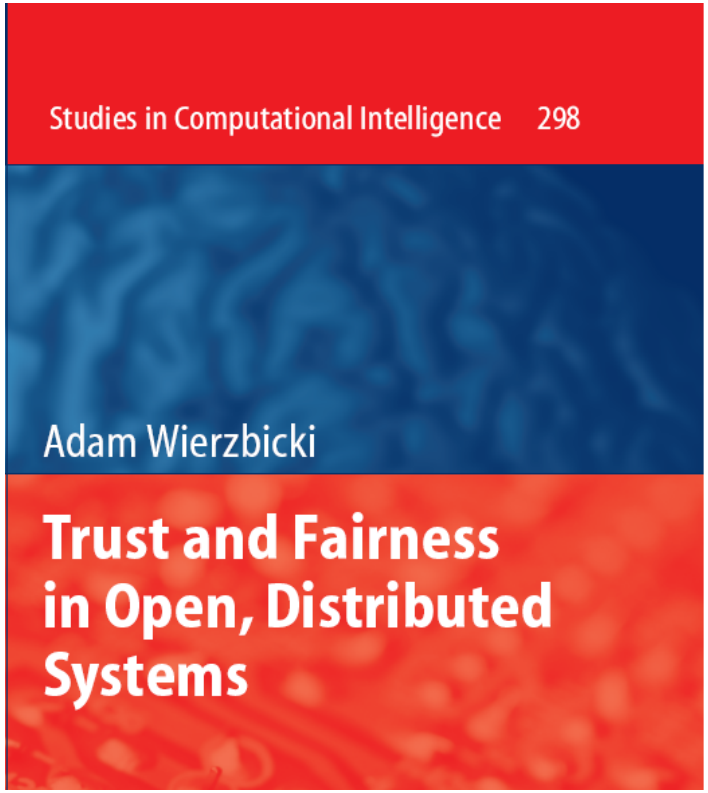
Dealing with Social Concepts is Fun…

- Social Concepts are often hard to define precisely
  - For this reason, they are often considered „vague” by computer scientists
- Examples I have dealt with:
  - Fairness
  - Trust
  - Credibility
  - Quality of Collaboration



Interdisciplinary Research in Social Informatics

- Dealing with research problems like Networked Individualism is a task for a new research area
  - Social Informatics is an area of Informatics that attempts to realize social goals or apply social concepts to improve information systems
- Social Informatics requires an interdisciplinary collaboration of Social Scientists and Computer Scientists
  - In 2009, I have founded a conference to bring together the two communities (SocInfo)
  - http://www.socinfo.eu/

Research in Social Informatics at PJIIT




- Research group exists since 2008
- So far, we have attracted grants of 1,2 mln euro
- Current projects:
  - Reconcile (http://reconcile.pjwstk.edu.pl)
  - TeamRec: Team Recommendation in Open Knowledge Communities (since February 2013)
- New Ph.D program in Social Informatics
  - 20 students
  - So far, 2 graduates ;]
- Collaboration with: Switzerland, Japan, Singapore, Italy




Social Informatics Research Group at PJIIT

Problem definition

- Human social interactions are increasingly mediated through information systems
- Informations system's performance and quality increasingly depends on human input and behavior
- We need models of human social behavior and psychological traits to improve information systems
- These models can also provide new insights into the social sciences, and help to achieve new social goals made relevant by information systems
  - Such as Networked Individualism

Why is *on-line* special ?

- Dynamic character
- Sense of anonymity
- Fake identities
- Way to maintain many contacts
- New tools for work, communication, socializing, …

- Researchers gained new tools for measurement and observation
- Social interactions leave detailed behavioral data
- Psychological traits gained new ways of expression

Main areas of study

- Social networks
- Open-source communities
- Crowdsourcing
- On-line marketing/advertising /sales
- Recommender systems and social filtering systems
- On-line learning (moocs)
- Browsing behaviour
- … and many many more

How to measure social interactions and psychological traits

- Quantitive methods
  - Declarative
  - Behavioral
- Qualitative methods
- Observations

Declarative Quantitative methods

- *Are traditional methods suitable for online environment?*
- *Should tests refer to specific online situations?*
- Thanks to ITC technologies:
  - We are able to control additional variables (eyetracking, item exposition time etc.)
  - We can change test architecture (i.e. computerized adaptive testing)

Quantitative Methods: Example 1

- IPIP – International Personality Item Pool (http://ipip.ori.org/)
- Our research team examined relationship between:
  - Risk taking
  - Need for cognition
  - Trust
  - Conformity
  - and Internet users' tendencies to misjudge presented websites' credibility
- We have used Amazon Mechanical Turk to recruit over 1000 participants

Rafalak, M., Abramczuk, K., Wierzbicki, A. (2014). *Incredible: Is (Almost) All Web Content Trustworthy? Analysis of Psychological Factors Related to Website Credibility Evaluation*, WWW'14 Companion, April 7–11, 2014, Seoul, Korea. ACM.

Quantitative Methods: Example 1

- People showing tendency to overestimate websites' credibility can be characterized by low need for cognition but relatively high positive level of conformity and risk taking.

- People showing tendency to underestimate websites' credibility can be characterized by moderate but negative level of trust and conformity , moderate positive level of need for cognition, strong negative level of intellect and risk taking.

Quantitative Methods: Example 2

- Brief test of online behaviour (BTOB)
- Three scales:
  - Sociability
  - Utility
  - Reciprocity
- May serve to create Internet users' typology

Johnson G. M,. Kulpa A.,Dimensions of Online Behavior:Toward a User Typology **(2007) Cyberpsychology and Behavior, 10,6.**

Quantitative Methods: Example 2

- Sociability: Test Items
  - 1. I e-mail people I hope to avoid.
  - 2. I add new contacts to my online accounts (e.g.,instant message).
  - 3. I meet new people online.
  - 4. Using the Internet interferes with my social life.
  - 5. The Internet helps me keep in touch with friends or family.

Quantitative Methods: Example 2

- Utility: Test Items
  - 6. I spend hours online without really accomplishing anything.
  - 7. The Internet helps me get the job done.
  - 8. I use the Internet to have fun.
  - 9. The Internet saves me time.
  - 10. Time seems to fly when I browse and surf.

Quantitative Methods: Example 2

- Reciprocity: Test Items
  - 11. I have several windows open on my PC at the same time.
  - 12. I feel that animation improves Web pages.
  - 13. I feel that Web sites provide too much information.
  - 14. When I use the Internet, my hand is on an input device (e.g., the Mouse)
  - 15. I instant message or chat more than I e-mail.

Quantitative Methods: Example 2

- A typology of online behavior reflects three assumptions:
  - (1) there are characteristic patterns or types of online behavior,
  - (2) such types can be determined or measured, and
  - (3) such measurement contributes to improved understanding of individual users.

Quantitative Methods: Example 2

- Applications:
  - Users who score high on sociability and reciprocity but low on utility (**Type X**) may learn best in interactive and stimulating online environments, which necessarily include self-regulating software.
  - Individuals who score moderate on sociability and reciprocity but high on utility (**Type Y**) may prove to be the most effective at online sales.

Qualitative methods

- Analyzing written statements, projective tests etc.
- ITC technologies:
  - automated methods for text analysis (NLP)
  - LIWC = Linguistic Inquiry and Word Count (**http://www.liwc.net/**)

Qualitative Methods: Example 1

- Studies dedicated to diagnosing psychological disorders from online written statements using NLP.
- Computerized word count was used to identify linguistic differences between the two groups.
  - Psychiatric patients used fewer words pertaining to optimism/energy, basic cognitive mechanisms, exclusion, and bodily functions compared to the controls. They also tended to use fewer references to the future and communication.
  - No differences were found on pronoun use, and sensation/perception. The LIWC captured features of natural word use that are of conceptual as well as empirical relevance for personality and psychopathology research.

Observations

- Quantitive & qualitative
- ITC technologies:
  - Observation of on-line bahaviour
  - Abundance of new indicators

Observations: Example 1

- Predicting personality traits from Facebook „likes”
  - http://youarewhatyoulike.com/

Private traits and attributes are predictable from digital records of human behavior by **Kosinski, M.**, Stillwell, D.J., Graepel, T. *Proceedings of the National Academy of Sciences (PNAS),* 2013.

Observations: Example 1

- Analysis based on a dataset of over 58,000 volunteers who provided their Facebook Likes,detailed demographic profiles, and the results of several psychometric tests.
- The proposed model uses dimensionality reduction for preprocessing the Likes data, which are then entered into logistic/ linear regression to predict individual psychodemographic profiles from Likes.
- The model correctly discriminates between homosexual and heterosexual men in 88% of cases, African Americans and Caucasian Americans in 95% of cases, and between Democrat and Republican in 85% of cases.
- For the personality trait “Openness” prediction accuracy is close to the test retest accuracy of a standard personality test.

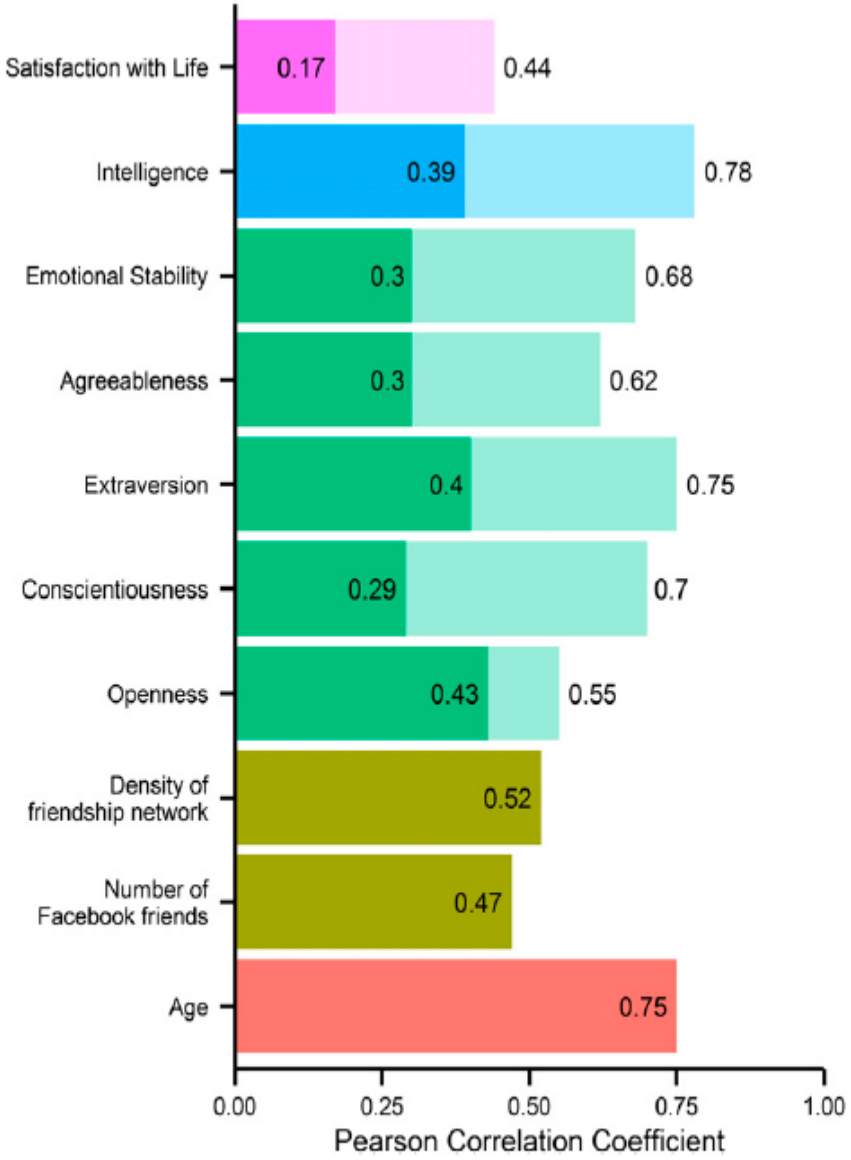


Fig. 3. Prediction accuracy of regression for numeric attributes and traits expressed by the Pearson correlation coefficient between predicted and actual attribute values; all correlations are significant at the $P < 0.001$ level. The transparent bars indicate the questionnaire's baseline accuracy, expressed in terms of test–retest reliability.

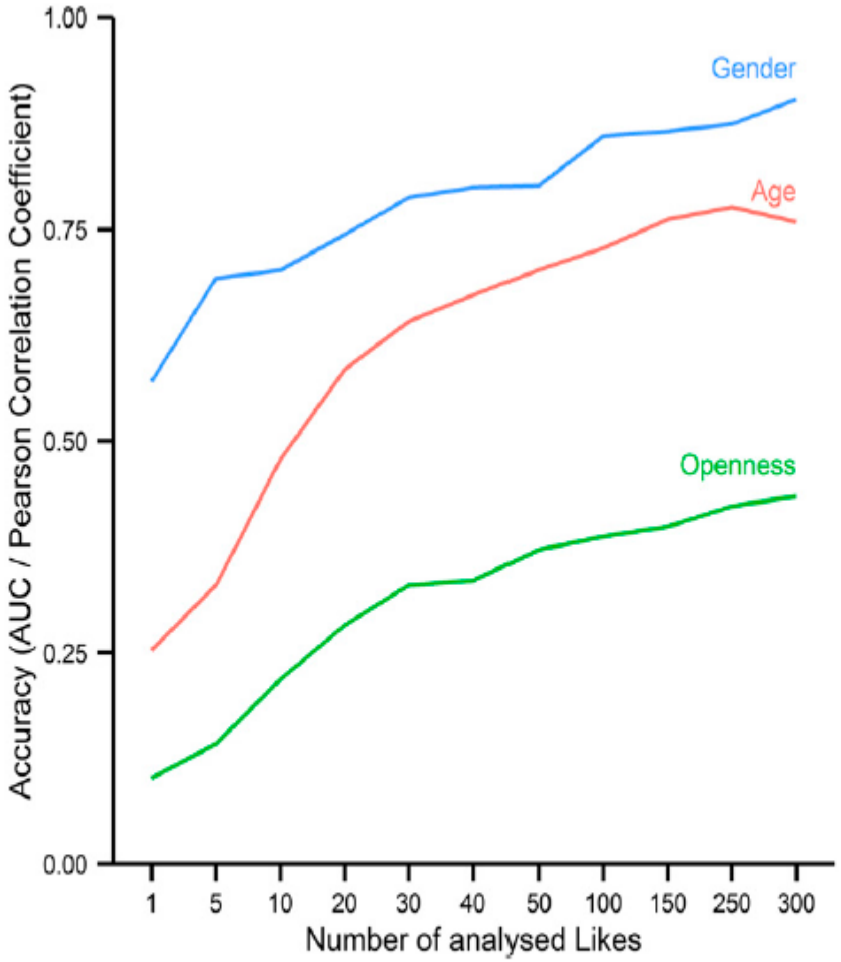


Fig. 4. Accuracy of selected predictions as a function of the number of available Likes. Accuracy is expressed as AUC (gender) and Pearson's correlation coefficient (age and Openness). About 50% of users in this sample had at least 100 Likes and about 20% had at least 250 Likes. Note, that for gender (dichotomous variable) the random guessing baseline corresponds to an AUC = 0.50.

Behavioral quantitative methods

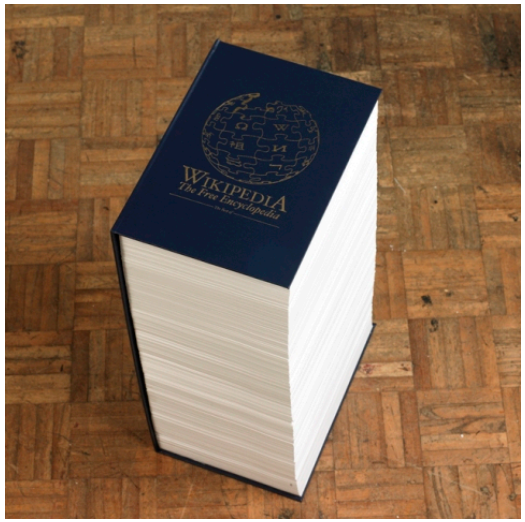
- Use data about online social behavior
- Use statistical data analysis („Big Data”)
- Can create computational models of social environment or behavior
  - Social Networks
  - Models to predict human behavior

Behavioral quantitative methods: example 1

- Studies of the Wikipedia Knowledge Community
  - The Wikipedia is a laboratory of open collaboration, and a model of the knowledge economy (Wikinomics)
  - Wikipedia management: admin elections
    - Called Request for Administrators (RfA) procedure
    - Criteria: number of edits, duration of participation
    - Election method: a vote by other admins
  - Studies of PJIIT team aimed to answer the question: what is the impact of the social network of Wikipedia editors on admin elections?

Behavioral quantitative methods: example 1

- **We have analyzed the whole edit history of the Polish-language Wikipedia and the English-language Wikipedia**
  - Over 1 mln articles (Polish), almost 4.5 mln articles (English)
  - About 40 mln edits (Polish, almost 700 mln edits (English)
  - Over 600K users (Polish), over 20 mln users (English)
- The dataset:
  - Contains every version of every page
    - Full text
    - Time stamp
    - Nick of registered author or IP address
  - Many different pages: articles, talk pages, special pages etc.
  - Dataset size (Polish): over 250 GB uncompressed text
  - English-language Wikipedia edit history has over 18TB



Behavioral quantitative methods: example 1

- Multi-dimensional Behavioral Social Network (MBSN)
- Dimension 1 (Discussion)
  - Edge strength is the number of words of author A written near words of author B on the talk pages
  - Possible interpretation: *acquaintance*
- Dimension 2 (Reverts)
  - Edge strength is the number of reverts of revisions made by author B that have been done by author A
  - Possible interpretation: *distrust* or *criticism*
- Dimension 3 (Co-edits)
  - Edge strength is a decreasing function of the distance between words of author B and words of author A
  - Possible interpretation: *trust in another's expertise*
- Dimension 4 (Topics)
  - A bipartite graph connecting authors with Wikipedia subject categories
  - Edge strength is the number of edits of an author in a category
  - Possible interpretation: *interest* or *knowledge*

Behavioral quantitative methods: example 1

- Impact of social network on RfA
- Confirmed hypotheses:
  - Mean „coedits” is higher for accepting votes than for rejecting votes
  - Mean „reverts” is higher for rejecting votes than for accepting votes
  - Mean „discussion” is higher for accepting votes than in rejecting votes

Behavioral quantitative methods: example 1

Measure	Votes „for”	Votes „against”
Coedits median	57.3	41.1
Coedits mean	442.2	287.7
Reverts mean	2.3	4.2
Reverts 3d quartile	2.0	3.0
Discussion median	492	405
Discussion mean	1,035	751

Behavioral quantitative methods: example 1

- Social capital of editors

Variable	R square	Linear model coeff.
Degree in dimension 1	0,272	0,16
Degree in dimension 3	0,43	1,34
CC in dimension 1	0,053	-2,93
CC in dimension 3	0,014	-1,18

- Let's look at the number of featured articles co-authored by an editor.
- Is this number related to the editor's social capital?
- Yes. The degree in dimension 3 (*discussion*) and 1 (*coedits*) is positively and significantly related to the number of co-authored featured articles.
- It is good to have many neighbors in dimensions 3 and 1, but these neighbors should not be too connected to each other.

Behavioral quantitative methods: example 1

- Possible application: Recommend candidates for admins using social networks
  - Currently, candidate needs to be proposed by another admin
  - The number of candidates is declining
  - Additional evidence: social capital of authors is related to article quality

M. Jankowski-Lorek, L. Ostrowski, P. Turek, A. Wierzbicki: Modeling Wikipedia admin elections using multidimensional behavioral social networks. Social Networks Analysis and Mining 3(4): 787-801, Springer, 2013

Learning About the Quality of Teamwork from WikiTeams, P. Turek, R. Nielek, A. Wierzbicki, A. Hupa and A. Datta Proc. Second IEEE International Conference on Social Computing (Socialcom-2010), 2010.

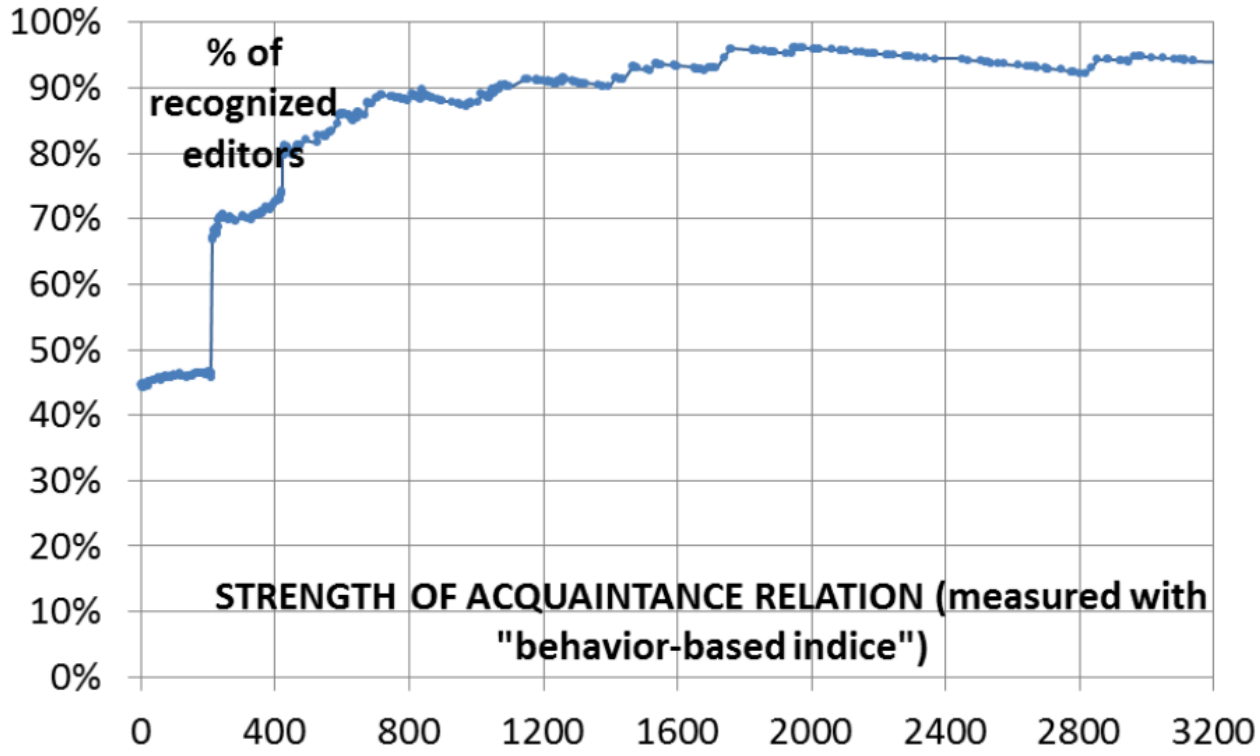
Behavioral quantitative methods: example 2

- How do we know that our interpretations of the MBSN are correct?
  - We have indirect evidence: if „trust” increases for good WikiTeams then „it works” ;]
  - If we want more, we have to ask the editors!
- **Survey on Polish Wikipedia**
  - Editors responded to „personalized” questions that were based on the edit history
  - Editors were asked to recall the nicks of other editors and then to recognize them from a list
  - Then they were asked about trust, antagonism, interests and knowledge
  - Reponses are anonymized

Behavioral quantitative methods: example 2

1. ***Please give the nicks of all Wikipedia editors that you remember.***
2. ***We will show you a list of nicks of editors that you have worked with. Please select the nicks that you recognize.***
3. Please select the nicks of editors that you have had contact with (using talk pages, communicators, e-mail, personally or in any other way).
4. ***Please select the nicks of editors that have, in your opinion, edits of a good quality.***
5. ***Please select the nicks of editors with whom you have at any time disagreed with or argued with*.**
6. How did you contact other editors? (multiple choice)
7. ***Please look at the following list of Wikipedia categories. Please select the categories in which you have expert knowledge.***
8. ***Now select the categories that you are interested in.***
9. How much time (monthly) do you work on Wikipedia?
10. Age, social status, education

Behavioral quantitative methods: example 2



- Percentage of recognized nicks as a function of strength in d-1 (Discussion)

Our other work on Wikipedia

- Using sentiment analysis to diagnose controversy
  - Together with other methods, article controversy classifiers approach 90% accuracy
  - Sentiment analysis allows to locate controversial parts of discussions and articles
- Determining dialog acts and user roles from talk pages using NLP

Behavioral quantitative methods: example 3

- Goals: Create a general model of mood changes based on Twitter data
- Methodology: Analysis of big dataset from Twitter
- Results:
  - confirmed the ability of using sentiment analysis to diagnose mood changes
  - Confirmed common-sense correlations of mood and social interaction

Michael Macy et at., Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures, Science, 2011

Summary

- Thanks to ICT we have gained new, powerful tools to investigate and model online social environments and psychological traits
- These new methods are gaining higher precision
- Results of such studies are of great scientific and commercial interest

Questions?