Affect as Information about Users' Attitudes to Conversational Agents

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- Our fields of interest:
  - Natural Language Processing
  - Human Computer Interaction
  - Affect Analysis
  - Sentiment Analysis
  - Humor Processing
  - ...and more

Our ambient applications:

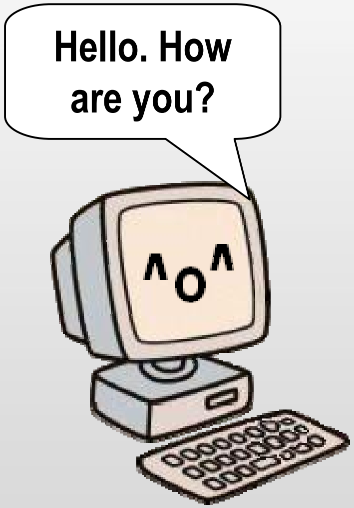
- -*"Conversational agents everywhere"* (talking car navigations systems, talking furniture, etc.)
- -Joking Hoover-Roomba (in development)
- -Multimodal Affect Analysis from content (language patterns) and voice (tone patterns)

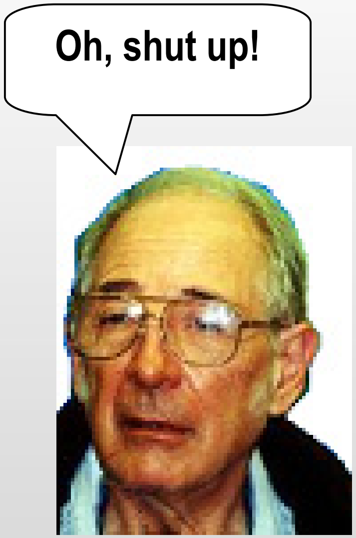
Experiments on:

- -Conversational Agents
- -Enhancing Homan-Computer Communication (e.g. with humor)
- -Emotiveness and Emotion Classification

Discovery

- Chat logs of users with a system described as better were more emotional





- …could there be a tendency?

Inquiry

Outline of the experiment

Assumptions

System for affect analysis of textual input

- ML-Ask

Conversational agents to compare

- Modalin
- Pundalin

Survey vs. ML-Ask's output

- Comparison
- Conclusions

Theory of Affect as Information

Conclusions

Assumptions

Looking for similar tendencies in survey evaluation and affect analysis

1. Do emotionally invilved users think of an agent as more human?

- Checking the <u>number of emotive sentences </u>in chat logs (affect analysis)
- Checking the <u>evaluation of the agent's performance </u>(survey)
- Comparing the results and looking for tendencies

2. Do attitude and affect go together?

- Checking what <u>emotion types </u>were found in the utterances (affect analysis)
- Checking <u>general attitude </u>to an agent (survey)
- Comparing the results and looking for tendencies

ML-Ask system for affect analysis of textual input

Inguistic Approach to Affect

In language there are:

1. **Emotive expressions. Parts of speech, that in emotive sentences describe emotional states.**
   A. Nakamura, *Kanjō hyōgen jiten* (Dictionary of Emotive Expressions), Tokyodo Publishing, Tokyo (1993)
   Examples: nouns: *aijou* (love); verbs: *kanashimu* (feel sad); adjectives: *ureshii* (happy)

2. **Emotive elements. Indicating that emotions have been conveyed, but not detailing what specific emotions there are. The same emotive element can express different emotions depending on context.**
   M. Ptaszyński, *Moeru gengo - Intānetto kei-jiban no ue no nihongo kaiwa ni okeru kanjōhyōgen no kōzō to kigōrontekikinō no bunseki – "2channeru„ denshikeijiban o rei toshite* –(Boisterous language. Analysis of structures and semiotic functions of emotive expressions in conversation on Japanese Internet bulletin board forum - 2channel -), UAM, Poznań (2006)

Emotive Elements / Expressions Analysis System (ML-Ask)

emotive expr. DB

emotive elements DB

nouns

愛情 *aijou* (love)
安心 *anshin* (relief)
恐怖 *kyofu* (fear)

verbs

喜ぶ *yorokobu* (be glad)
悲しむ *kanashimu* (feel sad)
むかつく *mukatsuku* (get angry)

phrases / idioms

虫酸が走る *mushizu ga hashiru* (give *one* the creeps)
心が解ける *kokoro ga tokeru* (*one's* heart is melting in relief)
歓天喜地 *kantenkichi* (delight larger than Haven and Earth)

adjectives

嬉しい *ureshii* (happy)
悔しい *kuyashii* (mortifying)
怖い *kowai* (scary)

exclamatives

すげぇ *sugee* (great!)
うおぉ *wooo* (whoa!)

mimetics (*gitaigo*)

ワクワク *wakuwaku* (heart pounding)
ドキドキ *dokidoki* (go pit-a-pat)

vulgarities

–やがる –*yagaru* (fu**ing do sth)
くそ *kuso* (shit)
馬鹿 *baka* (stupid)

hypocorystics

–ちゃん –*chan* (name suffix)

textual representations of voice modulation and body language (emoticons)

"!" , "??", "…", (T_T), (-д-;), _|￣|○

Definition of emotions

Emotions = every temporary state of mind, feeling or emotional state evoked by experiencing different sensations.

Nakamura, A.: Kanjo hyogen jiten (Dictionary of Emotive Expressions) (in Japanese), Tokyodo Publishing, Tokyo (1993)

Emotive utterances = every utterance in which the speaker in question is emotionally involved, and in which this involvement is linguistically expressed by means of intonation or by the use of performative expressions.

Beijer, F.: The syntax and pragmatics of exclamations and other expressive/emotional utterances. Working Papers in Linguistics 2, The Department of English in Lund. (2002)

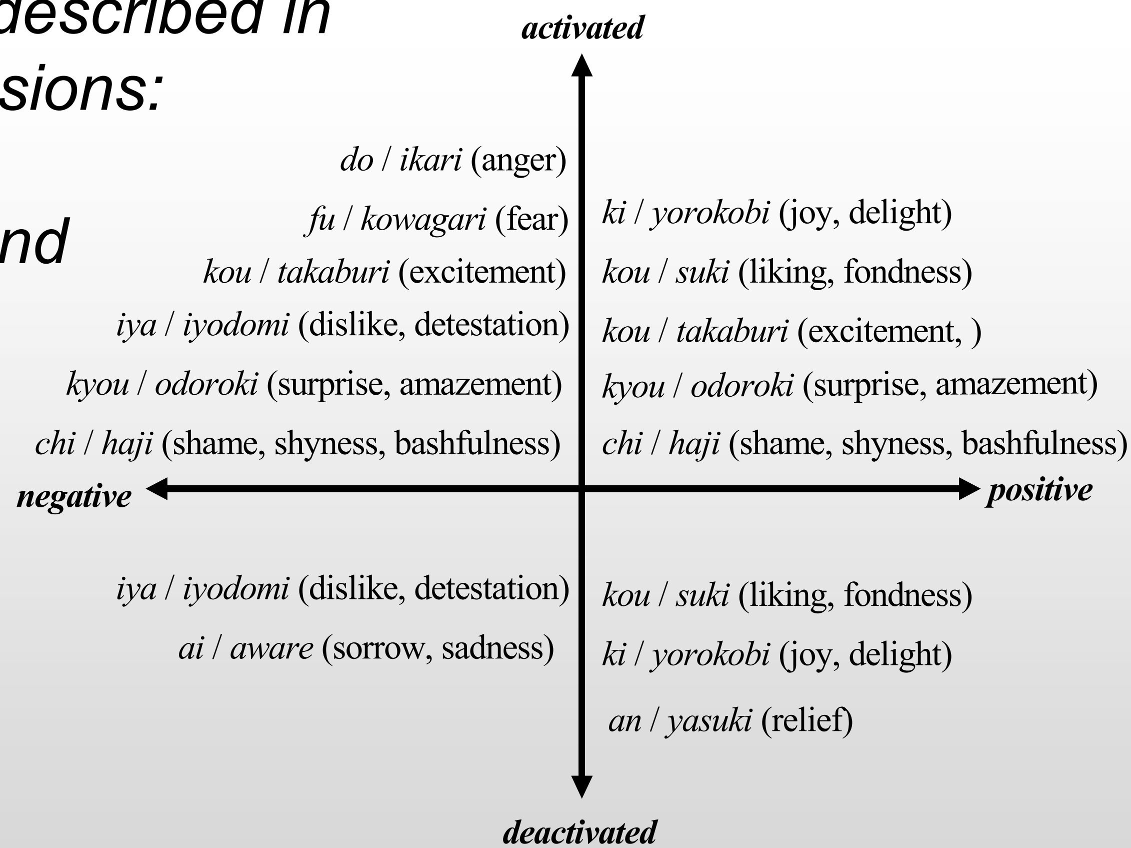
Nakamura's <u>classification of emotions</u> (after a thorough study in the Japanese):

10 types:

1. 喜 *ki* / *yorokobi* [<u>joy, delight</u>]
2. 怒 *do* / *ikari* [<u>anger</u>]
3. 哀 *ai* / *aware* [<u>sorrow, sadness</u>]
4. 怖 *fu* / *kowagari* [<u>fear</u>]
5. 恥 *chi* / *haji* [<u>shame, shyness, bashfulness</u>]
6. 好 *kou* / *suki* (<u>liking, fondness</u>)
7. 厭 *iya* / *iyodomi* (<u>dislike, detestation</u>)
8. 昂 *kou* / *takaburi* (<u>excitement</u>)
9. 安 *an* / *yasuki* (<u>relief</u>)
10. 驚 *kyou* / *odoroki* (<u>surprise, amazement</u>)

2-dimmensional model of affect

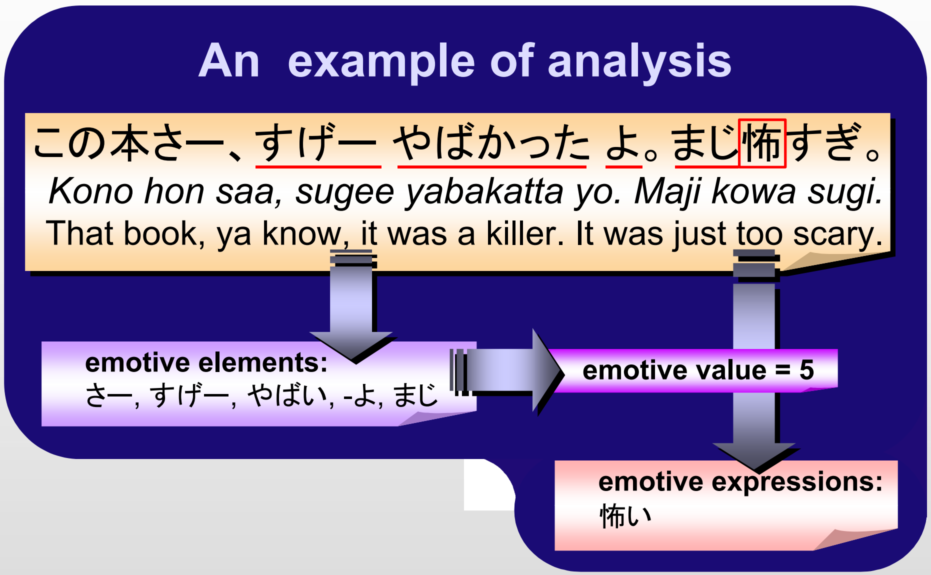
"All emotions can be described in a space of two-dimensions: valence polarity (positive / negative) and activation (activated / deactivated)."

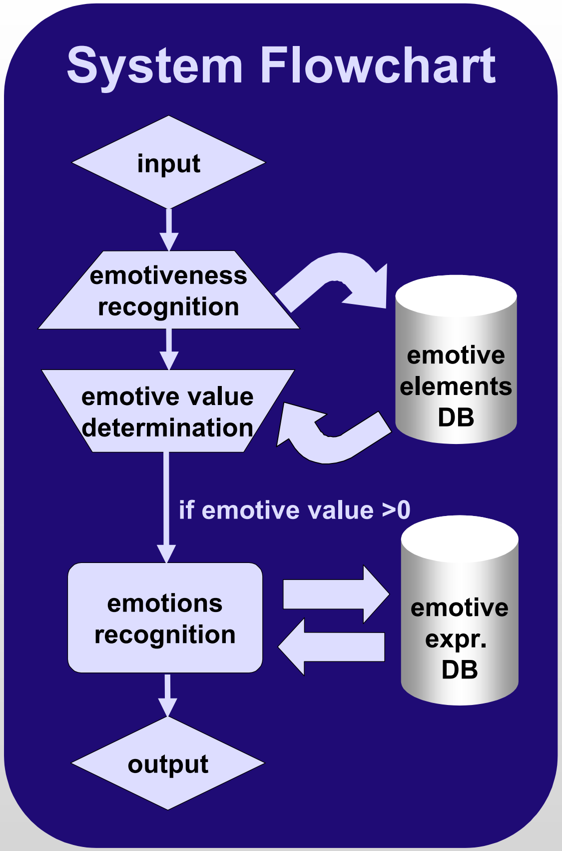


H. Schlosberg. "The description of facial expressions in terms of two dimensions." Journal of Experimental Psychology, 44:229-237. 1952.

James A. Russell. "A circumplex model of affect." Journal of Personality and Social Psychology, 39(6):1161-1178. 1980.

ML-Ask – how it works?





Conversational Agents

Definition

Conversational agent –
communication technology that utilize natural language and computational linguistic techniques to engage users in human-like Web-based "dialogs."

Application in: business enterprises, education, government, healthcare, entertainment, etc.

Conversational Agents

Agents for experiment

Modalin. A non-task oriented keyword-based conversational agent, which uses modality to enhance Web-based propositions for dialogue.

Pundalin. A non-task oriented conversational agent created on the base of Modalin combined with pun generating system. Pundalin therefore is a humor-equipped conversational agent using puns to enhance the communication with a user.

- Shinsuke Higuchi, Rafal Rzepka, and Kenji Araki. "Web wo riyoshita renso tango oyobi modarithi-hyougen ni yoru zatsudan shisutemu [Chat system based on modality expressions and association words extracted form the Web] (in Japanese)." *Proceedings of The 14th Annual Meeting of The Association for NLP*:175-178. 2008.
- Pawel Dybala, Michal Ptaszynski, Rafal Rzepka, and Kenji Araki. "Extracting Dajare Candidates from the Web - Japanese Puns Generating System as a Part of Humor Processing Research." *Proceedings of International Workshops on Laughter in Interaction and Body Movement (LIBM'08)*: 46-51. 2008.

Survey

Particular questions about performance

(5-point scale with explanations):

A) Do you want to continue the dialogue?;
B) Was the agent's talk grammatically natural?;
C) Was the agent's talk semantically natural?;
D) Was the agent's vocabulary rich?;
E) Did you get an impression that the agent possesses any knowledge?;
F) Did you get an impression that the agent was human-like?;
G) Do you think the agent tried to make the dialogue more funny and interesting?;
H) Did you find agent's talk interesting and funny?;

Survey

Mapping the particular questions on affect analysis

- B-D: how high did the users evaluate agents' talking abilities;
- A, E-F: how much could the users familiarize with agents
- A, G-H: how much could the users get involved emotionally in the conversation.

→particular questions ⇒ OPINIONS ABOUT PERFORMANCE

Survey

Summarizing question about attitude

"Which agent do you think was better?"

Mapping the summarizing question on affect analysis

- The general summarizing question = <u>POSITIVE / NEGATIVE ATTITUDES</u>

Survey vs. ML-Ask results

Particular questions about performance vs number of emotive utterances

Survey: Pundalin received higher scores in detailed questions.

Affect Analysis: The users were more emotionally involved in the conversations with Pundalin.

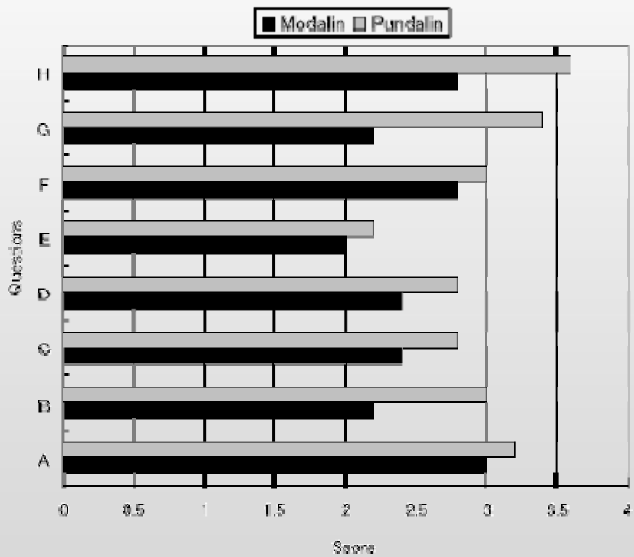


Fig. 4. User's evaluation - results for Modalin and Pundalin for detailed questions (see 5.2.1.). Answers were given in a 5-point scale.

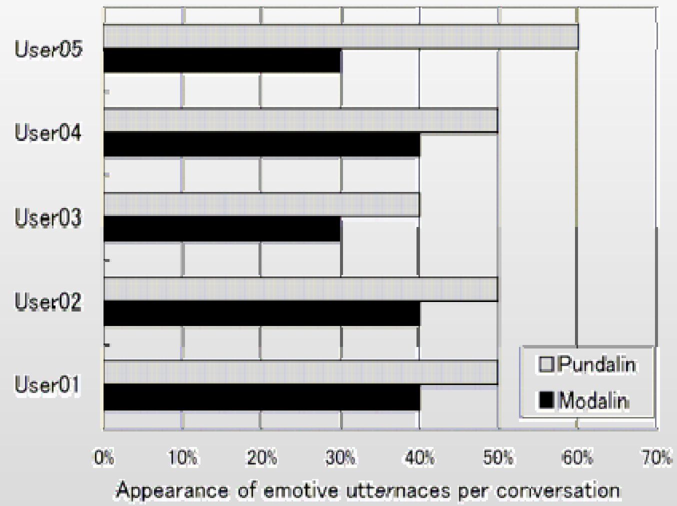


Fig. 5. Percentage of average appearance of emotively engaged utterances for all five users in conversations with both agents.

Survey vs. ML-Ask results

Summarizing question about attitude

Survey: 4 out of 5 users (80%) evaluated Pundalin (humor-equipped agent) as better than Modalin.

Affect analysis: The users' general attitudes to Pundalin were in 80% positive whereas to Modalin the attitudes of the users were only negative.

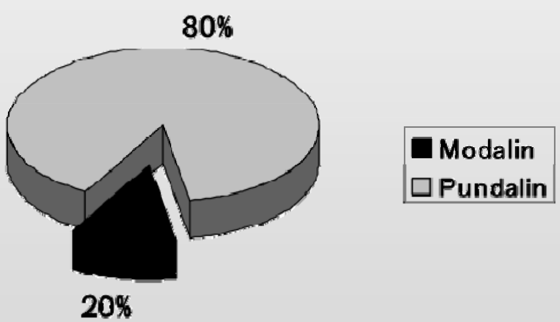


Fig. 3. User's evaluation-results for the question "Which agent do you think was better?"

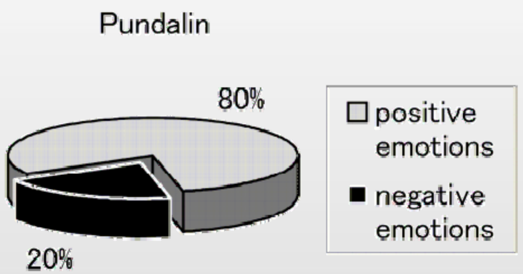


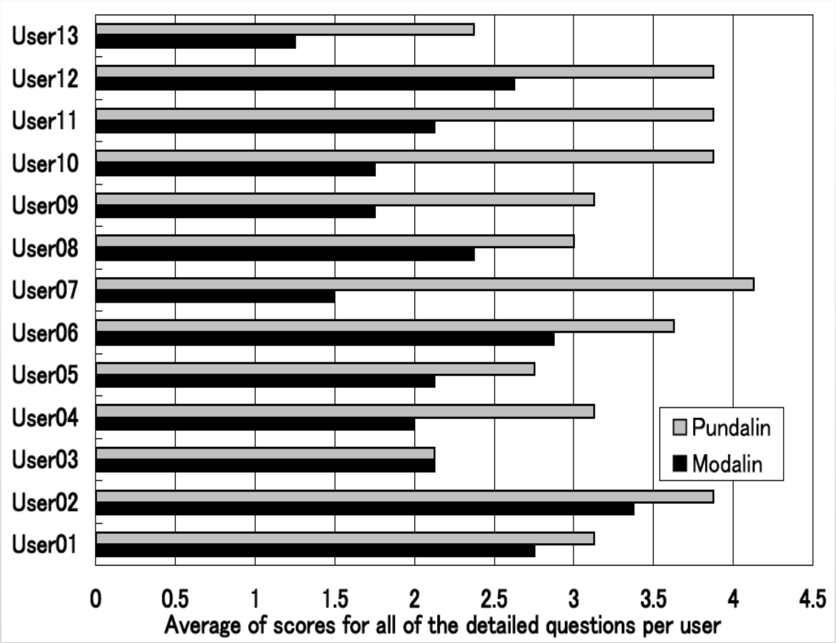
Fig. 7. The total relation of emotions positive to negative conveyed in the utterances of users with Pundalin.

Fig. 6. The total relation of emotions positive to negative conveyed in the utterances of users with Modalin.

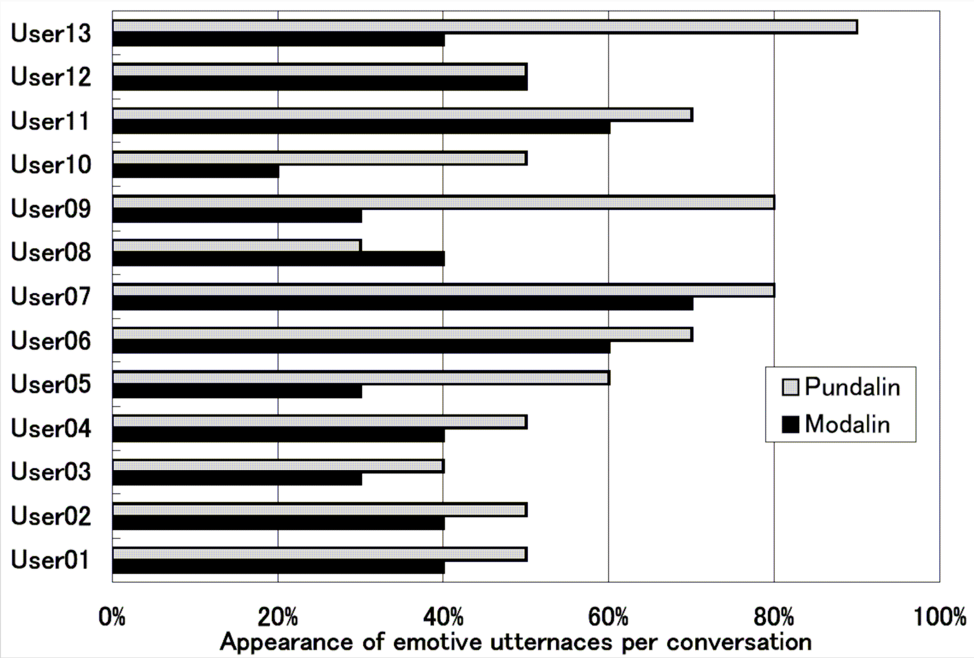
Survey vs. ML-Ask results – 8 more evaluators!

Particular questions about performance vs number of emotive utterances

The same tendencies…



User's evaluation – results for Modalin and Pundalin for detailed questions per user (see 5.2.1.). Answers were given in a 5-point scale.



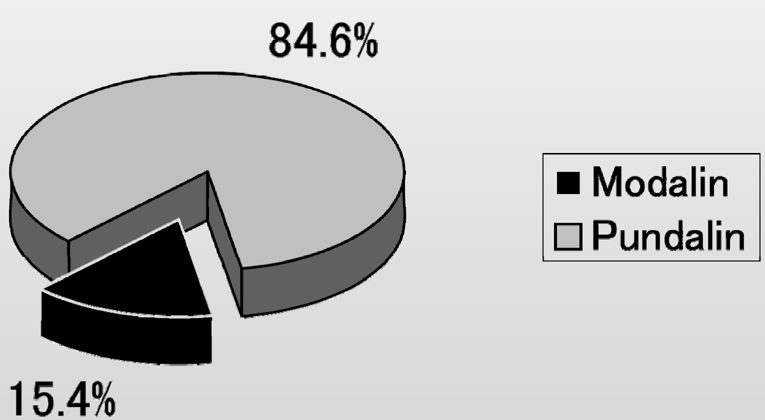
Percentage of average appearance of emotively engaged utterances for all 13 users in conversations with both agents.

Survey vs. ML-Ask results – 8 more evaluators!

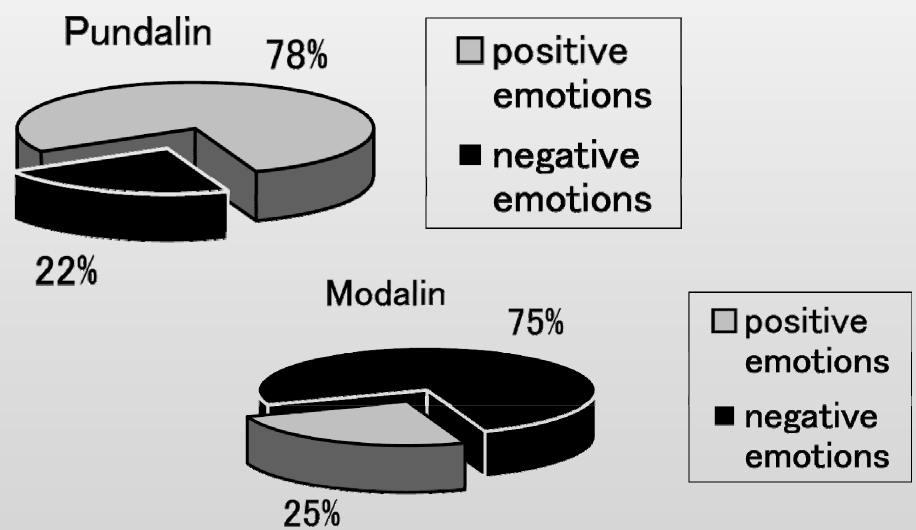
Summarizing question about attitude

Survey: 11 out of 13 users (84.6%) evaluated Pundalin (humor-equipped agent) as better than Modalin.

Affect analysis: The users' general attitudes to Pundalin were in 78% positive (see Fig. 7.) whereas to Modalin the attitudes of the users were mostly (75%) negative (see Fig. 6.).



User's evaluation–results for the question "Which agent do you think was better?"



The total relation of emotions positive to negative conveyed in the utterances of users with Modalin and Pundalin.

Conclusions

- There have been seen similar tendencies in the results acquired by affect analysis and the results of the survey.
- The proposed method is non-invasive and can provide objective information on user's sentiment about machine-interlocutor.
- Provide hints for the agent about the potential undesirable changes in the user's attitudes and the need for appropriate counteractions, during an everyday use.

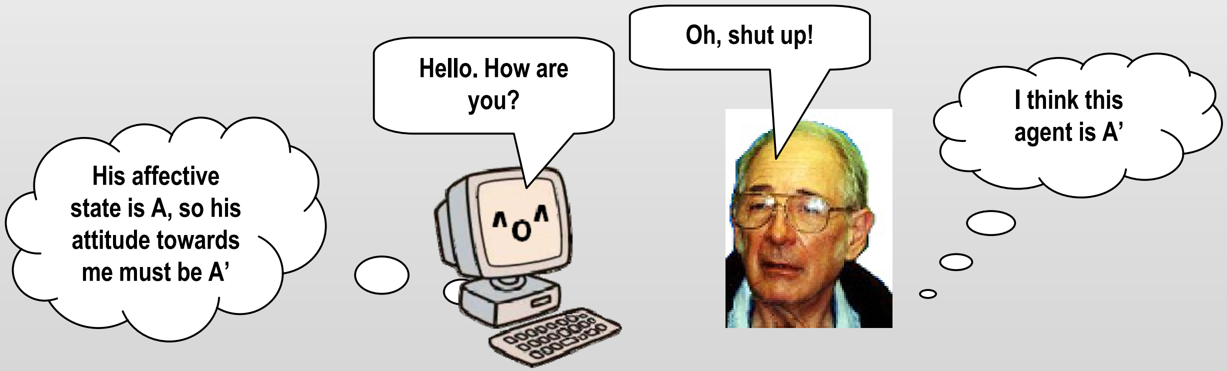
- As an evaluative mean of agents performance, the method saves time, effort and funds spend each time on preparing and performing laborious surveys.

Affect as Information

"People use affect as information as a criterion, by applying the informational value of their affective reactions to form their judgments, attitudes and opinions."

If we know <u>affective states</u> of a user during his conversation with an agent, we can derive from it a reasoning about <u>their judgments during filling in the survey</u> (=attitudes/sentiment to the interlocutor).

Experiment provided proof for the theory



- Schwarz, N., and Clore, G. L. "Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states." *Journal of Personality and Social Psychology*, 45: 513–523. 1983.

Impact on Ambient Intelligence

Fast evaluation of a product (conversational agent)

Language → Semantics → fill the lacks of information provided by sensors

Analysis of textual layer:

	textual data	voice and visual data
gathering	easy	laborious
available data	many corpora plus Web	only prepared for the needs of researches
processing	fast	slow and heavy
semantics	OK.!	NO!

Future work

- Increase number of users/evaluators
- Specify the mapping of questions vs. affect analysis
- Try different agents
- Find universalities (now – 2 or more agents are compared – how to make it appropriate for 1 agent evaluation?)
- Improve tools (affect analysis system – still not perfect)