



# A Virtual Diary Companion

**Anton Nijholt, Ferdi Meijerink and  
Peter-Paul van Maanen**



## HMI Research & Projects

- About 45 people, including 10 staff members, 20 PhD students, post-docs, secretaries, manager, etc.
- FP6: NoE Humaine, NoE Intuition, AMI/AMIDA, MESH, MediaCampaign, COST Action 2102
- FP7: Semaine, PuppyIR, SERA, NoE SSPnet, MetaVerse
- Dutch projects on Multimedia, Bio-Informatics, HCI & Crisis Management, Visualization, Games, and BCI for Games

## 'Understanding' or 'Listening' Behavior

- Previous Research
  - Behavior of Friends (AMAAS, 2003)
  - Quit Smoking Coaching (Persuasive Computing, 2006)
  - HUMAINE/SAL Research (2006-2007)
  - AMIDA Research (2007-2009)
  - SEMAINE Research (2008-2010)
  - Chat Bots that Joke (Portofino, 2007)
  - Now: Empathic Diary Companion (Bellagio,2008)

3/25

## Quit Smoking Coach (Analysis)<sup>†</sup>

Meta-discursive



Performative



Alphabet and  
Lexicon of Eyes  
(Poggi &  
Pelachaud)

Meta-cognitive



Affirmative



Affective



<sup>†</sup>First International Conference on Persuasive Technology for Human Well-being, 2006

4/25

## Quit Smoking Coach (Analysis)

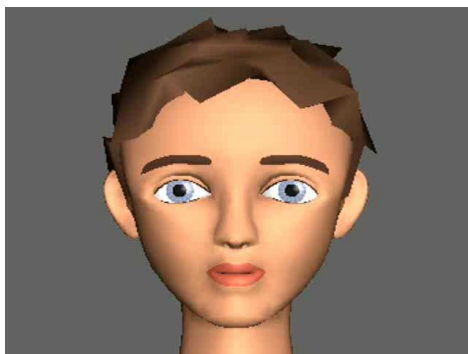
- Conversational techniques
  - Reflection of content, emotion and conflict
  - Active listening ('humming')
  - Techniques to decrease resistance
  - Posing open-ended questions
  - Summarizing
  - Provoking

### Prosody

- Low speed and volume of speech to create possibility to take the floor
- Empathy with lots of intonation and lowering of pitch
- During resistance higher speed and lowering of pitch

5/25

## HUMAINE RESEARCH

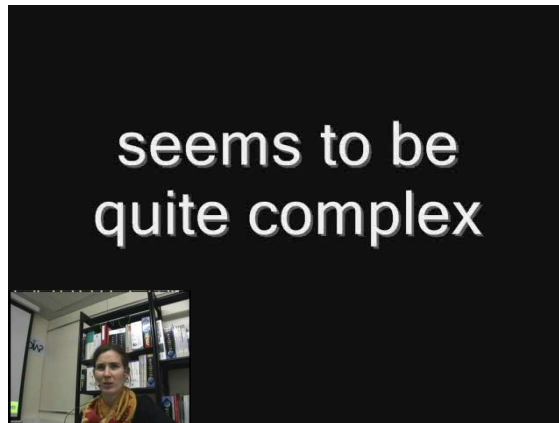


### 'Fake' Interaction

- study face-to-face conversation
- derive 'listening' rules
- 'hardware' them in an existing conversation where the ECA replaces the human conversational partner

6/25

## AMIDA/HUMAINE/SEMAINE



7/25

## AMIDA/HUMAINE/SEMAINE

1	Small blink. Eyelids slightly squeezed, head turns down, gaze constant at viewer
2	Head tilt to the right, downwards and gaze aversion. Head moves back, look at viewer.
3	Blink. Raise of left eye-brow (fast/high). Blink.
4	Eyes slightly squeezed (whole duration). Eyebrow contraction. Mild head tilt.
5	Head moves down slightly, slowly. Eyebrows raised. Eyes turned upwards. Gaze away.
6	Similar to 5 but head tilted to the left as well. More blinks.
7	Two firm nods and eyeblink
8	Two firm nods and eyebrow raising, several eye blinks.
9	Two nods, several blinks. Eyelids squeezed at start. Mouth corner raised.
10	Fast shakes. Frown. Lips pressed together.
11	Frown. Lips pressed together
12	Shakes (as in 10)
13	Shakes and frown.
14	Head tilt to the left. Frown.
15	Head tilt to the right and raised eyebrows.

accept agree angry astounded attentive believe bored compassionate  
 considering disagree disappointed disbelieve disdain disgust dislike  
 distrust doubt encourage helpless interested like meaningless not  
 interested oh no not again pity pondering refuse sad sorrow surprised  
 thinking thoughtful uncertain understand unhappy worried not  
 understand

8/25

## SEMAINE (recently started)



Build a SAL that

- Performs listening behaviour
- Motivates the user to continue speaking
- Has 4 different personalities which try to get the user into their emotional quadrant

UT-HMI

- Dialogue Management



Cheerful



Pragmatic



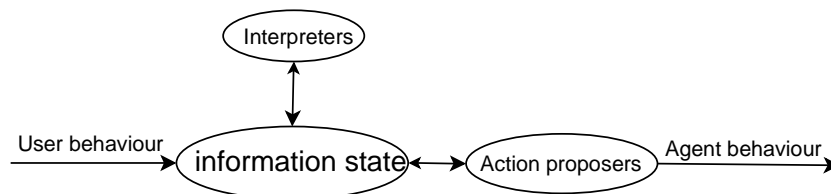
Sad



Angry

9/25

## Semaine – Dialogue management (UT-HMI)



The dialogue management has 2 main functions: interpreting the behaviour of the user, and proposing behaviour for the Virtual Human to perform

The interpreters try to find the intention behind the user behaviour

For example, gazing to the listener can mean:

- Ask for feedback
- Give the speaking turn to the other person

The action proposers determine what the virtual human does, for example:

- Give feedback to the speaker (for example nod or say 'uhuh')
- Take the turn and say something

10/25

## SEMAINE Issues (UT-HMI)

- Interpretation of user behaviour
  - The intention of certain behaviour is not always clear. The context of that behaviour should also be considered, and then it is still difficult to interpret the user behaviour correctly
- Timings
  - Feedback signals and turn management requires very specific timing or their effect will be lost.
  - Utterance selection: The chosen utterance has to fit the context, it has to motivate the user to keep on speaking and it has to elicit an emotional reaction from the user (preferably from the same emotional quadrant as the current personality)
- Utterance selection:
  - Fits the context
  - Motivates the user to keep speaking
  - Has to elicit emotions

11/25

## Virtual (Diary) Companion

TNO Defense & Security  
University of Twente, HMI

## Goals and Context (1)



### Motivation

- Military crew exposed to great stressors
- Emotion expression has a positive effect on physical and psychological health (Pennebaker)  
Family support or psychic help not available
- Agent as a substitute: Conversational agent for emotional disclosure

### Virtual Conversational Agent

- meant to evoke disclosure of emotions and traumatic events for soldiers on peace keeping missions or astronauts on enduring space missions



13/25

## ELIZA (1966)

**You:** I've had a terrible day

**Eliza:** Please go on.

**You:** First we were under attack

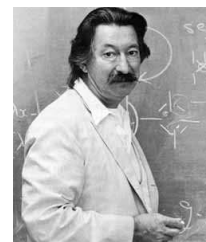
**Eliza:** Please go on.

**You:** Then our vehicle struck a landmine

**Eliza:** Please go on.

**You:** Then my friend got killed

**Eliza:** Why do you say your friend got killed?



14/25

## ALICE



*Human: I've had a terrible day*

*ALICE: What happened to it?*

*Human: First we were under attack*

*ALICE: And then what happened? And second?*

*Human: Then our vehicle struck a landmine*

*ALICE: Fascinating. It would be nice if our vehicle struck a landmine.*

*Human: Then my friend got killed*

*ALICE: Good reasoning. How well do you know this person*

15/25

## Some Related Work

- A.C. Boucouvalas. Real Time Text-to-Emotion Engine for Expressive Internet Communications. International Symposium on CSNDDSP 2002.
- H. Liu, H. Lieberman, & T. Selker. A Model of Textual Affect Sensing using Real-World Knowledge. Proceedings Intelligent User Interfaces 2003.
- M. Al Masum Shaikh, H. Prendinger, & M. Ishizuka. An Analytical Approach to Assess Sentiment of Text. Proceedings ICCIT 2007.
- M. Al Masum Shaikh, H. Prendinger & M. Ishizuka. Linguistic Interpretation of Emotions for Affect Sensing from Text. Proceedings IJCNLP 2008.

16/25

## Time Schedule

- Phase 1: Inventory of off-the-shelf available application
- Phase 2: Development of a demo application
- Phase 3: Evaluation of the demo application
- Phase 4: Demonstration to army people

Available period: Six months (!)

Not Perfect? Not necessarily a problem

## Requirements (thoughts)

The diary companion should

- should provide emotional support
- should reflect the conversational behavior of the user
- should have a conversational interface
- should satisfy expectations of the user
- should adapt to the user
- (should win (and keep) the trust of the user)
- (should build a relationship with the user)

## Build Prototype that Satisfies (maybe in some primitive sense) most of these Requirements

Embodiment, Talkativity, Emotion Model?

- No embodiment: distracts, expectations
- Listening rather than reacting at every user utterance
- Use simple emotion model to start with and to make problems explicit
- Modular Design that allows the implementation of different emotion models, user models, feedback models, ...

19/25

## Goals and Context (2)



### Motivation

- Military crew exposed to great stressors
- Emotion expression has a positive effect on physical and psychological health (Pennebaker)
- Family support or psychic help not available
- Diaries as a substitute: Diary companion for emotional disclosure

### Virtual Diary Companion

- meant to evoke disclosure of emotions and traumatic events for soldiers on peace keeping missions or astronauts on enduring space missions



20/25

## Processing User Input

- User types in text in a text area. He is free to type whatever comes to mind and cannot be interrupted by the system. The system communicates with the user in a separate window.
- The system monitors the text area continuously. Input is pre-processed into complete sentences. 'Part of Speech' processing is applied.
- Emotional content is extracted from the words using WordNet Affect. Using information available in the user model, the affective state of the user is calculated.

21/25

## Processing Affect

- Only nouns, adjectives, verbs, and adverbs are checked for emotional content in WordNet Affect. Tokens are scored for the number of references they have to the positive, neutral or negative emotion category .
- E.g., 'happy' has three references to a positive emotion category: 'contentment', 'euphoria', and 'happiness'. No negative and neutral references. Vector [3,0,0] will be associated with the token.
- Affective state associated with the sentence: Sum of vectors associated with tokens in the sentence.
- The current affective state is updated after every processed sentence. For updating the state smoothing functions are used. Some thresholds in the emotion detection are user-dependent and based on the performance of the system they are updated.

22/25

## Providing Feedback

- Feedback in a separate text field, adjacent to the diary area. Feedback consists of emotional support and reflections of the user (i.e. confirmation of correctly interpreted input).
- Information from the stored discourse and the user model is used to determine feedback moments. In the feedback process decisions are made whether or not to encourage a user to disclose more of his feelings, to ask the user whether he is (still) content with the amount of feedback provided.
- In order to be sure that the system is on the right track with the particular user confirmative questions can be generated regarding the detected emotions. The answers are assessed and the parameters of the emotion detection mechanism are adapted accordingly.

23/25

## Evaluation

- Until now:
  - 4 test persons
  - 15 minutes use
  - take the role of a very optimistic or a very pessimistic person
- Good performance, but
  - not a natural situation
  - subjects exaggerated their roles
  - too much repetition in the template feedback

24/25



## Conclusions

### RESULT

- Eliza-like, but different (encouragement based on affective content)

### POSITIVE

- Full implementation achieved
- Useful for making problems explicit

### IMPROVE

- More linguistic analysis (but, ...)
- Add domain knowledge to WordNet and WordNet-Affect
- Need of 'cause retrieval'
- Better feedback