Automating question-answer sequences to improve text-based virtual agents

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The promise

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Understand

With Watson, you can analyze and interpret all of your data, including unstructured text, images, audio and video.

Reason

With Watson, you can provide personalized recommendations by understanding a user’s personality, tone, and emotion.

Learn

With Watson, you can utilize machine learning to grow the subject matter expertise in your apps and systems.

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The challenge

- How can text-based Virtual Agents (chat bots) operate more naturally and effectively?
- Key problem: chat bots do not work on the basis of conversational meaning, they do not understand the language they produce
- Hard to see why some questions invoke so-called preferred, affiliative answers and others invite resistance or no response
- Especially important in delicate contexts such as mental health
Our approach

- Automation of dialogical structures in text-based virtual agents
- Based on existing knowledge and models derived from Conversation Analysis / Discourse analysis for analysing question-answer sequences
- Combining with Natural Language Processing and Machine-Based Learning to analyse and predict successful and unsuccessful sequences
Objective: setting the ambition level and scope

- Develop new algorithms for text-based virtual agents?
- Gaining knowledge about differences between face-to-face and digital conversational patterns?
- Gaining knowledge about context-specific and generic conversational patterns in various digital conversation contexts?
- Construct a text-based real-time virtual agent with improved responsiveness for a particular setting?
Conversation Analysis (Sacks, 1992)

- everyday talk is very much structured, in detail
- talk is essential for society: ‘social institutions are talked into being’ (Heritage & Clayman 2010)
- language is not neutral but a *tool for action*
Example

1 Ireen_ How about the _following weekend
2
3 (0.8)
4 Charles hh _Dat's the _vacation isn't it?
5
6 Ireen hhhhh _Oh: .hh ALright so:
7 no ha:ssle (.) so o
8 Charles_ Ye:h

(Drew, 1984: 130; see also Wooffitt, 1992)
setting the interactional scene

- participants use language not only to describe reality but also to *do things with* (here: invitation-turning it down)
- interaction is organised through *turns* and *sequences* (series of turns) – not single sentences!
- people use the turn-by-turn basis (*sequential context*) to make sense of each others’ actions
- actions are *normatively* organised in
  - *adjacency pairs* (e.g. question-answer)
  - *preferred* and *dispreferred* options (here: acceptance/rejection)
four dimensions of questions

- set action and topical agendas
- embody presuppositions
- convey epistemic stance
- incorporate preferences

- reflects and constitutes social relationship between experts and patients

Heritage & Claymann 2010
(1) agenda setting

1 Doc  Do you have any drug allergies?
2  (0.7)
3 Pat:  .hh hu= Not that I know of no.
(2) presuppositions (Sorjonen, Raevera, Haakana, et al 2006)

Female patients are asked:
“Do you use alcohol?”

Male patients are asked:
“How much alcohol do you use?”
Figure 10.1 Question designs and epistemic gradients

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(4) preference

- some grammatical designs favor Yes responses:
  - declarative questions: You’re married currently.
- others invite a No response:
  - negative declaratives: There’s no blood in the diarrhea.
- counselors lack the epistemic right to acknowledge their own advice
- it is the privilege of client to do that and initiate the closing of the conversation: ‘I know enough’ or ‘I am reassured now’
- this treats the provided advice as an answer to their question, and it opens up the closing
three ways to open up the closing: eliciting advice acknowledgment

- questions projecting the client’s future action ("Does that give you something to work with?")
- elicitations of direct advice acknowledgment ("I hope you know enough now")
- offers of a new advice sequence ("Do you have any other questions?")
[13:43:28] Co: als je ervan af wil kan je contact opnemen met een instelling voor verslavingszorg bij jou in de regio, check out sites of brijder, jellinek, tactus en verder op drugsinfo.nl voor meer informatie, we kunnen hulp bieden op maat offer tailored care

[13:44:22] Co: Heb ik zo antwoord gegeven op je vragen? Have I answered your questions like this?

[13:44:29] Co: Kun je hiermee verder? Does that give you something to work with?


[13:47:44] Co: heb je zo voldoende info, of is er nog iets anders so do you have enough info, or is there anything else

[13:49:01] Co: Ik wens je veel succes en je kunt altijd nog eens I wish you good luck and you can always terugkomen come back again.
conclusions

- compared to telephone counseling it is easier for clients in chat sessions to resist pre-closing questions
- reasons as to why advice acknowledgment is not given can be manifold (simultaneous typing; doing other things at the same time etc.)
- this creates the flexibility to leave acknowledgements out and expand the counseling sessions
Should we limit the study to e-mental health settings?

- Relevance?
- What is typical for e-mental health compared to other settings
- What is similar /generalizable?
Should we opt for variety or homogeneity in data types?

- Chats only?
- e-mail correspondence
- twitter data
- face-to-face

- generalization vs context-specificity issue
- Setting the right ambition level, feasible yet innovative
Current proposal involves three different text corpora on E-mental:

(1) Centre for E-health and well-being research (UT): 10,000 e-mails between counselor and client

(2) Trimbos Institute (counselling alcohol and drugs addiction): 200 chat sessions, corpus expanding

(3) Korrelatie (counselling helpline): 350 chat sessions.
Analytical procedure/methods choices

- Partly supervised based on hand-coded patterns and un/semi-supervised using outcome labelling?
- Parallel or sequential data-driven vs theory-driven analyses?
- How to best increase (and test) the external validity of the model?
Ethical issues

- Risk of contributing to making human interaction redundant? (de-humanizing care)
- Opportunity to discern more clearly what is uniquely human and what is best done by machines?