

Can we talk? What Bots can do in our cyberspace and does it matter?

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1. Can we talk? I'm just a robot

- You can be asked by a Bot in online chat system;
Or maybe not... as
- the **Bots (robots, algorithms)** operate silently
behind the scene
- What they are? Here are three examples, to get an idea



2. Ubuntu channel: Online chats

- Ubuntu system support:
ask the Bot and will get a predefined answer to your question; ask again...
will **always get the answer**...until you solve the problem;
 - this might be very efficient and
 - maybe even more pleasant than talking to a human!

- But, the data are stored systematically in a *logfile*;



3. The Boston Shuffler and other: Algotrading

- Algotrading—robots trading shares at stock market (**behind the scene**);
 - they do it according to preset algorithms;
execute it when (some conditions occur)... and so on
 - humans can realize it only afterwards, when they induce some large-scale effect;

- and give it a name, like the Boston shuffler, ...
(it's like hurricanes)



4. The Googlebot: Get known to others

- Googlebot—visits your Web page every day (even if you do not realize it)
 - gets news from your Page and adds it to the Google index

- Others can find your information through Google-search



5. What do they really do?

Millions of Bots exist/ new are created every day to do specific tasks; Does it matter?

- QUESTIONS are
 - Can we know what they really do?
 - Can we predict their effects at a large scale?

- What are our chances to influence the situation?



6. Can we do something about it?

To “compete”, we need to know the mechanisms of Bot’s actions; **(humans + Bots may compete other Bots)**

To what extent humans can **know** about the activity of Bots?
Even if we know,
can we do something about it?

DO SOME RESEARCH....

use aforementioned logfiles with the data



7. Research on the data that hold the Bot's traces

Our research:

- **Self-organized dynamics** can be studied in detail from the high-resolution data
- Use graph theory & Statistical physics:
Complex dynamical systems & Agent-based modeling
- Quantify the Bot's impact at large-scale



8. Design Agent-Based Model

Agents with the attributes of human users are designed:

- $A[id, (a_i(t), v_i(t)), profile, connections]$
 - id, activity.profile, (knowledge),...
 - fluctuating emotions; social connections
 - small delay; circadian.cycles



9. Agent-Based Model close to a particular system

Agents' interactions on (evolving) social networks via chat process is simulated [Ref*]:

- $A[id, (a_i(t), v_i(t)), profile, connections]$
- interaction rules & parameters inferred from real system!

*[Tadić & Šuvakov: Can human-like Bots control collective mood: agent-based simulations of online chats, JSTAT P10014 (2013)]



10. Two types of questions

These are nonequilibrium dynamical phenomena (*driven self-organized systems*);

Can we find out
if the Bots are (were) there?

Yes, we can
the Bots change the process

Why the underlying stochastic
point processes change?

when the Bot is there
it drives the system (from inside)

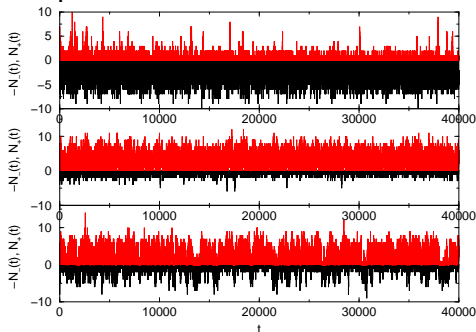
this impacts on?

the quantitative measures of SPP



11. The Bot's emotion affects connected agents and propagates

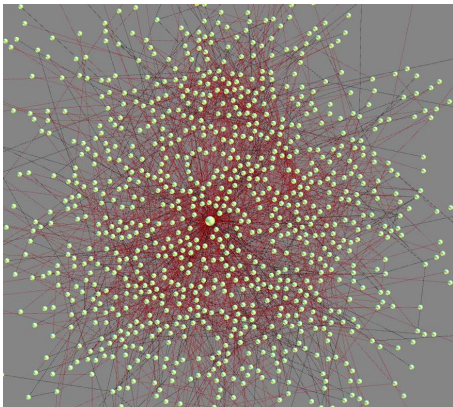
joyBot induces positive emotions in chats with agents



JoyBot induces more positive messages (comp. with neutralBot);
MiseryBot induces more negative messages;



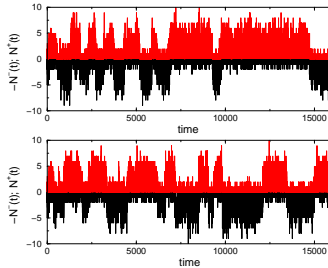
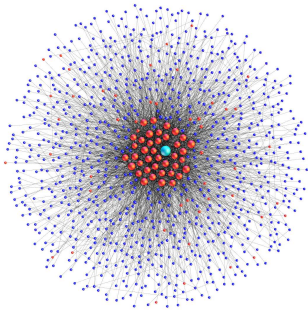
12. The Bot can affect the entire network



JoyBot induces more links carrying positive emotion;
(MiseryBot induces more negative links;)



13. Real Chat Bots can do the same?



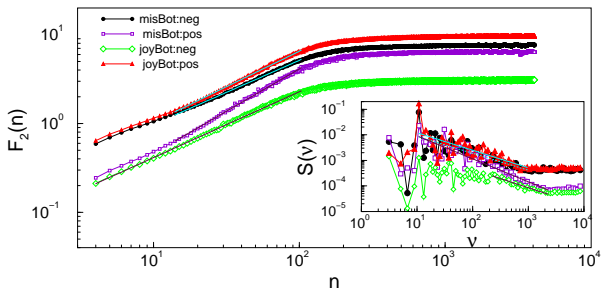
The Bot

with predominantly positive emotion: chats with few agents; They spread positive emotion over the network

[Gligorijević, Skowron, Šuvakov & Tadić, 2013]



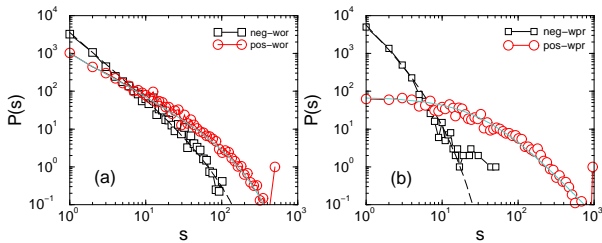
14. Quantitative measures of SPP changed



The process appears to be less self-organized; Less persistent



15. Clustering of emotional events changed



The avalanches of positive emotion messages increase in size, duration and frequency; Theoretically different mathematical law! [Ref.]



16. Why the Bots are so effective?

In these examples, the Bot is **slightly different** from other agents; still it is effective. Why?

Some of the reasons:

- always there;
- can communicate with many agents simultaneously;
- its emotion is *predefined* by an algorithm;
no bio-chemical processes!
- ...more features can be added



17. The Bots are changing our (online) world

And they can do it very effectively.

Some good news are:

- By data analysis and using science methods:
 - We can find out if a Bot is (was) active
 - and how effective it is (was)
- Can create another Bot to act against it(?)



18. Chat Bots can be nice

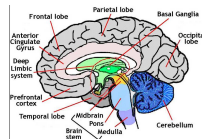
More good news for Chat channel users:

- **User:** Chat Bots can improve your mood (if it's positive Bot)
- **Owner:** Can “seize” your emotions first; then “sell” you other stuff (information, knowledge, ideas, social engagement...)



19. The message

The bottom line is:



- A well designed Bot can do the job
 - **instead of and/or better than humans**
(for instance, can give this talk in exactly 5 min)
- that's what we always wanted, isn't it?



20. Conclusion

The Bots are out there! Our **Cyberspace is their paradise**;

In order to:

adjust to the new world & and try to make use of it

We need to understand the **stochastic processes**
through which the Bots fulfill their tasks!

THANKS

