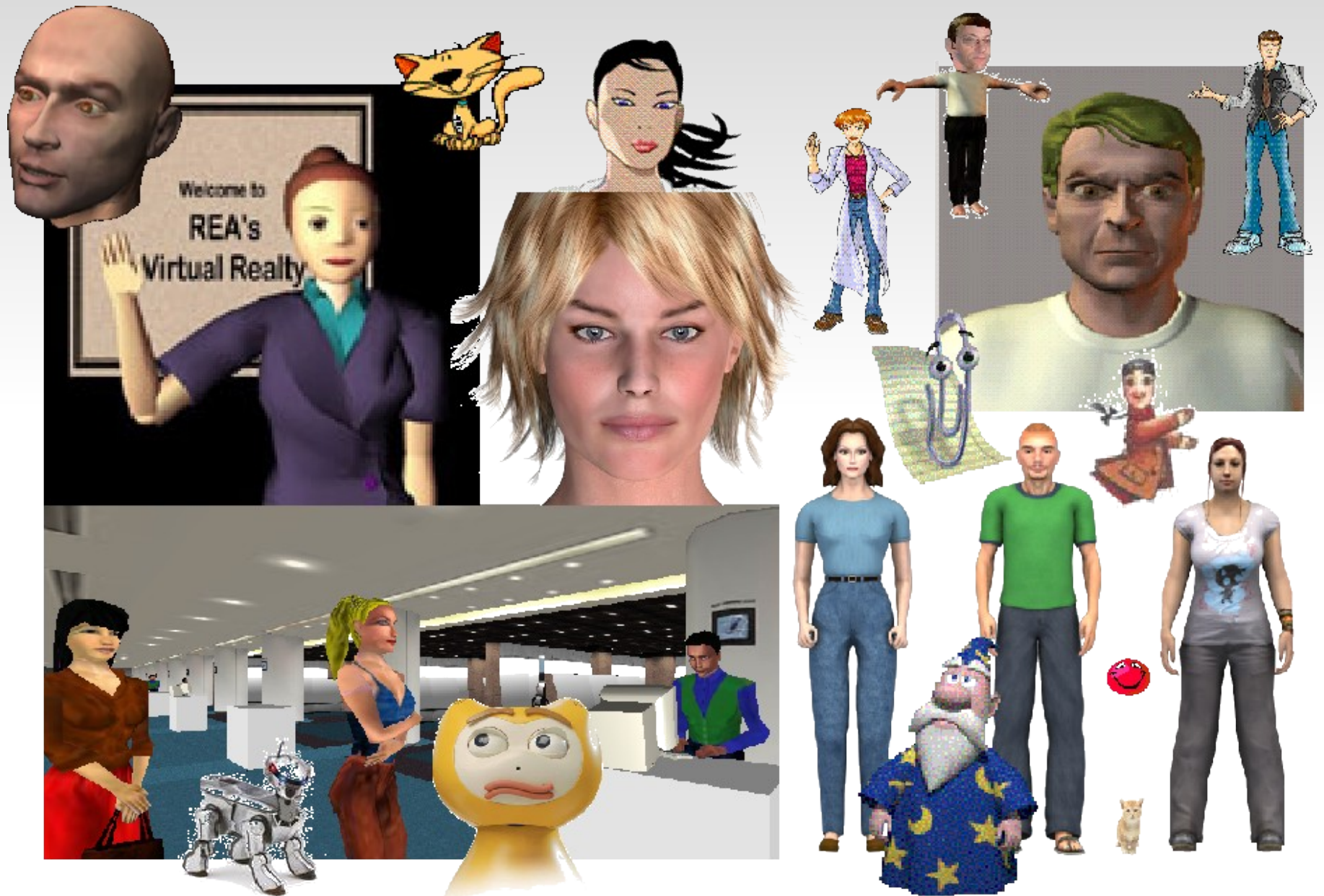


## Embodied Conversational Agents

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# Introduction



# French working group ACAI

## Bienvenue sur le site du GT ACAI

Le groupe de travail "Affects, Compagnons Artificiels et Interactions" (ACAI) de l'AFIA a été créé en 2012. Son objectif est de regrouper les activités en France autour de l'informatique affective et de l'interaction avec des compagnons artificiels. Il se situe dans la continuité du [groupe de travail ACA](#) créé initialement au sein du GdR I3 du CNRS.

Depuis le 1er janvier 2015, le GT ACAI est aussi un "Local Interest Group" (LIG-France) de l'association AAAC (ex-Humaine).

Ses principales actions sont :

- La diffusion d'information à travers la liste [acai@poleia.lip6.fr](mailto:acai@poleia.lip6.fr) (220 membres en juillet 2018)
  - Pour vous abonner, vous pouvez envoyer un email à [Nicolas.Sabouret@limsi.fr](mailto:Nicolas.Sabouret@limsi.fr)
- L'organisation de journées de travail :
  - La journée du [22 novembre 2011](#) à Paris - Informatique Affective, Agents Conversationnels Animés et Robots
  - La journée du [6 avril 2012](#) à Paris - Affects, Compagnons Artificiels et Interactions
  - La journée du [7 juin 2013](#) à Paris - Affects, Compagnons Artificiels et Interactions
  - La journée du [17 juin 2015](#) à Paris - Affects, Compagnons Artificiels et Interactions
  - La journée du [28 juin 2017](#) à Paris - Affects, Compagnons Artificiels et Interactions
- L'organisation de la conférence WACAI (qui prend la suite des conférences WACA) :
  - [WACA 2005](#) Premier Workshop ACA, 13-14 juin 2005, Grenoble.
  - [WACA 2006](#) Deuxième Workshop ACA, 26 et 27 octobre 2006, Toulouse.
  - [WACA 2008](#) Troisième Workshop ACA, 28 novembre 2008, Paris.
  - [WACA 2010](#) Quatrième Workshop ACA, 25-26 novembre 2010, Lille.
  - [WACAI 2012](#) Cinquième Workshop ACAI, 15-16 novembre 2012, Grenoble. Les articles sont [disponibles ici](#).
  - [WACAI 2014](#) Sixième Workshop ACAI, 1-2 juillet 2014, Rouen. Les articles sont [disponibles ici](#).
  - [WACAI 2016](#) Septième Workshop ACAI, 13-14 juin 2016, Brest, au cours de laquelle nous avons animé une [table ronde sur les thématiques ACAI](#). Les articles sont [disponibles ici](#).
  - [WACAI 2018](#) Huitième Workshop ACAI, 13-15 juin 2018, Porquerolles. Les articles sont [disponibles ici](#).
- La participation à des journées communes avec d'autres GDR :
  - Journée commune au GT 5 du GDR Robotique et au GT ACAI [6 décembre 2017](#) à Paris.
- La publication de travaux scientifiques de la communauté :
  - Après le numéro spécial édité en 2011, la revue TSI a publié en 2012 un nouveau numéro spécial sur le thème du GT: [Agents Conversationnels Animés et Informatique Affective](#) (numéro 31, volume 4).
  - En 2014, la revue RIA a édité un numéro spécial ACAI basé sur les meilleurs articles de la conférence WACAI 2012 (volume 28/1). 5 articles de la conférence y sont publiés.
  - En 2017, la revue RIA a édité un numéro spécial ACAI basé sur les meilleurs articles de la conférence WACAI 2016 (volume 31/5). 4 articles de la conférence y sont publiés.

Vous trouverez [ici](#) les transparents de présentation du GT ACAI à l'assemblée générale du GDR I3 du 4 décembre 2012.

## Voir aussi

- [Présentation des objectifs scientifiques du GT](#)
- [Les quatre axes thématiques du GT](#)
- [Organisation du GT](#)
- [Principales équipes impliquées \(en France\)](#)

# GT ACAI

- 2004: GT ACA (ECA)
- 2012: GT ACAI
  - GDR I3, SMA from AFIA
  - Affects, Artificial Companions and Interaction
- 2015: Local Interest Group (LIG-France) of AAAC (ex-Humaine association)
- Thematic meetings
  - Corpus
  - Virtual agents
  - Affective computing
  - ....
- From 50 to 100 people

# GT ACAI

- Workshop WACA 2005, 2006, 2008, 2010
  - Chatbots, dialogical agents
  - Assistant agents
  - Virtual agents
  - Emotions
- WACAI: Affects, Artificial Companions and Interaction
  - 2012 in Grenoble, 2014 in Rouen, 2016 in Brest, 2018 in Porquerolles
- Web Site: <http://acai.lip6.fr/>
  - GT ACA: <http://www.limsi.fr/aca/>
- Mailing list: [acai@poleia.lip6.fr](mailto:acai@poleia.lip6.fr)



# Definitions

**ECA:** "Embodied Conversational Agent"

**IVA:** "Intelligent Virtual Agent"

**Agent**

**Rational  
Proactivity**

**Perception**  
(awareness)

**Decision**  
(rationality, AI)

**Expression**  
(affects)

**Conversational**

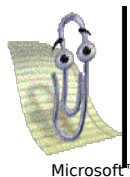
**Multimodal  
Social interaction**

**Multimodality**

- Graphic User Interface (GUI)  
- Natural Language Processing (NLP)  
...

**Embodied**

**Personification  
Situated**



Microsoft™

**Icons**



Agents La  
Cantoche™

**Virtual  
Characters**



Aibot  
Sony™

**Robots**

# Roles of ECAs

ECAs are “**Interactive Virtual Characters**” that are **situated** in mediated (often distributed) environments.

They can play four main roles:

- Assistants** to welcome **users** and to assist them in understanding and using the structure and the functioning of applications
- Tutors** for **students** in human-learning mediated environments, or for **patients** in psychological/pathological monitoring systems
- Partners** for **actors** in virtual environments: partner or adversary in a game, participant in creative design groups, member of a mixed-initiative community, ...
- Companions** as a friend in a long term relationship

# Categories of ECAs

GRETA (Pélachaud LTCI)



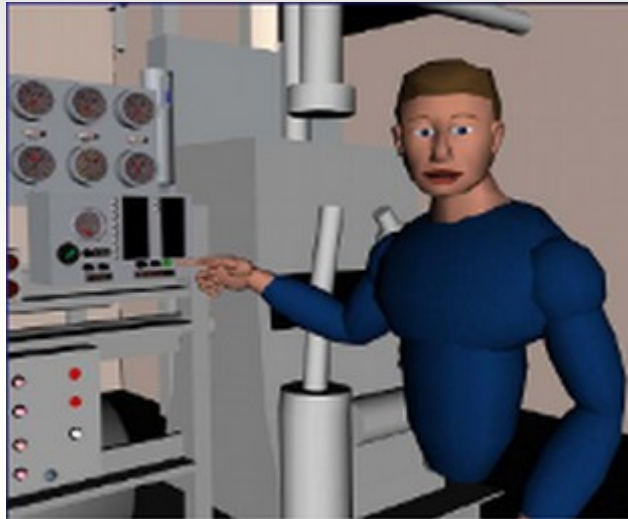
## Talking heads

Fixed - Realistic

Expressions - LipSynch

Emotions

STEVE (Rickel et al USC)



## Gestural Agents

Fixes/floating - moving arms

Dialogue - Deictic - Sign language

Tutoring - Assistance

VTE (Gratch et al USC)



## Situated Agents

Complete mobile characters

Virtual/Augmented reality

Training - Action



# Deploying environments

## APPLICATIONS

Assistance



## WEB PAGES

Welcoming



## AMBIENT

Smart  
Objects



Education



Mixed  
Communities



Augmented  
Reality



# Scientific issues

## Agent modelling: interaction performance/efficiency of models

- Interaction models with users: Multi-modality, H/M Dialogue
- Models of cognitive agents: BDI logics and planning, affective logics, ...
- Task models and user models: Symbolic Representation and Reasoning

## Human modelling: ecological relevance of models

- Capture
  - Representation
  - Reproduction
  - Evaluation
  - Application
- of physiology  
of expressions  
of behaviours
- of humans
-

# Scientific communities

## Computer Science and Natural Language Processing

- Multi-Agent Systems
- Human-Machine Interaction/Interfaces
- Human-Machine Dialogue

## Humanities and Society Sciences

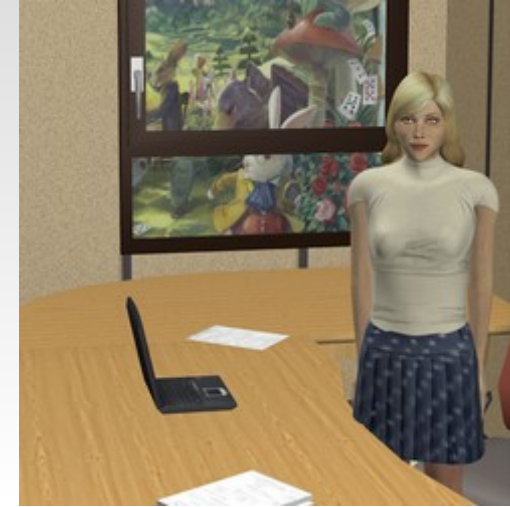
- Psychology of Language Interaction
- Ergonomic psychology

# Projects and teams

- European project SEMAINE (<http://www.semaine-project.eu/>)

- ISIR (France):

Greta



- LIMSI (France): MARC



- Bielefeld University (Germany)

- USC (USA): Virtual Human Toolkit

# Design of animated characters (ECAs or avatars)

- Independent of the embodiment level
- Non verbal behaviours (postures, gestures, ...):
  - Theoretical approach (related works)
  - Empirical approach (corpus analysis)
- Generated animations
  - From an intention (triggering action)
  - Automatically and cyclically



Evaluation



Reproduction



Corpora



```
<configuration>
  <timecode>10</timecode>
  <body>front</body>
  <head>front</head>
  <eyes>open happy</eyes>
  ... ..
</leftArm>hello</leftArm>

<rightArm>hip</rightArm>
  <speech>Hello!</speech>
</configuration>
```

Representation





# Talking heads



**Nikita by Kozaburo © 2002**

Done with Poser 5 / No  
Postwork

Model: DAZ-3D Victoria-3

Skin Texture:Mec4D

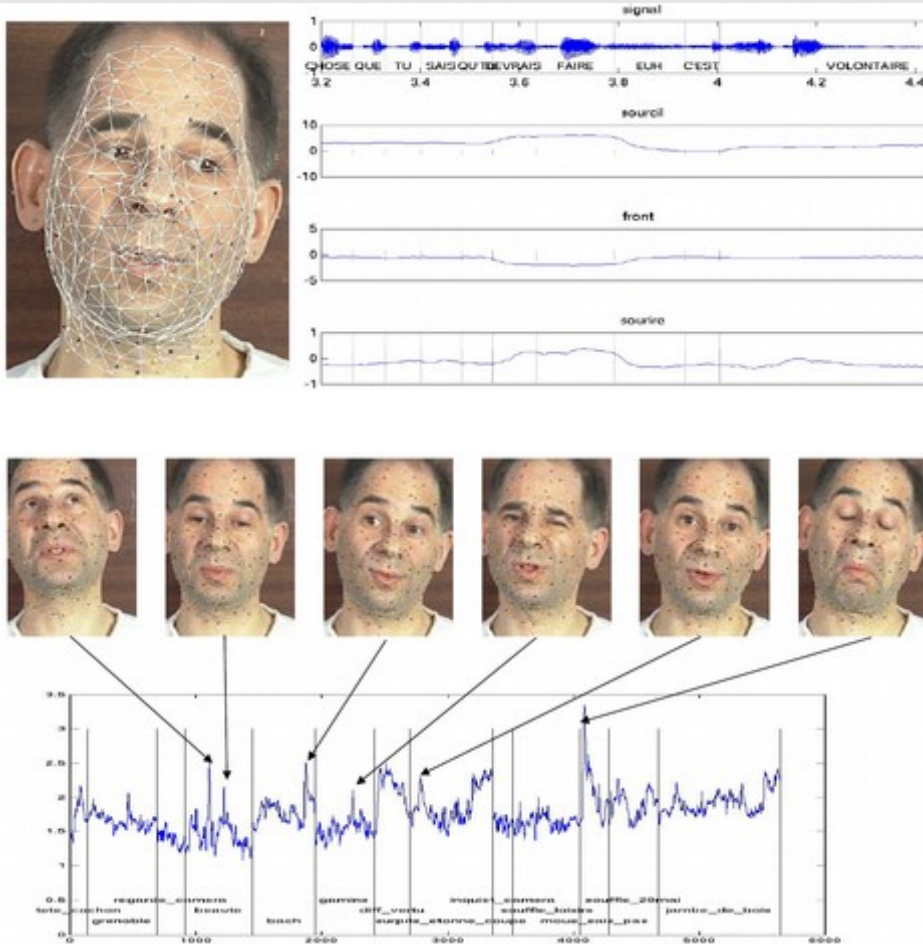
Beauty contest for Embodied Conversational agents  
[www.missdigitalworld.com](http://www.missdigitalworld.com)

# Models based on visems

- **Visem:** elementary unit of the position of the muscles of the human faces (3D model)
- Experimental settings:
  - Small red balls manually placed on the face
  - 3 to 5 cameras
  - Training corpus



# Transitions between expressions

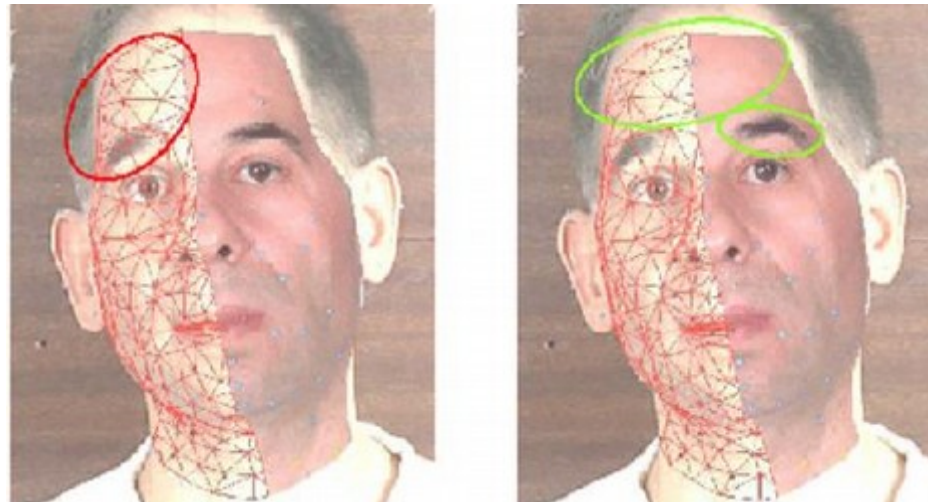


- Torsion model of the face and the neck
- The positions of the red balls are set manually
- Pattern recognition is used to monitor ball movements
- Extraction of key frames automatic and manual

G. Bailly and F. Elisey, GT ACA, 2006.03.15, <http://www.limsi.fr/aca/>

# Analysis and synthesis

- Visems + 3D model are used to (re-)generate expressions
  - 6 to 11 parameters
- Validation by comparing to real expressions



G. Bailly and F. Elisey, GT ACA, 2006.03.15, <http://www.limsi.fr/aca/>

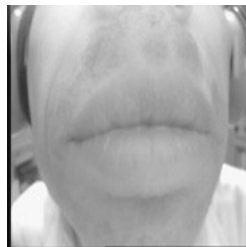
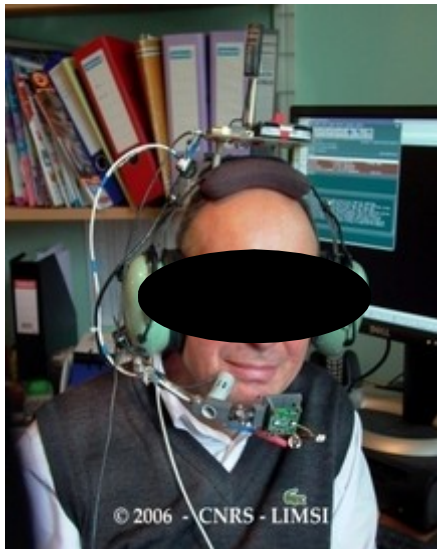


# 'Talking head' project (LIMSI)



- Based on visemes
- Video corpus of 21 utterances:

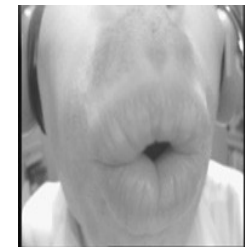
« C'est /phonem/ ici » (Ex: « C'est u ici »)



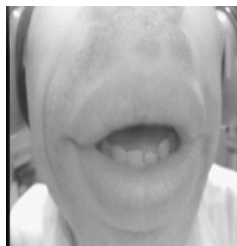
...



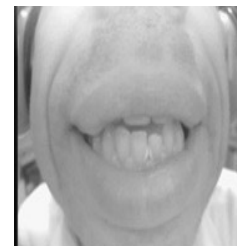
C'est



u



i



ci



...



# Realistic talking heads

Greta (Prudence, Obadiah, Poppy and Spike)  
LTCI - Telecom ParisTech



MARC  
LIMSI



# Gestural agents

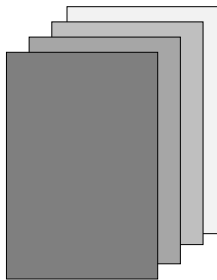


<http://marc.limsi.fr/>

# Design of realistic gestural agents and avatars



Annotated corpus of videos (ex: Anvil)



Psychological knowledge (Related works)



MARC (LIMSI)



GRETA (ISIR)



# Multimodal Social Behaviours

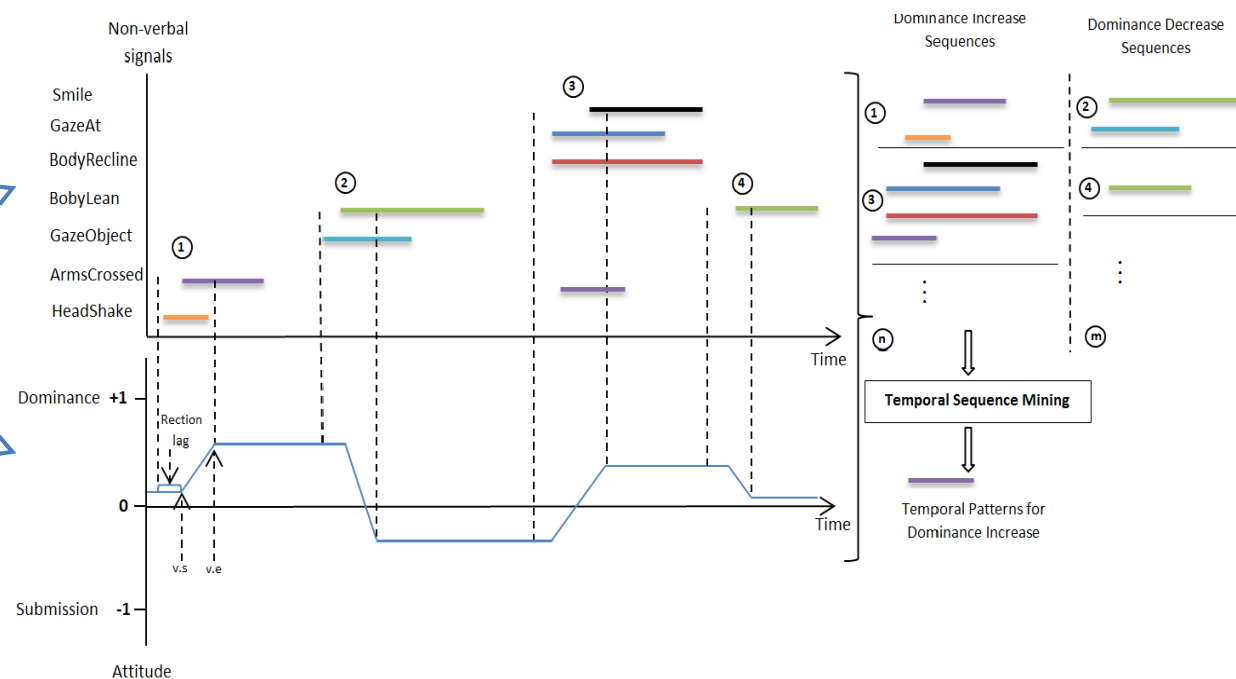
- How to capture variety and subtleness of human behaviors?
  - Build multimodal repertoire
  - Learn by imitation
- How to go beyond prototypical expressions of emotions?
- How to convey social attitudes?

# Social attitudes behaviour model

1. What are the sequences of multimodal behaviours that trigger change in social attitude perception
2. **Extraction of sequence of non-verbal signals expressing attitudes variations (increase or decrease)**



NVB  
Attitude





# Social Attitudes

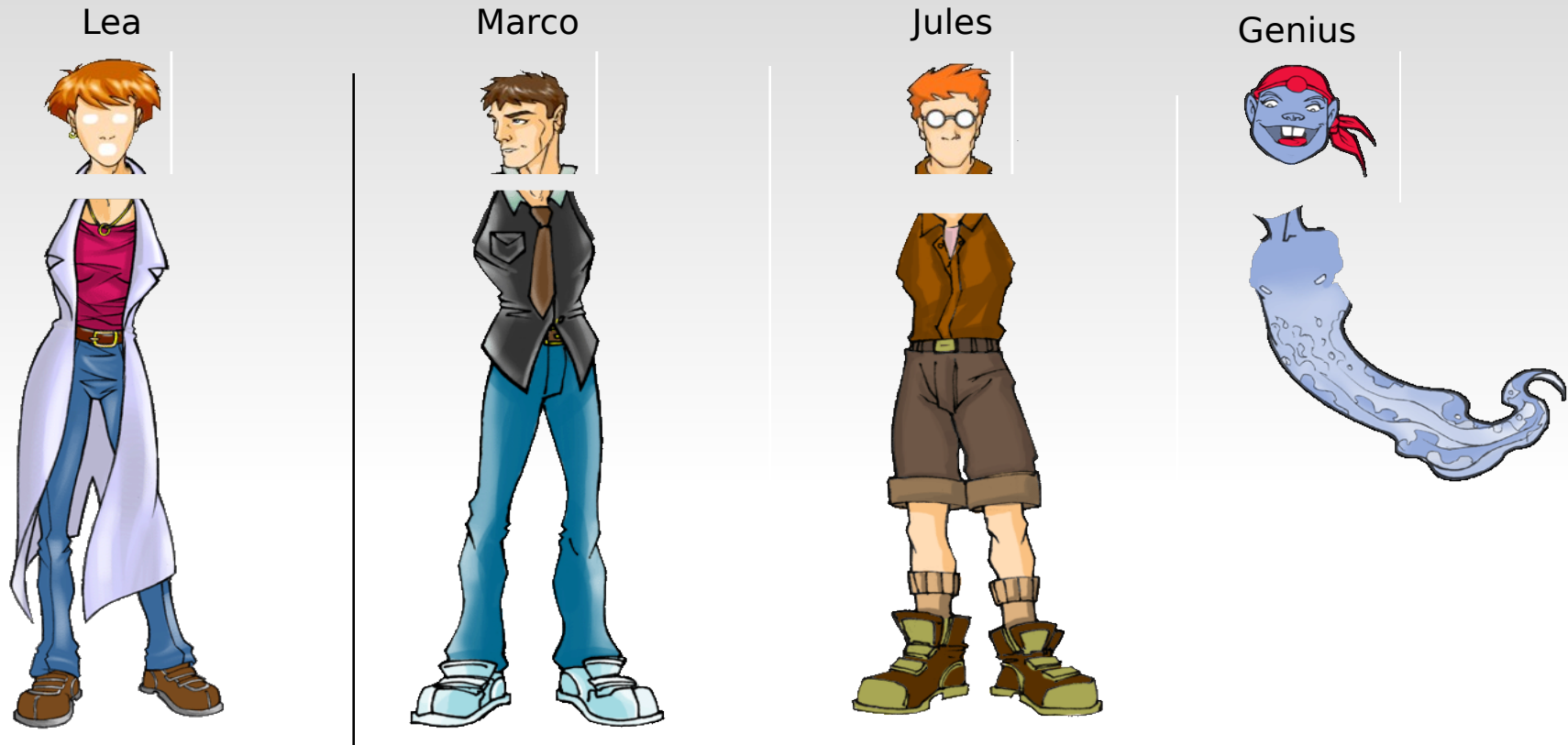
**Decrease in dominance**



**Decrease in friendliness**



# 2D cartoon agents: Lea

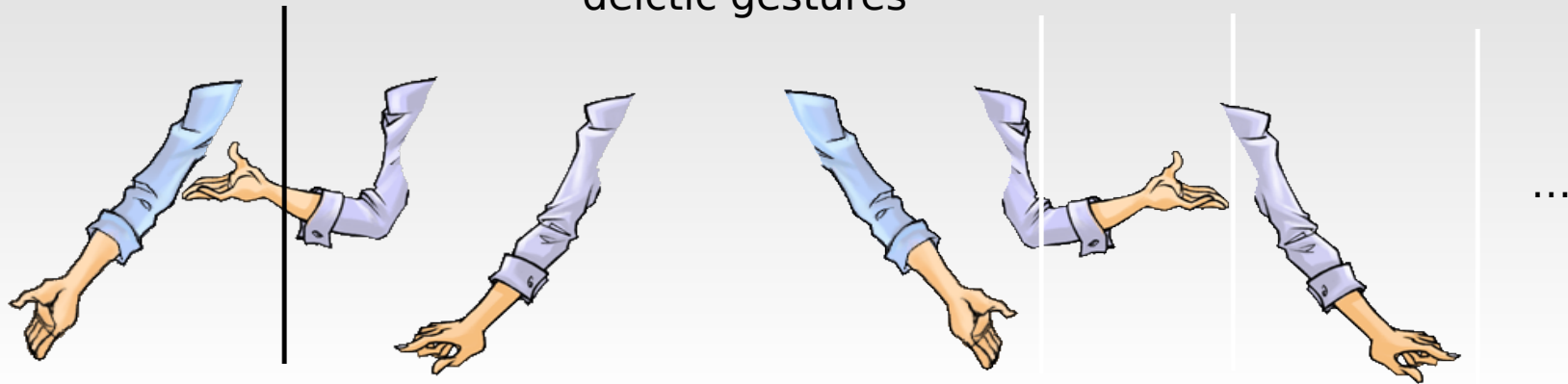


## LEA Agents (LIMSI)

- 2D cartoon characters (110 GIF files)
- Easily integrated into Java applications and JavaScript
- Description language for high-level behaviours

# Lea: gestural expressiveness

deictic gestures



iconic gestures



adapters



Emblematic gestures



transparent GIF files

# Specifying attitudes and animations in XML

```
<?xml version='1.0' encoding='utf-8'?>
```

```
<configurationsequence nbrconfig="1">
```

```
<configuration>
```

```
<timecode>10</timecode>
```

```
<body>front</body>
```

```
<head>front</head>
```

```
<eyes>open happy</eyes>
```

```
<gaze>middle</gaze>
```

```
<facialExpression>close  
</facialExpression>
```

```
<bothArms>null</bothArms>
```

```
<leftArm>hello</leftArm>
```

```
<rightArm>hip</rightArm>
```

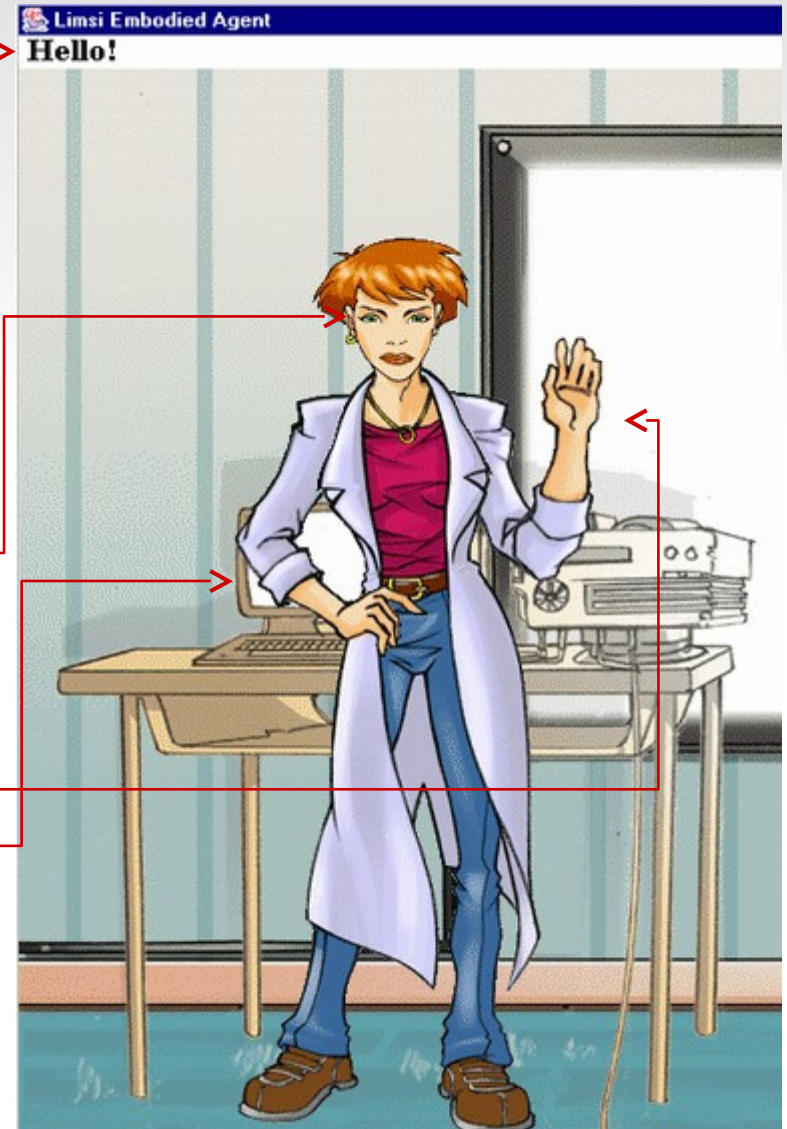
```
<speech>Hello!</speech>
```

```
</configuration>
```

```
</configurationsequence>
```

Number of configurations = attitudes

An attitude





# Dynamic Deictic

The screenshot shows the WebLea application running in a Windows Internet Explorer browser. The browser address bar displays the URL: <http://www.limsi.fr/~jps/online/weblea/leaexamples/leawebsite/index.html>. The application interface includes a navigation menu with links such as "Movie Editor", "Rule Editor", "WebLea Characters", "Quick Help", "About WebLea", "Static Deictic", "Dynamic Deictic", "Chat Room", "Coco", "Hanot", "Kitty", and "LIMSI Tour".

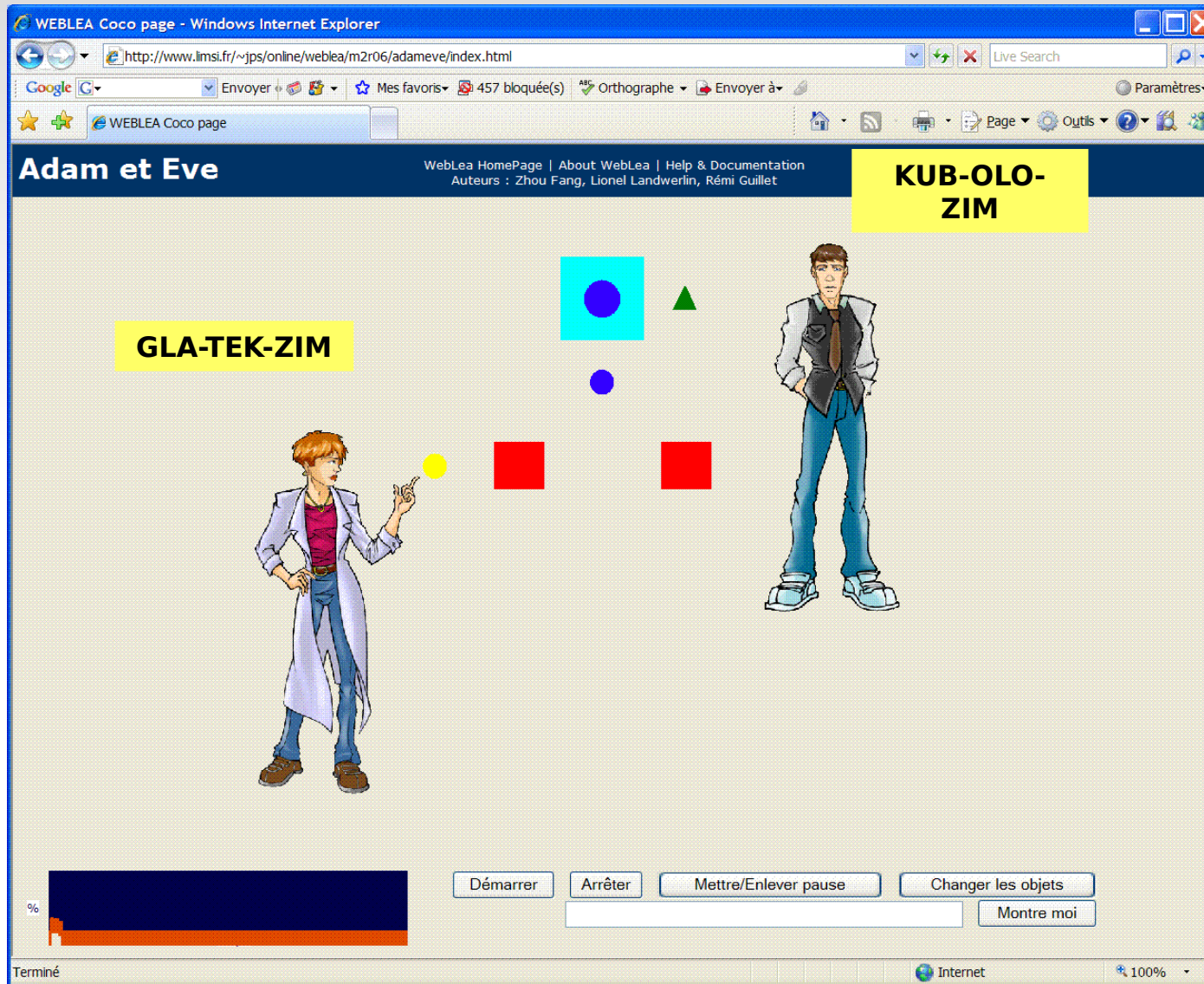
The main content area features a large grid of data with a character pointing to a specific cell. A yellow text box above the character reads: "This is the cell at line 134 and column 27." A blue circle highlights the cell being pointed to. The grid contains numerical data and text labels, including "hiver" and "stable".

At the bottom of the application, there is a chat window with the text "Hello, How are you?" and a "Send" button. Other controls include a volume slider set to 100, a "STAND" dropdown menu, a "LEA" dropdown menu, a "100%" zoom level, and "Hide" and "Debug" buttons. The status bar at the bottom indicates "Terminé" and "Internet".

Table : Frédéric Vernier LIMSI-CNRS

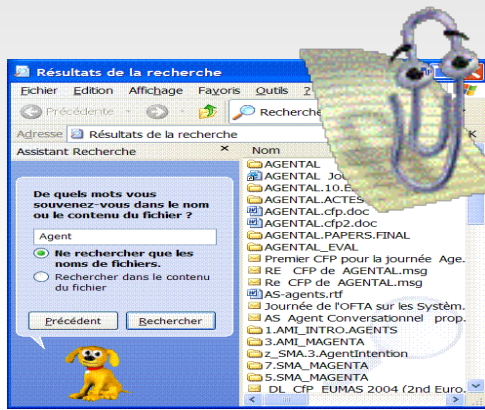


# Designation of DOM objects



# Deploying environments

## APPLICATIONS



## WEB PAGES



## AMBIENT



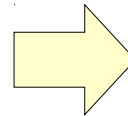
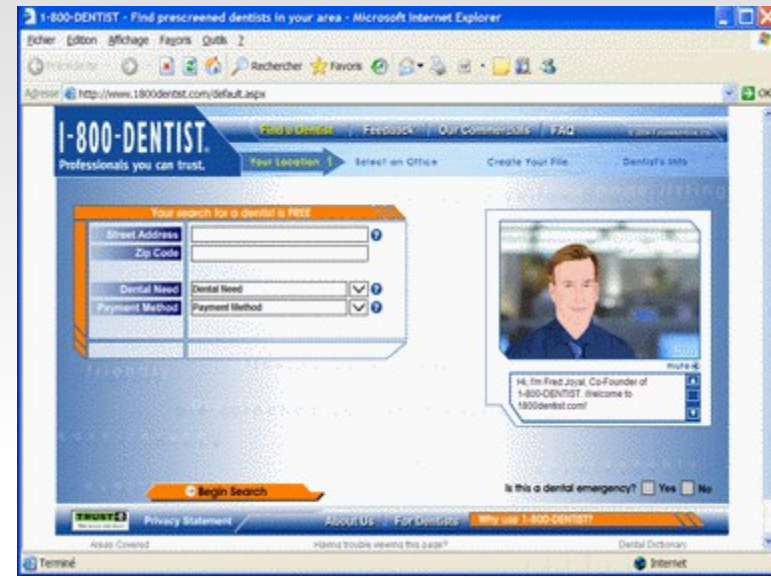
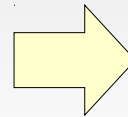
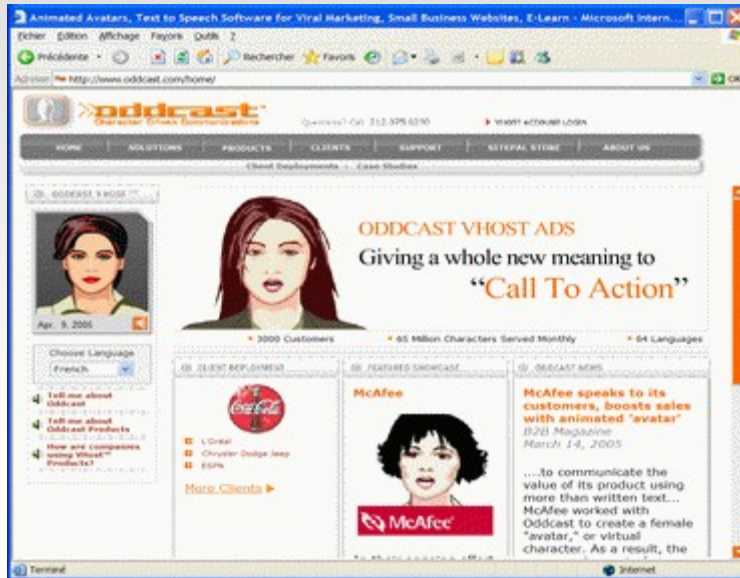
# Chat bots in the Internet

- Chat bot = “chatterbox” + “robot”
- A program capable of NL dialogue
  - Usually key-word spotting
  - No dialogue session or context
- No embodiment
- Goals: only chat



ELIZA (J. Weizenbaum,1965)

# Assistant agents (application/web)





# Web Assistant Agents

Avec **Léa**, trouvez facilement le billet de train qu'il vous faut !

**Nouveau !**  
**Léa**, votre conseillère virtuelle, devient également votre **hôtesse de réservation**.

Je vous trouve le billet de train qu'il vous faut !

**Comment ça marche ?**

- > Via une **messagerie instantanée**, indiquez vos souhaits à Léa, elle cherche pour vous !
- > Choisissez le billet de train qui vous convient parmi la **proposition personnalisée de Léa...** vous gagnez du temps !
- > Une demande ?  
Dialoguez avec Léa, **elle vous guide** dans votre recherche.

Je trouve mon billet avec Léa !

**Laura**, ma conseillère virtuelle

Pour profiter de mes conseils, posez-moi votre question ci-dessous :

Laura, ma conseillère virtuelle

ma conseillère virtuelle

OK

Besoin d'aide ?

**Laurent**  
votre **conseiller**

comment m'abonner OK

**accès membre**

identifiant

mot de passe

[mon mot de passe oublié](#)

devenir membre pour gérer votre compte, suivre vos données et bénéficier des services personnalisés



LA POSTE

Bonjour, je suis le caporal Dupont. En quoi puis-je vous aider ?

Posez votre question ici ... Envoyer



Ines © Nespresso 2010



# Social avatars on the web

## Social avatars

The recent evolution of the communication over the web has prompted the development of so-called “avatars” which are graphical entities dedicated to the mediating process between humans in distributed virtual environments (ex: the “meeting services”)

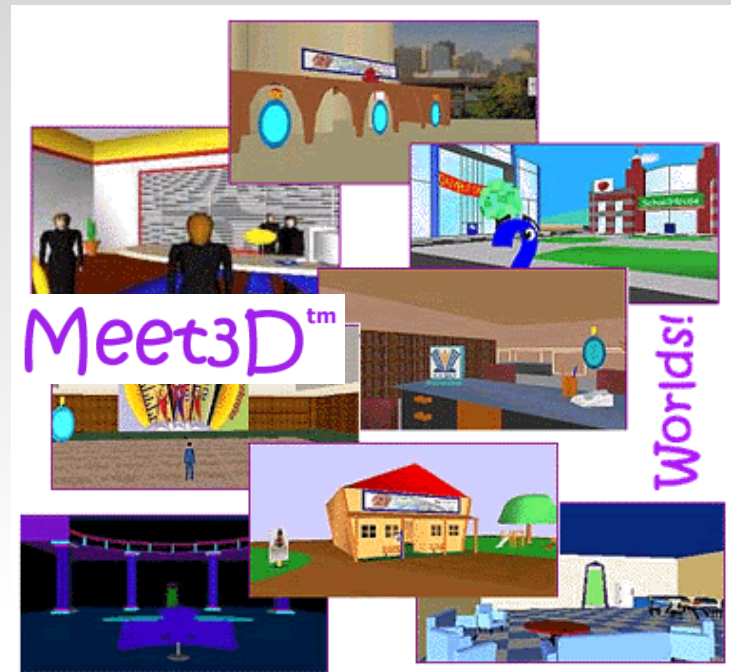
Contrary to an ECA which is the personification of a computer program (an artificial agent) an avatar is the personification of a real human who controls the avatar.

*(Avatar = Mask) ≠ Agent*

## Second life

Presented as a « metaverse » by its developer, Linden Lab, Second Life is a web-based virtual simulation of the social life of ordinary people.

**5 000 000 avatars were created  
Permanently , ~ 200 000 visitors are logged**



# Mixed communities

## Project : « Le deuxième Monde » 1997-2001

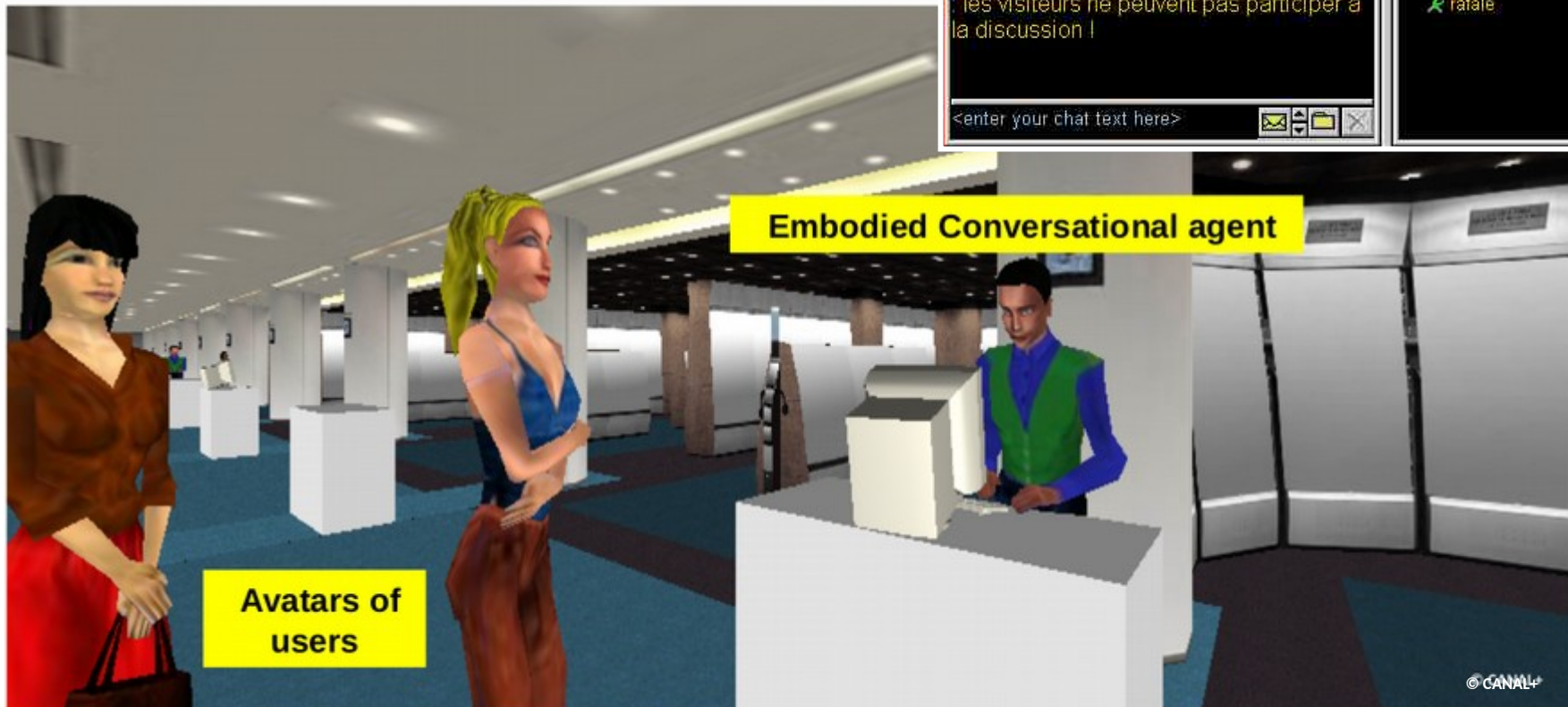
- Company: Canal +™
- Head: Sylvie Pesty (LIG – Grenoble)
- PhD: Guillaume Chicoisne (LIG – Grenoble)

## Mixed Community

- People chatting and purchasing in a Virtual World
- ECA interacting with the people



Navigation  
and chat  
interface



Avatars of  
users

Embodied Conversational agent

# Mixed communities and Heterogeneous MAS

## Metaphor: meetings

- **Definition:** computerised environments that integrates *transparently* humans and artificial agents within meetings
- **Mixed initiative communities:** brainstorm, design, decision, ...
- **Virtual Training Environments (VTE):** training, simulation, ...

## Deploying environments

- **Smart Room:** physical place with augmented reality
- **Web-based:** distributed and mediated environments

## Animated characters

- **Avatars:** virtual characters driven by humans
- **Agents:** virtual characters which embodies artificial agents

# Social interaction in virtual environments

## Mixed training environments

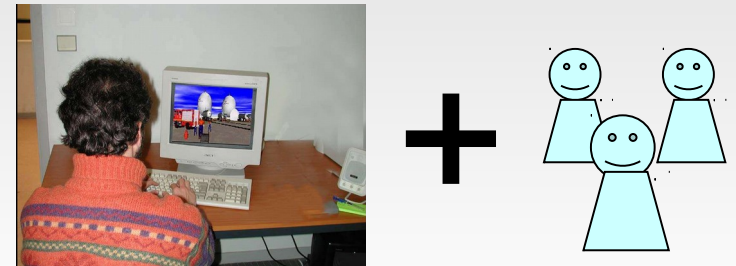
- Avatars
- ECAs

## Task: virtual firemen

- Recognition of fire
- Activity reports

## Interaction

- Emotion management
- Gestures and facial expressions
- NL dialogue management





# Realistic behaviour of agents

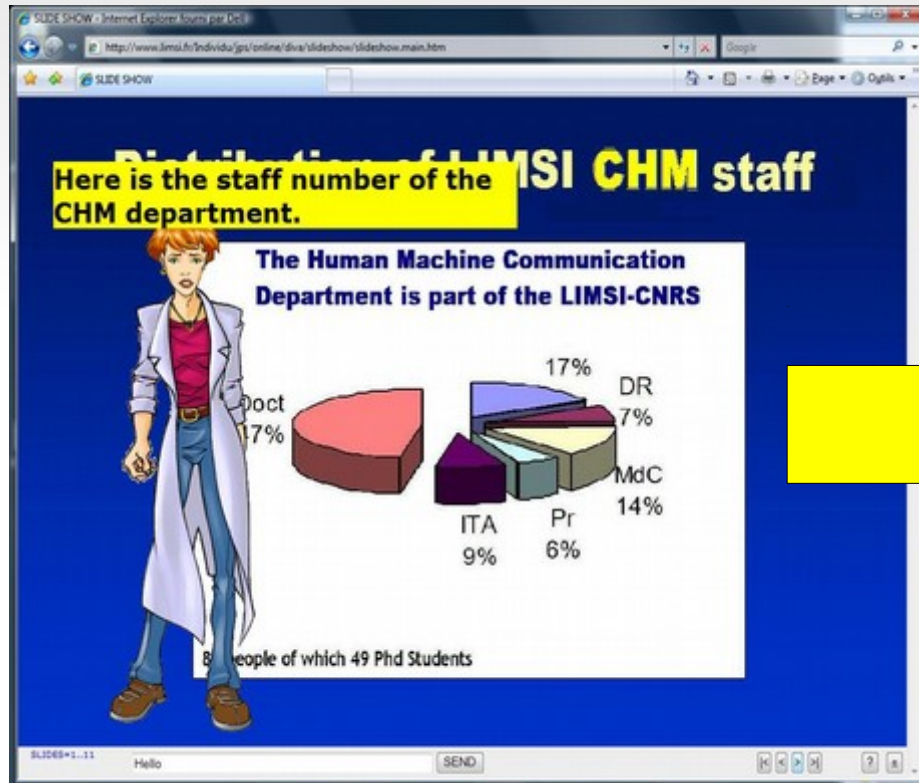
The study of videos enabled to highlight how deictic gestures and gazes towards items are used concomitantly with natural language words ("here", "it", "now", ...)





# From assistant agents to ambient environments

Application taken from the DIVA toolkit (LIMSI)



Transporting the **Function of Assistance** from stand-alone applications to room-based ambient environments

# DIVA display devices of the

HD TV Screen



Large touch Screen



Portable touch Screen

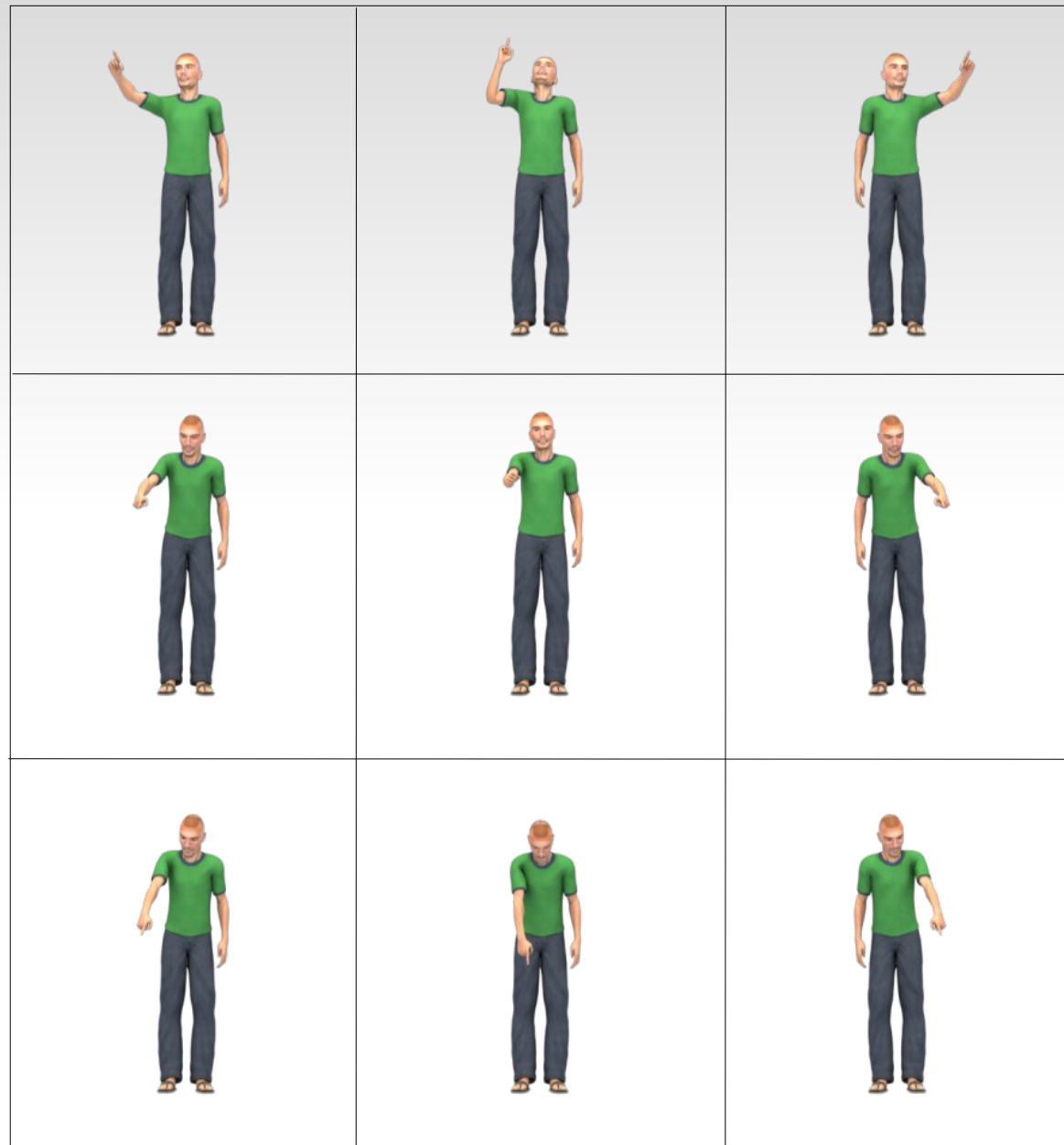


Presentation of any Internet content



Presentation of the IRoom controls

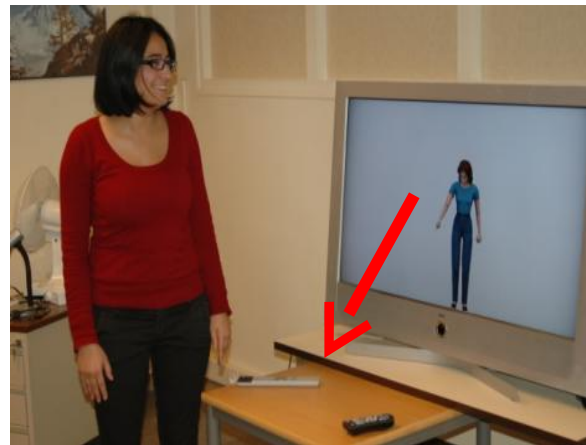
# DIVA 3D-pointing gestures



9 loci

# Pointing objects in the physical world

Body zooming for close objects

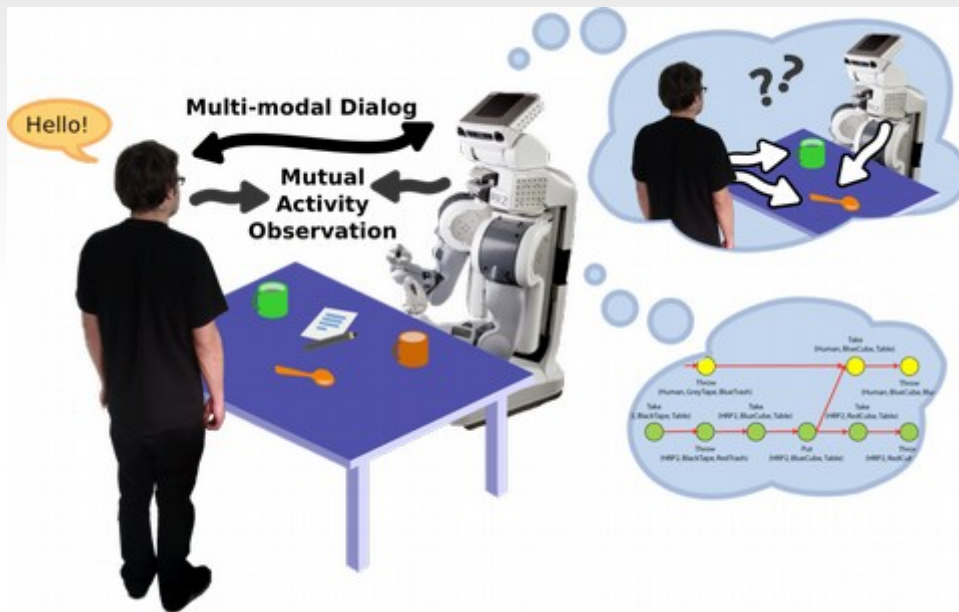


*“Which of the two remote controllers should I use?”*



# A Cognitive and collaborative robot which achieves joint activities with humans

## H&R Sharing Task and Space



## Contributions

- ① Decisional issues in Human-Robot Collaboration
- ② “Human-aware” Task and Motion Planning
- ③ Situation assessment, Theory of Mind, Perspective-Taking and affordances
- ④ Explicit consideration of Legibility, Predictability and Acceptability of Robot Behaviour

LAAS – CNRS Robotics and InteractionS (RIS) Team: Rachid Alami

<https://homepages.laas.fr/rachid/>





# Assistant agents




# Examples from professional web sites

Lucie, virtual assistant of SFR

**Lucie,  
votre assistante virtuelle**

Bonjour. Je m'appelle Lucie. Ma mission est de répondre à vos questions sur le mobile, l'ADSL et la téléphonie fixe chez SFR, 24h/24, 7j/7 !  
Posez-moi votre question !



Oui, je suis mariée. Mais arrêtons de parler de moi, je suis là pour vous aider!



→ êtes vous mariée ?



Question

ECA

EDF Site

# A cons-example: the « Clippie effect »

## Microsoft Agents™

- Free technology – no support
- Agents 2D cartoon
- Can be used on web pages
- Third part characters (LaCantoche™)
- API for JavaScript & VBScript

## Limitations

- Inputs limited to clicks and menus
- No proper dialogue model
- No application model
- No synchronization speech/movements
- Emotions = cartoon 'emotes'



The screenshot shows the Microsoft PowerPoint Help window. At the top, there is a search bar with the text "Je veux te détruire espèce d'idiot !!!!". A yellow box highlights this text with the label "Intuitive request expressed in NL". Below the search bar, a list of search results is displayed. The first result is "Récupérer un programme qui ne répond plus", which is highlighted in blue. A yellow box points to this result with the label "2 results too far ranked but quite relevant". To the right of the search results, there is a list of instructions for recovering a program that no longer responds. A yellow box highlights the first line of this list with the label "Helping text corresponding to the 1st line of result".

Microsoft PowerPoint : Aide

Sommaire Aide intuitive Index

Qu'aimeriez-vous faire ?

**Je veux te détruire espèce d'idiot !!!!**

Intuitive request expressed in NL

Récupérer un programme qui ne répond plus

2 results too far ranked but quite relevant

Helping text corresponding to the 1st line of result

Récupérer un programme qui ne répond plus

1. Dans le menu **Démarrer** de Microsoft Windows, pointez sur **Programmes**, sur **Outils Microsoft Office**, puis cliquez sur **Récupération d'applications Microsoft Office**.
2. Dans la liste **Application**, cliquez sur le programme ou le document qui ne répond pas.
3. Effectuez l'une des actions suivantes :
  - Pour tenter de récupérer des fichiers sur lesquels vous étiez en train de travailler, cliquez sur **Récupérer l'application**.
  - Si vous voulez simplement fermer le programme et perdre les dernières modifications apportées aux fichiers, cliquez sur **Fermer l'application**.
4. L'erreur à l'origine du problème peut être communiquée à Microsoft pour l'amélioration des versions à venir du programme. Cliquez sur **Envoyer le rapport d'erreurs** ou sur **Ne pas envoyer**.

# Assistant agents: definition

*« An Assistant Agent is a software tool with the capacity to resolve help requests, issuing from novice users, about the static structure and the dynamic functioning of software components or services »*

*InterViews Project - February 1999  
Following Patti Maes MIT, 1994*

<b>User</b> (novice)	person with poor knowledge about the component
<b>Request</b>	help demand in natural language (speech/text)
<b>Component</b>	computer application, web service, ambient appliance
<b>Agent</b>	rational, assistant, conversational, (can be embodied)
<b>Mediator</b>	symbolic model of the structure and the functioning

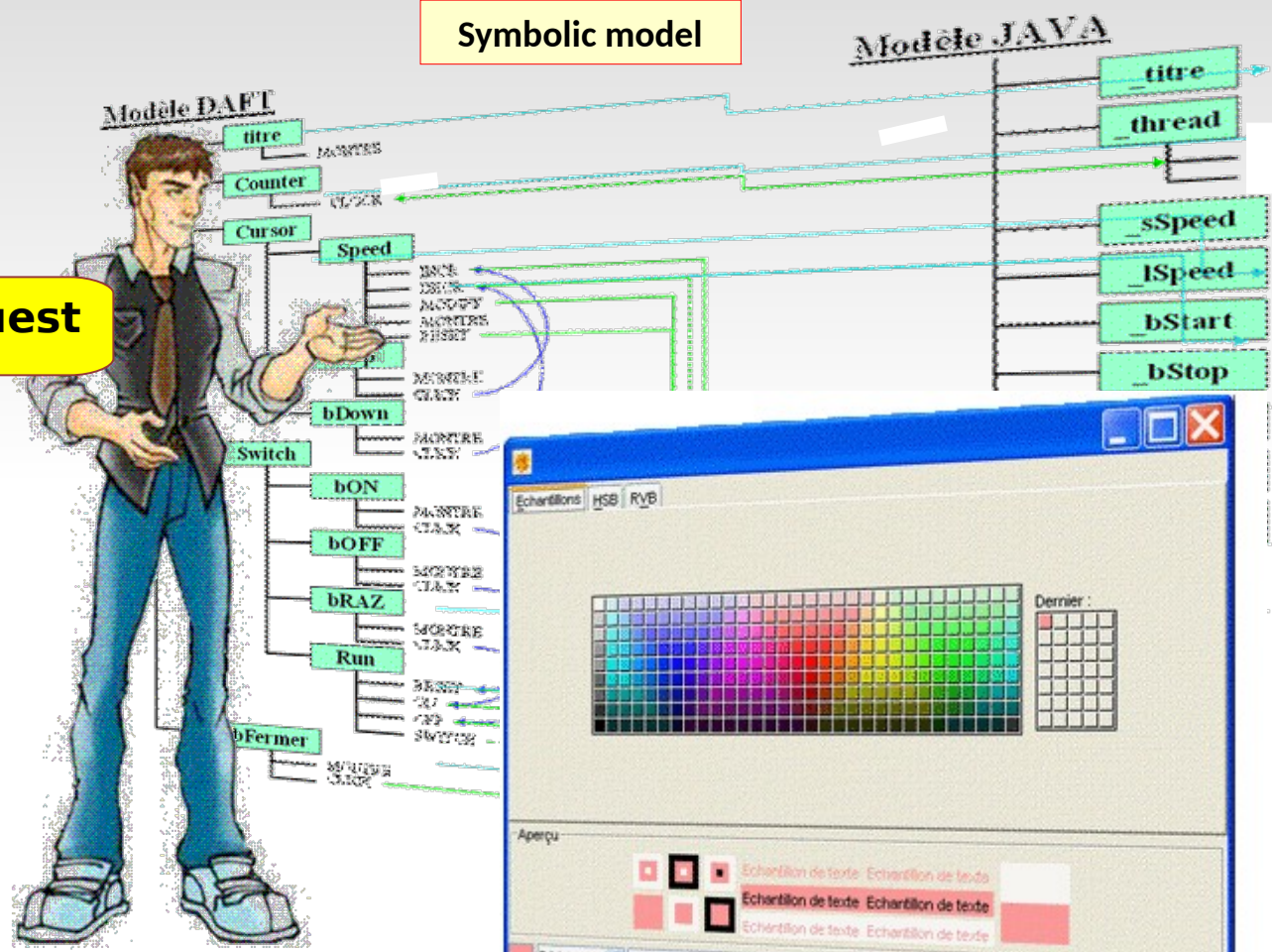


# The assistant metaphor



Novice user

Request

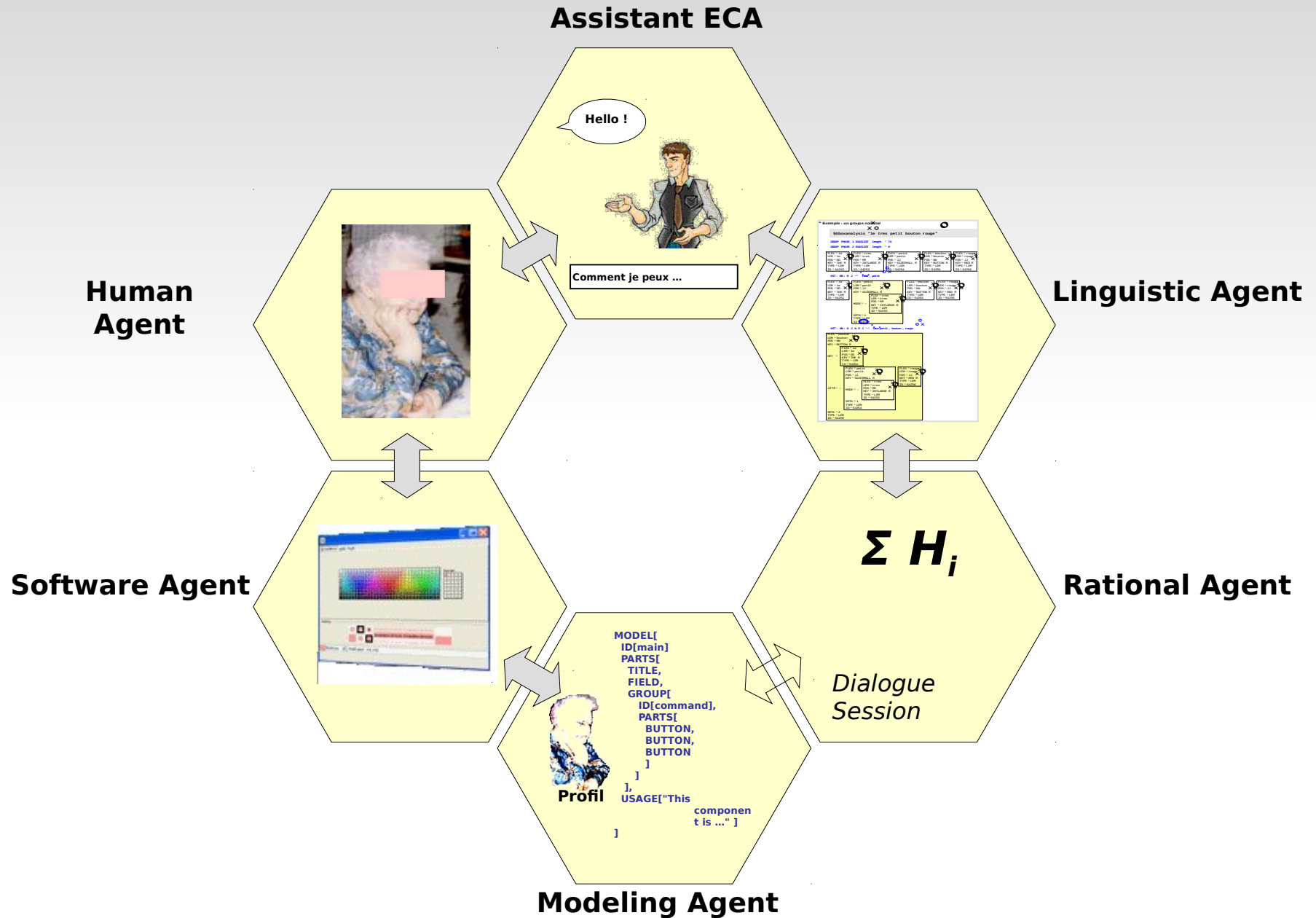


Assistant agent

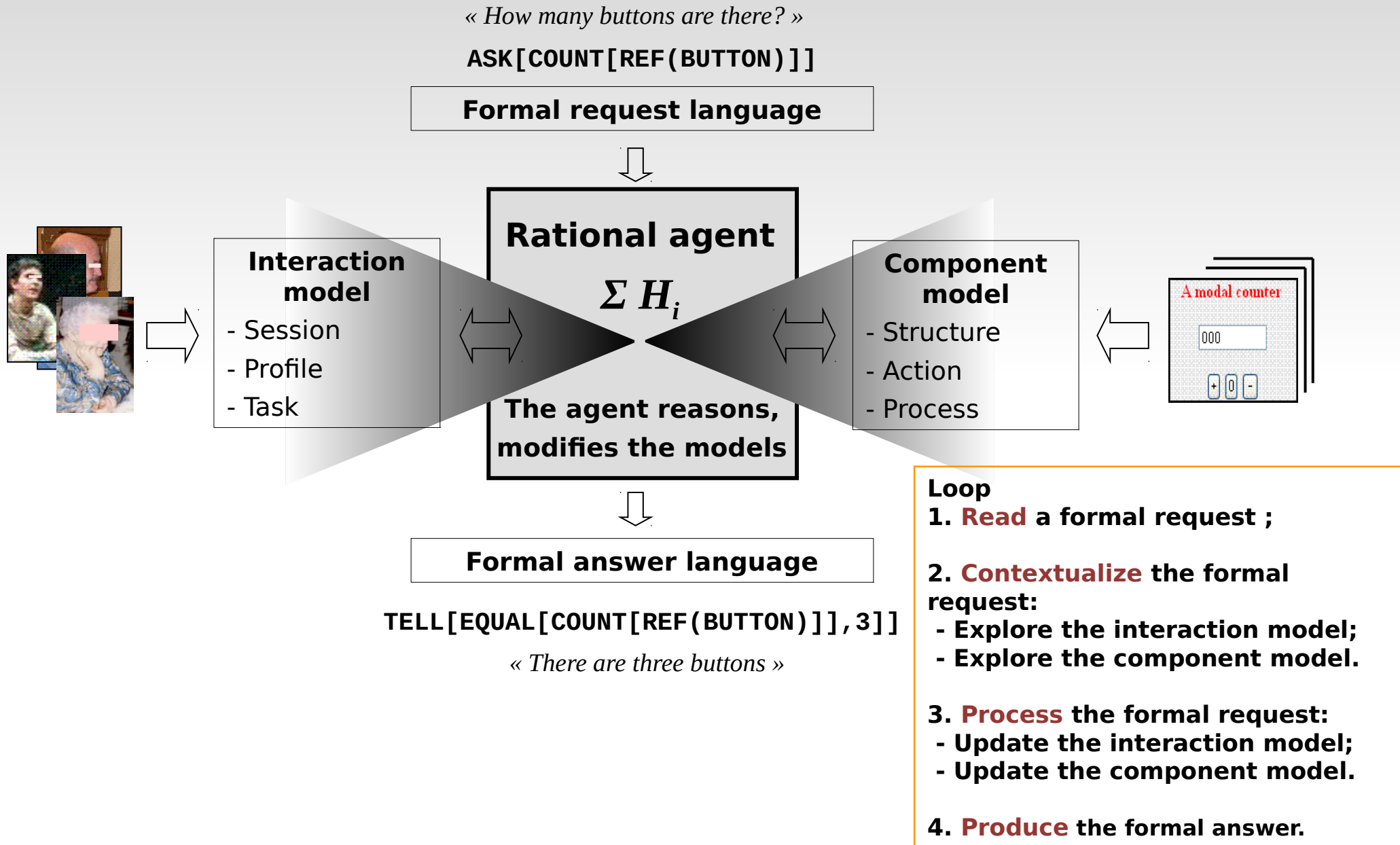
Software component



# The agents of the Daft project

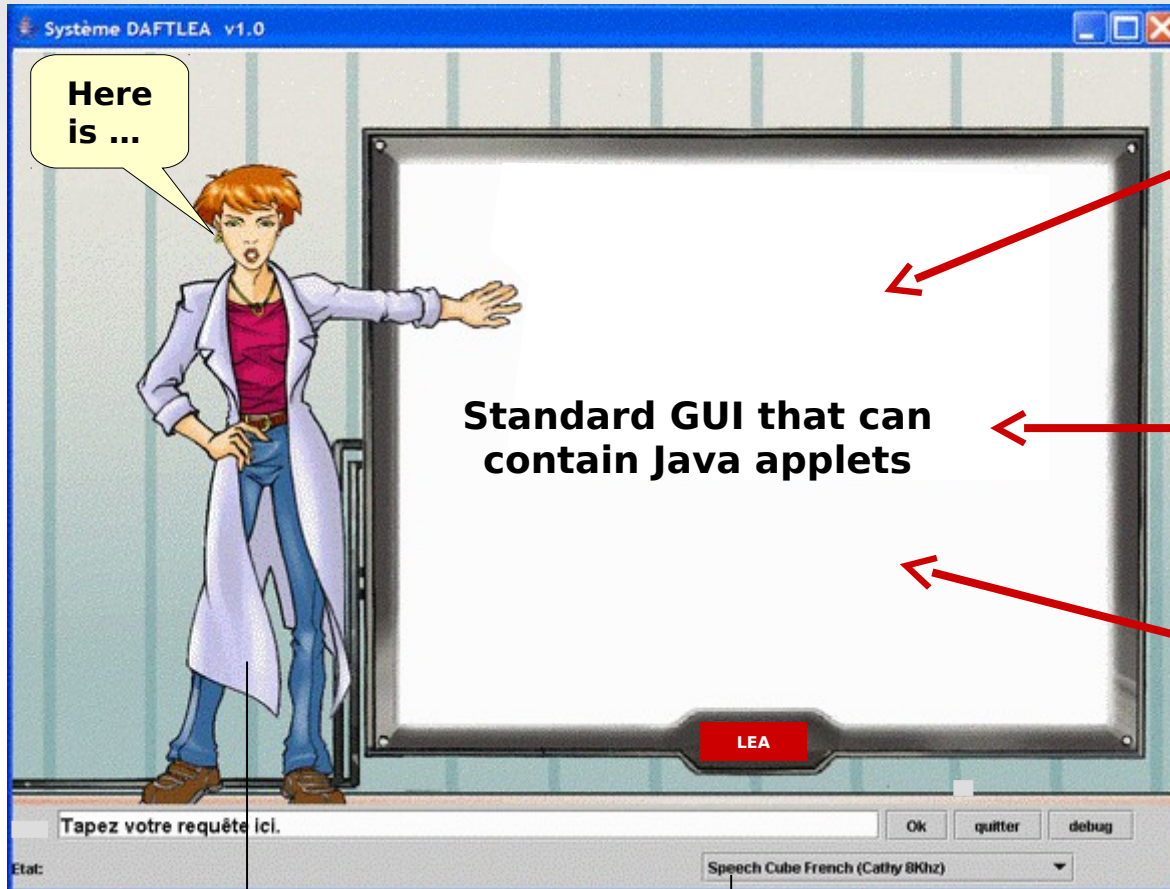


# The Rational Assisting Agent



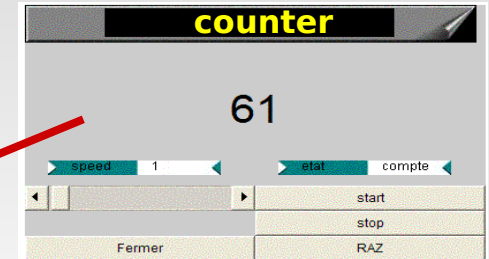
# Dialogue with components

Java Interface for ECA: DaftLea (K. LeGuern 2004)

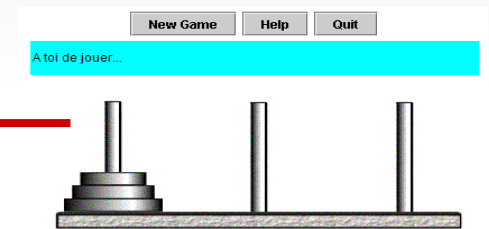


ACA LEA (Java)  
J-C Martin & S. Abrilian

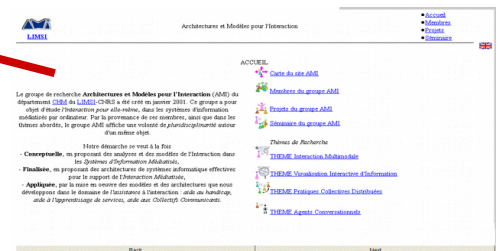
Speech synthesis: Elan Speech



“Counter” component



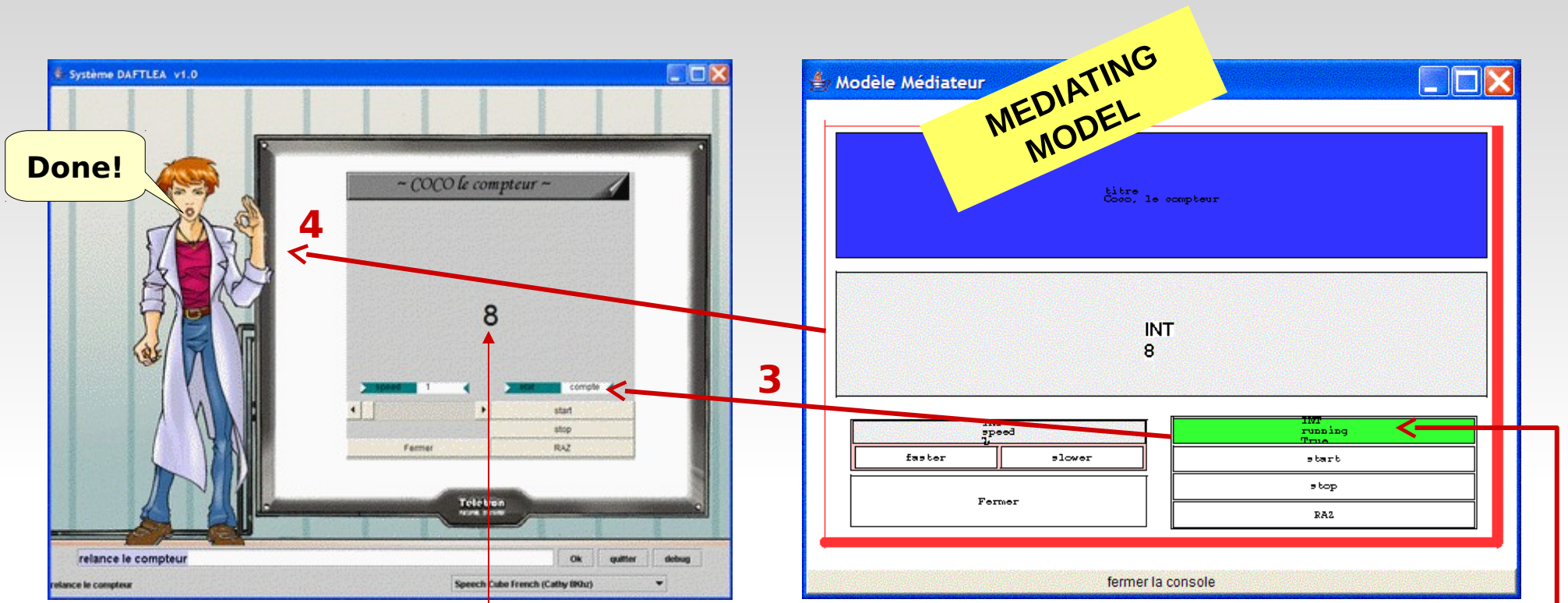
“Hanoi” component



“AMI web site” component

...

# Processing of a Daft request



« restart the counter »

1

When the user enters « restart the counter » in the chatbox, he/she can see:

- The number increments 8, 10, 12, 14 ...
- LEA says: « Done! »
- LEA expresses the emote: ACKNOWLEDGE

1) The utterance is analyzed to build a formal request:

RESTART[REF["COUNTER"]]

2) The reference REF is resolved within the model (large red rectangle)

3) The restart action is applied on the boolean of the counter thus producing the model variable INT[8] to be incremented

4) An update is sent to the boolean variable of the application

5) The behavioral answer « ACKNOWLEDGE » is sent to the virtual agent.

2



# Signing agents

LIMS I :  
Diva/DivaLite

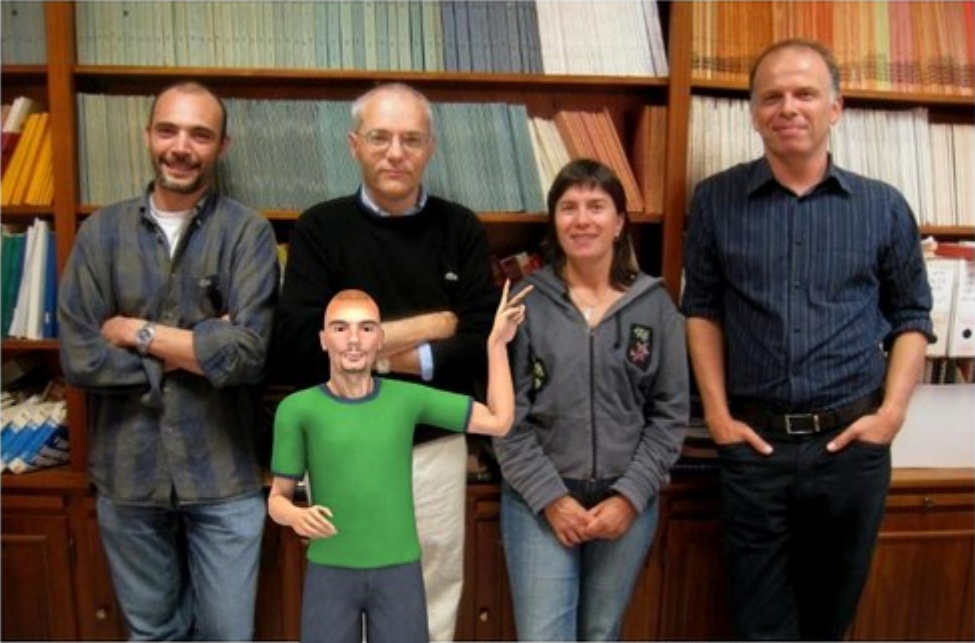
GESTURAL AGENTS - Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

http://www.limsi.fr/~jps/online/diva/geste/geste.main.htm

## LIMS I Gestural Agents Home Page

Gestural Agents is an incentive action at LIMS I-CNRS over 2007-2008. The objective of this work is the development and the validation of a toolkit for 2D/3D realistic animated agents which makes it possible to deploy virtual characters of the class « gestural agents » in web-based distributed interactive environments. The gestural library will be based on the new emerging standard BML (Behavior Modeling Language).



Members from Left to right are:

- Cyril Verrecchia
- Jean-Paul Sansonnet
- Annelies Braffort
- Jean-Claude Martin

(Just click on the agent to obtain a description from the agent Elsi)

### Demos pages

- **DIVA** Home page of DIVA toolkit supporting the realistic gestural agents.
- **LIMS I** Page of the organigram of LIMS I website which will soon be assisted by the agent ELSI.
- **Sign Builder** Web page of the building of LIMS I references that are played by the agent ELSI.

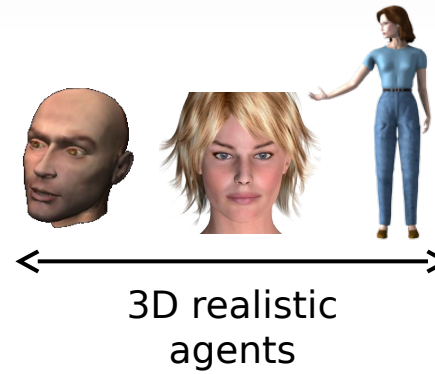
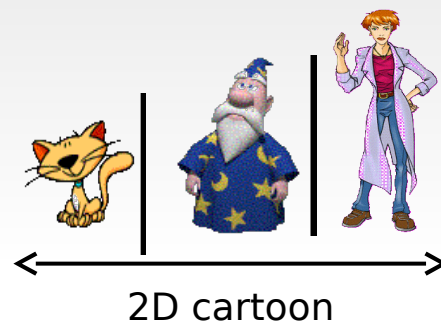
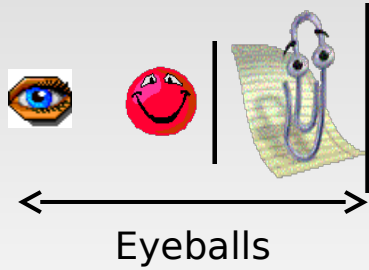
### Documentation

Paper	J-C Martin, J-P Sansonnet, A. Braffort, C. Verrecchia, <b>Informing the Design of Deictic Behaviors of a Web Agent with Spoken and Sign Language Video Data</b> , The 8th International Gesture Workshop, GW 2009, Bielefeld Germany Febr 2009
Poster	J-P Sansonnet, A. Braffort, C. Verrecchia, <b>Towards interactive web-based signing avatars</b> , Poster presentation at The 8th International Gesture Workshop, GW 2009, Bielefeld Germany Febr 2009
Paper	A. Braffort, J-P Sansonnet, J-C Martin, C. Verrecchia, <b>A web-based framework for interactive deictic and sign language agents</b> , Third Workshop on Animated Conversational Agents, WACA'2008, Paris, 2008

Hello  Send  ? ±

< user mousewindowclick >

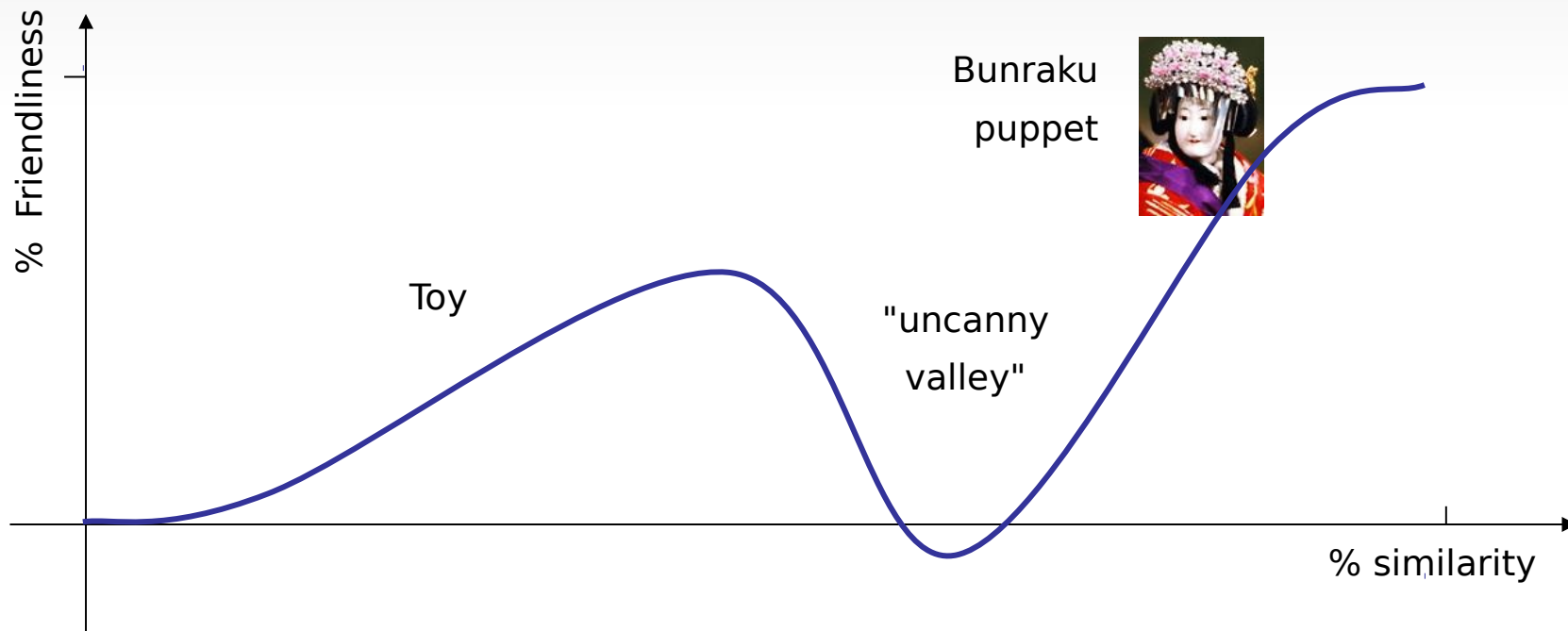
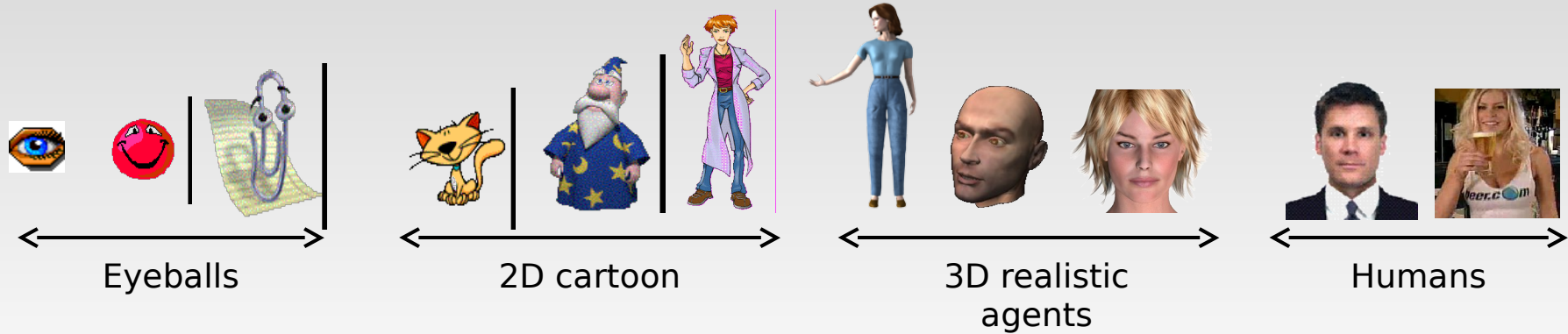
# Usefulness of embodiment



# Evaluation of ECAs

Objective	<b>Efficiency</b>	Measures the actual performance of the couple user-agent when carrying out a given task.
	<b>Usability</b>	Measures the capacity of the user to have a good comprehension of the functioning of the system and the fluency of the control.
<hr/>		
Subjective	<b>Friendliness</b>	Measures the “feeling” of the user about the features of the system (attraction, commitment, esthetic, comfort, ...)
	<b>Believability</b>	Measures the “feeling” of the user about the fact that the agent can understand the user’s problems and has the capacity to help with real competence.
	<b>Trust</b>	Measures the “feeling” of the user about the fact that the agent behaves as a trustable and cooperative entity.

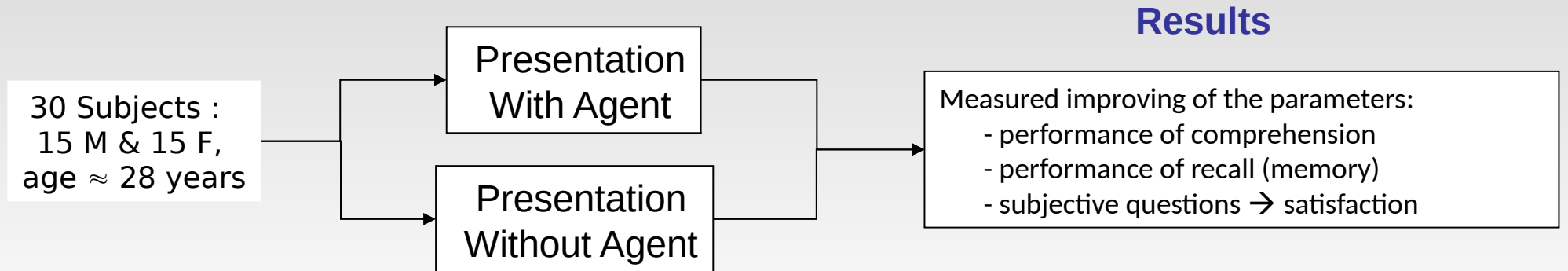
# Ratio realism / friendliness



Masahito Mori, Institut Robotique de Tokyo in Jasia Reicardt, "Robots are coming", Thames and Hudson Ltd, 1978



# The *Persona* Effect of Lester



ECA

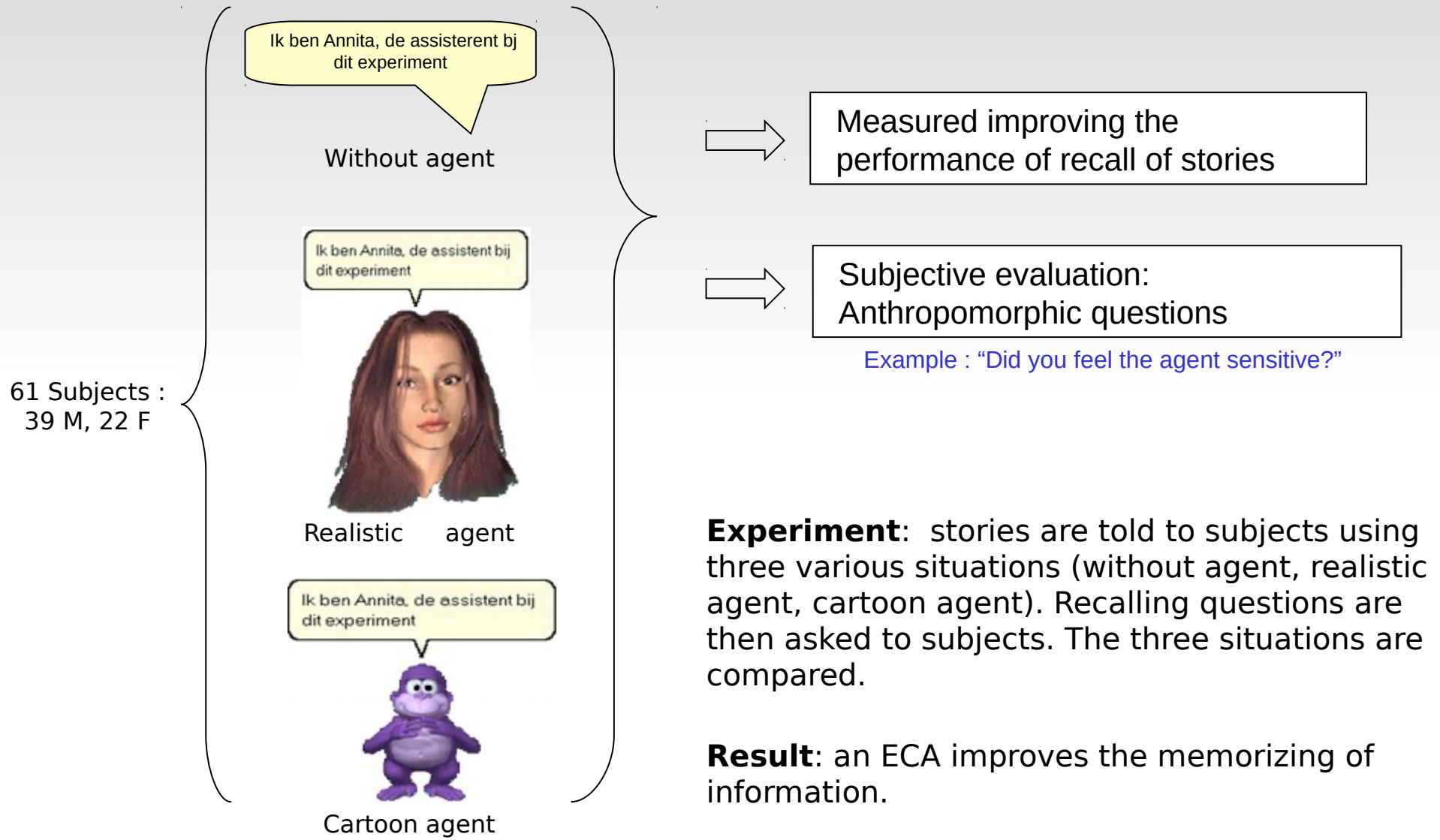


An arrow



- Lester et al. (1997). The Persona Effect: Affective impact of Animated Pedagogical Agents. CHI'97.
- van Mulken et al. (1998). The Persona Effect: How substantial is it? HCI'98.

# Persona effect and memorizing



# Experiments on Functional description

## Three different agents:

- 2 men (Marco, Jules) with different garment
- 1 woman (Lea)

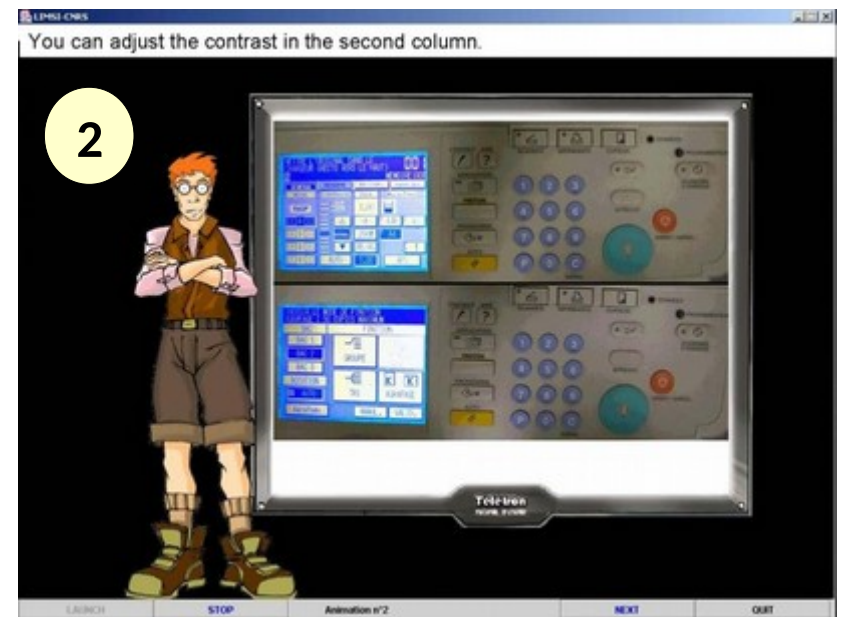
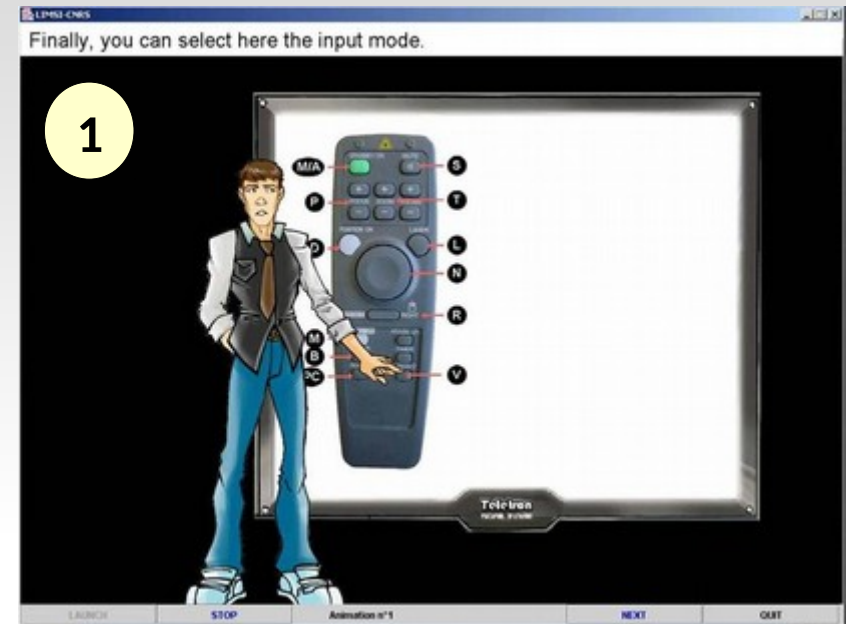
## Three strategies of cooperation:

- Redundancy (speech + gesture)
- Complementarity (50% speech / 50% gesture)
- Specialization (speech only)

## Three objects to describe:

1. Video recorder remote controller
2. Photocopier control panel
3. Application for designing graphic documents

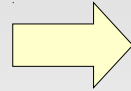
$3^3 = 27$   
experiments



# Functional description: evaluation results

## Quality of explanation

- No noticeable effect of the appearance,
- Noticeable effect of the multimodal behaviour: the redundant explanations are preferred.



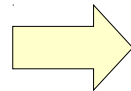
## Sympathy

- No noticeable effect of the multimodal behaviour,
- Noticeable effect of the appearance :



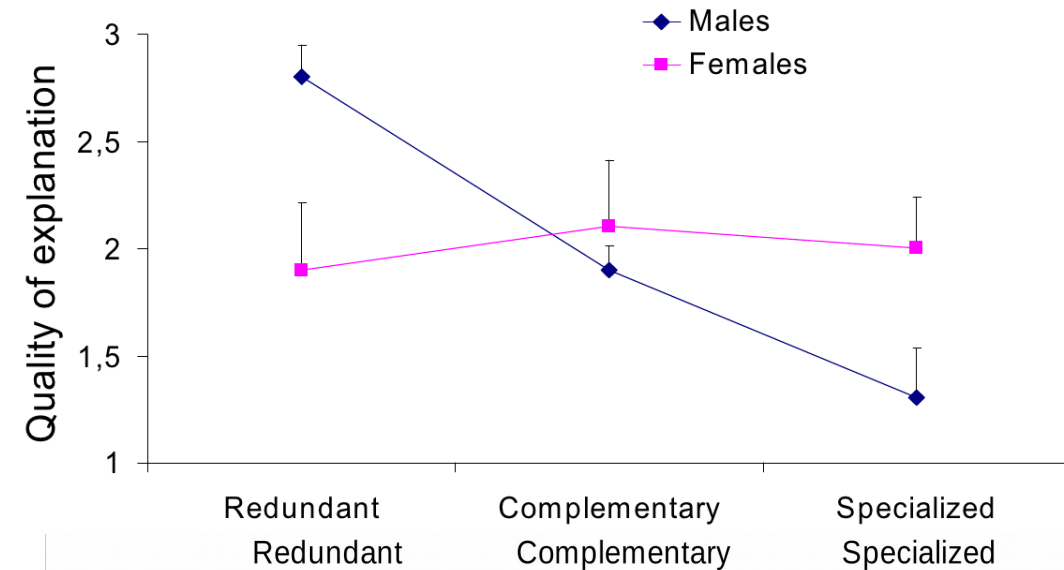
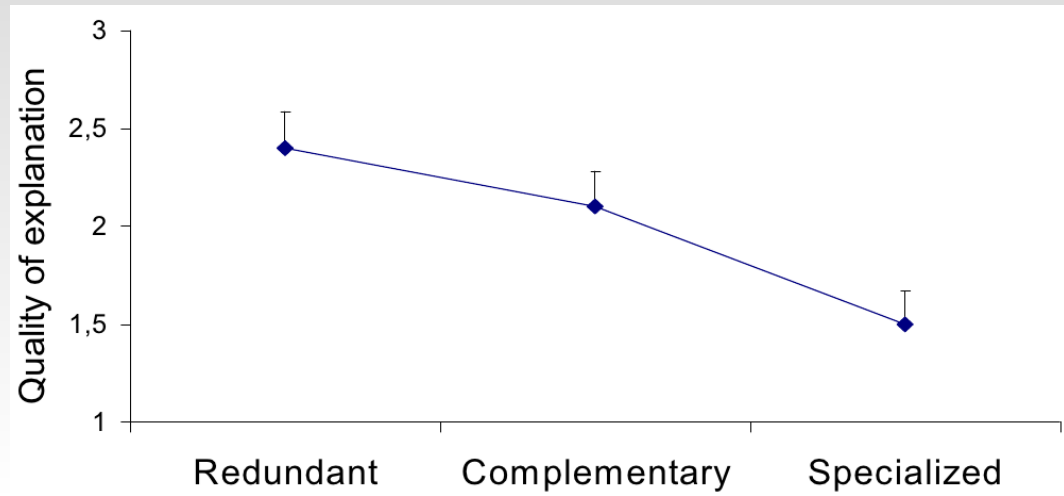
## Performance

- Same as the appearance,
- But no correlation between Sympathy and Performance.



## Impact of the user's gender

- Men react differentially and prefer redounding explanations,
- Women do not react differentially.

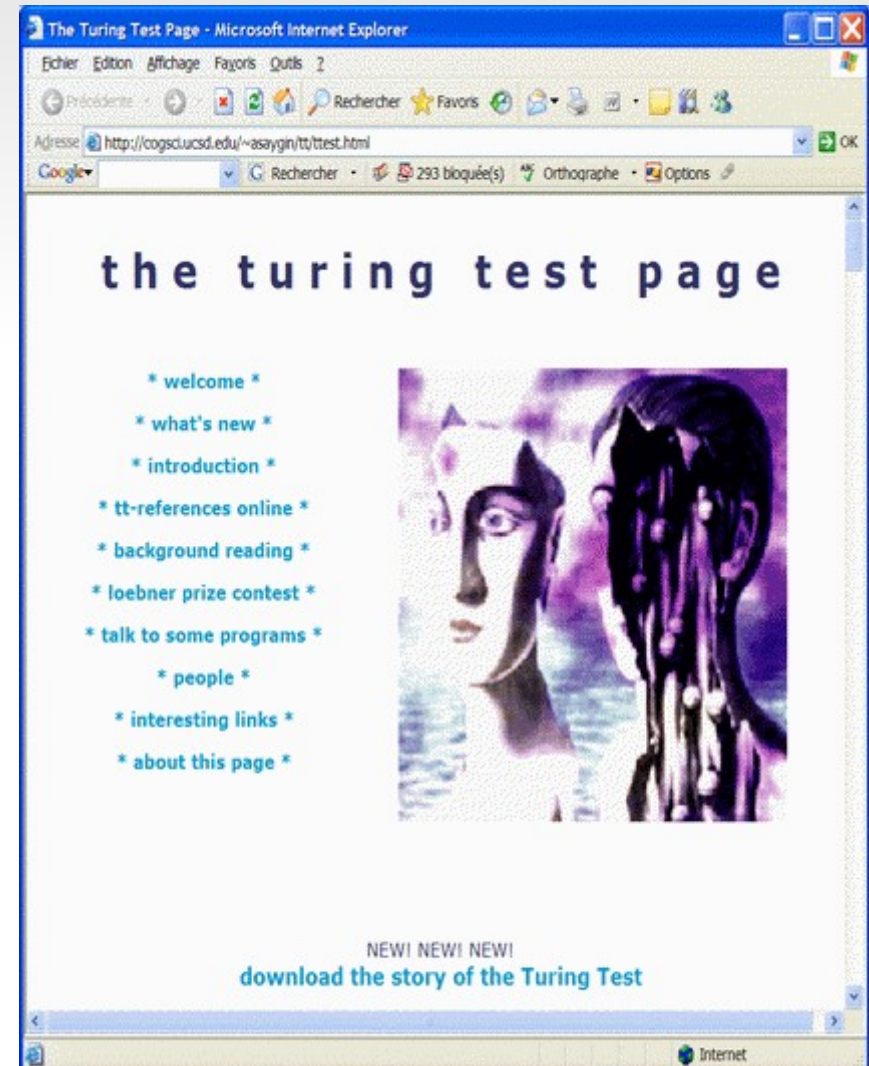




# Human-ECA Interaction

# Turing test: conversational intelligence

- Turing Test, Alan M. Turing (1912-1954) : "the imitation game" in "Computing Machinery and Intelligence", Mind, Vol. 59, No. 236, pp. 433-460, 1950.
- Can be replaced by a *Turing-like* test, on output data instead of during direct interaction



# Wizard of Oz methodology

## Wizard of Oz

- An experimenter pilots an avatar
- The user does not know that he is in front of another human (he thinks he faces a virtual agent)



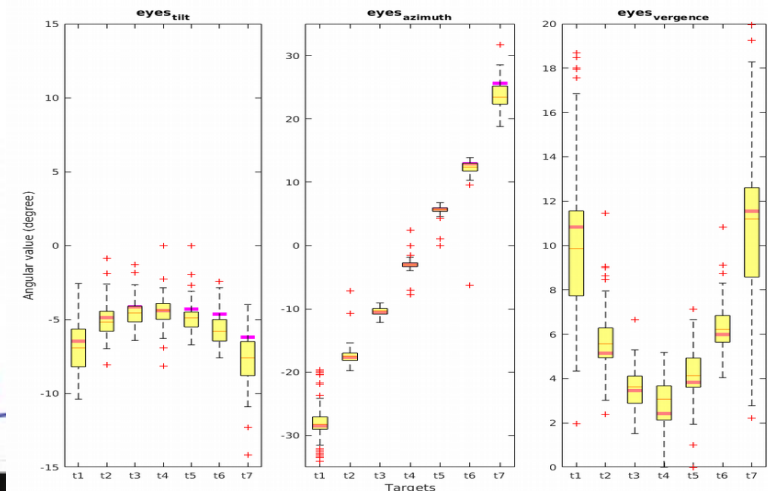
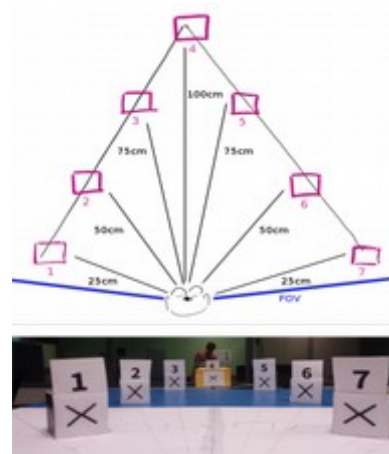
# HRI: Immersive teleoperation

... for demonstrating social behaviors  
G rard Bailly, Fr d ric Elisei & R mi Cambuzat

- Immersive teleoperation of Nina
  - Lips, head & eye movements (azimuth, elevation & vergence)
  - Audiovisual (binaural & stereo) feedback

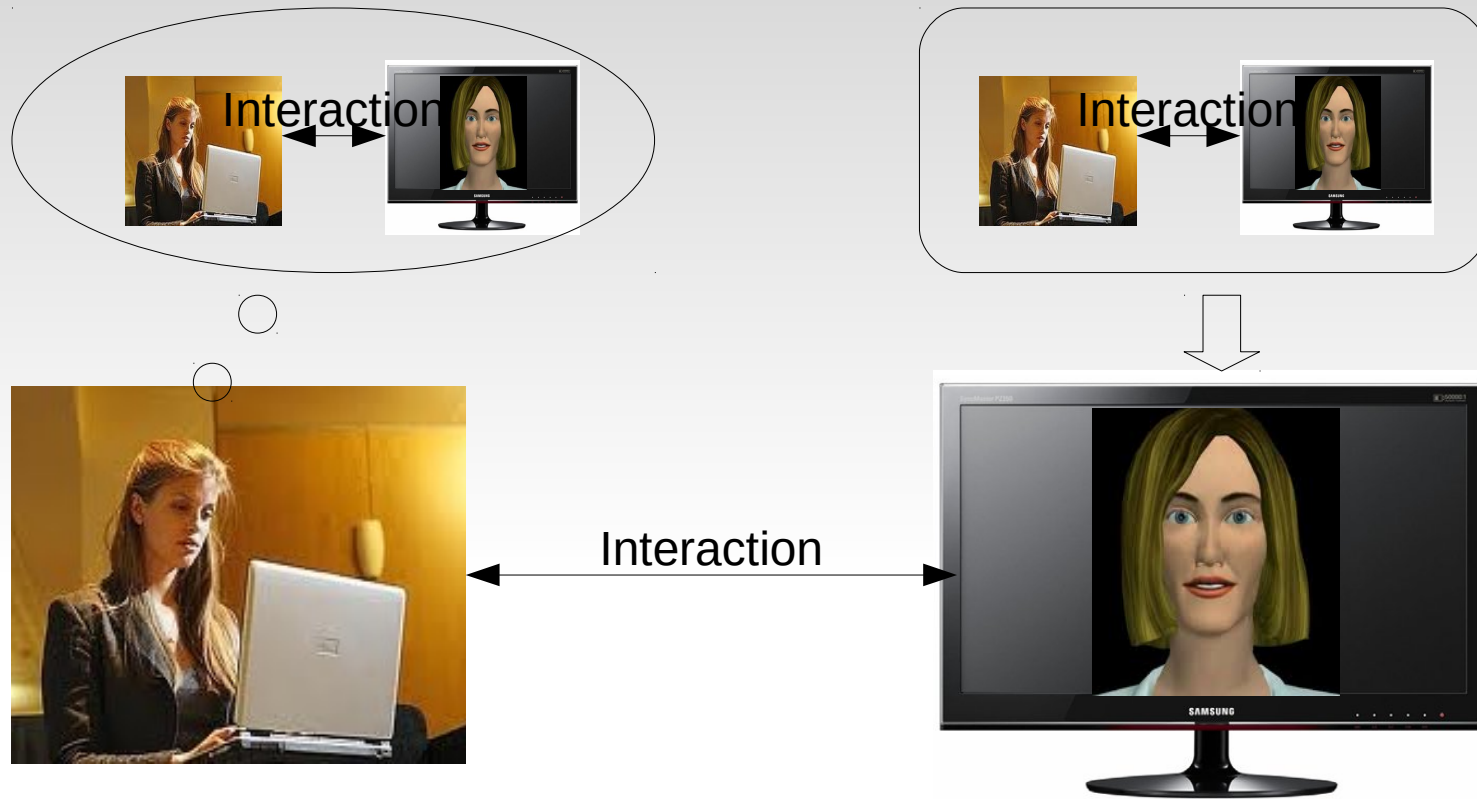
Cambuzat, R., Elisei, F., Bailly, G., Simonin, O., & Spalanzani, A. (2018) Immersive teleoperation of the eye gaze of social robots, International Symposium on Robotics (ISR), Munich, Germany: pp. 232-239.

- Learning behaviors
  - Intra- & inter-modal coordination
- Embodied cognition
  - Pilot's behavior





# Human-Agent interaction



## Multiple inputs

Textual (text boxes), audio (microphone), video (camera), sensors (Aml environment),...

## Multiple outputs

Textual, audio, facial expressions, postures, gestures, lighting, ...

## Multiple models

Conversational, emotional, of the environment, of the user, ...

# European project SEMAINE: an ECA architecture

## SEMAINE THE SENSITIVE AGENT PROJECT



-- [Home](#) -- [Project description](#) -- [Partners](#) -- [Events](#) -- [Publications](#) -- [Downloads](#) --

### The SEMAINE project

The Semaine project is an EU-FP7 1st call STREP project and aims to build a SAL, a Sensitive Artificial Listener, a multimodal dialogue system which can:

- interact with humans with a virtual character
- sustain an interaction with a user for some time
- react appropriately to the user's non-verbal behaviour

In the end, this SAL-system will be released to a large extent as an open source research tool to the community.

The second public demonstrator system can now be found in the [Downloads](#) section.

Sample interactions with the system can be found here:

[http://www.youtube.com/user/GMcKeownQUB?feature=mhum#p/a/u/0/6KZc6e\\_EuCG](http://www.youtube.com/user/GMcKeownQUB?feature=mhum#p/a/u/0/6KZc6e_EuCG)

This is a sample interaction with one of the characters (recorded with the real system!)



The participating institutions are:



DFKI, Deutsches Forschungszentrum für Künstliche Intelligenz, Germany (coordinator)



Paris8: Université Paris VIII, France



TUM: Technische Universität München, Germany



ICSTM: Imperial College of Science, Technology and Medicine, London, UK



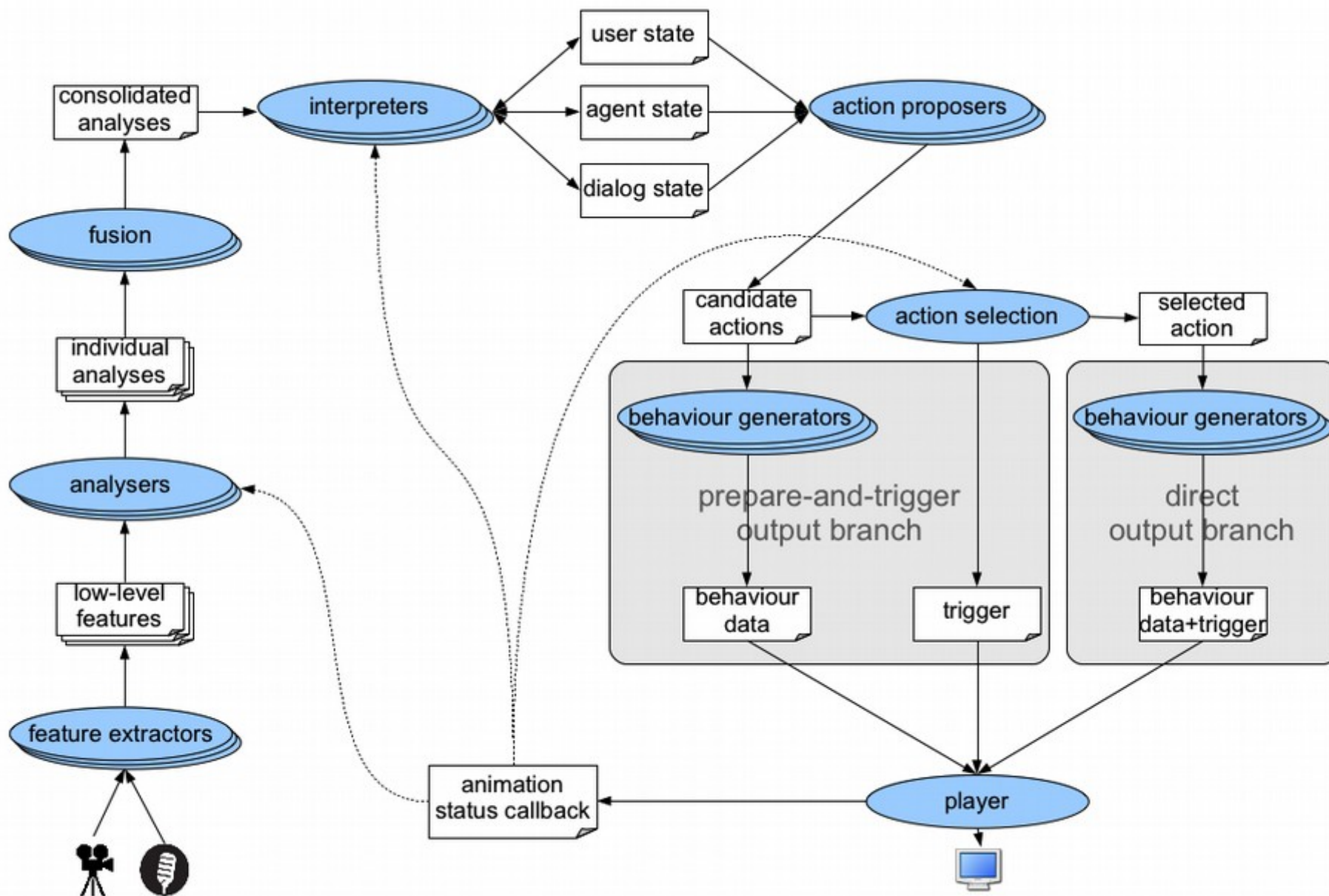
QUB: Queen's University Belfast, UK



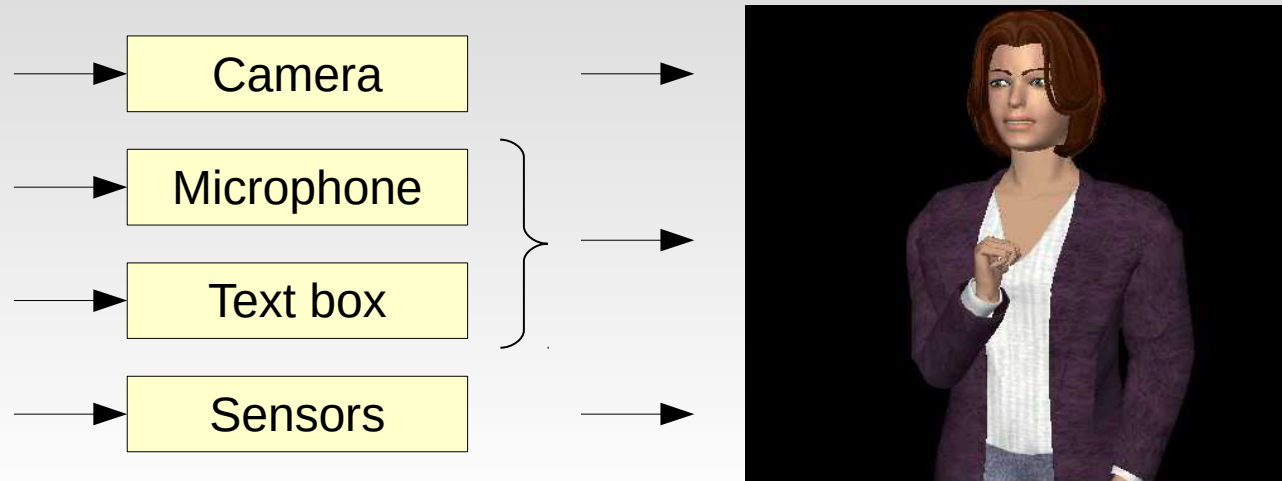
UT: Universiteit Twente, Netherlands

# Example of ECA architecture

Semaine Project



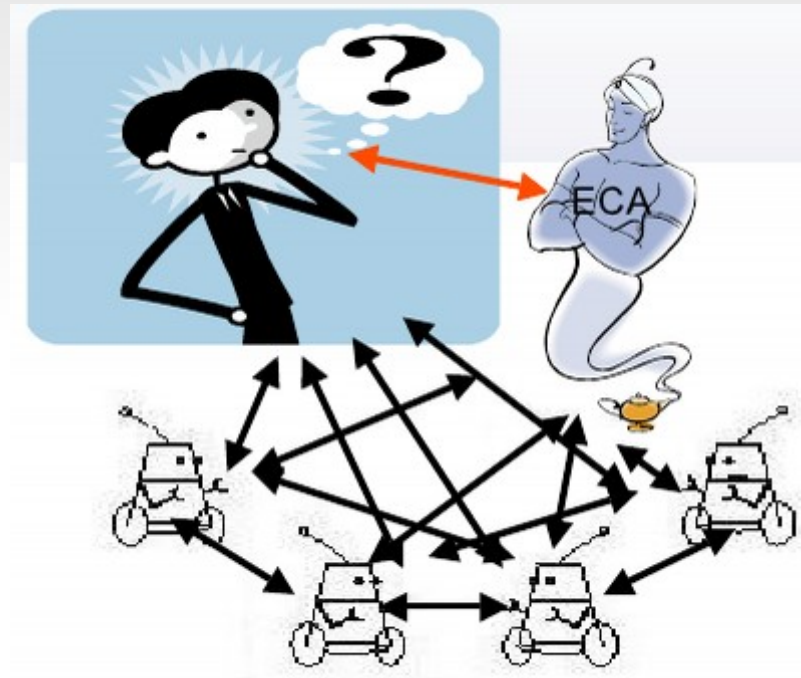
# Interaction inputs



- **Microphone + transc.:** dialogue input (semantic + emotions)
- **Microphone (emotion)**
- **Camera:**
  - Gestures (semantic)
  - **Facial expressions / postures (emotions)**
- **Sensors:**
  - Context
  - Physiological signals (emotions)



# Human-ECA Dialogue



S. Pesty, GT ACA, 2005.11.15, <http://www.limsi.fr/aca/>

# Conversational agents

## Textual / GUI

## Embodied

### Non linguistic

- Contextual help: pop-ups, ...
- Online manuals: hypertext navigation
- Assistants using a decision tree

- State printer: emotion, emotes

### Unidirectional, linguistic

#### INPUT

- Query fields embedded in an application window: keywords, free/open questions

#### OUTPUT

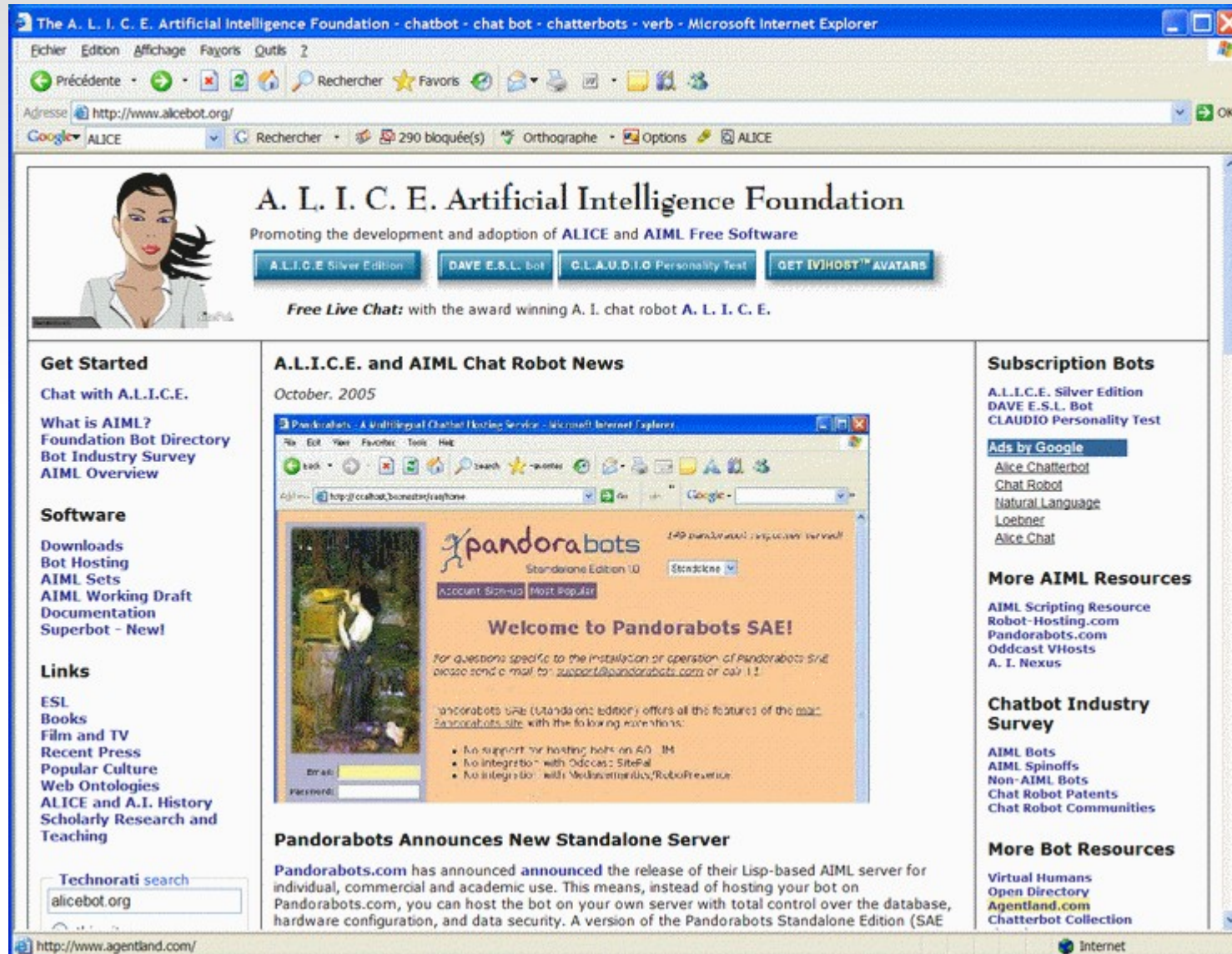
- Feature presenter

### Conversational (bidirectional, linguistic)

- Chat bots: Eliza
- Dialogical assistants: InterViews, Daft, Artemis, ...

- Mediators: acts as a representative of an application of a service
- Avatars

# The reference of the chatbots A. L. I. C. E.



The screenshot shows a Microsoft Internet Explorer browser window displaying the website for the A.L.I.C.E. Artificial Intelligence Foundation. The browser's address bar shows the URL <http://www.alicebot.org/>. The website's main header includes the text "A. L. I. C. E. Artificial Intelligence Foundation" and "Promoting the development and adoption of ALICE and AIML Free Software". Below this, there are buttons for "A.L.I.C.E. Silver Edition", "DAVE E.S.L. Bot", "C.L.A.U.D.I.O Personality Test", and "GET [V]HOST™ AVATARS". A prominent message reads "Free Live Chat: with the award winning A. I. chat robot A. L. I. C. E.".

The page is organized into several columns:

- Get Started:** Includes links for "Chat with A.L.I.C.E.", "What is AIML?", "Foundation Bot Directory", "Bot Industry Survey", and "AIML Overview".
- Software:** Lists "Downloads", "Bot Hosting", "AIML Sets", "AIML Working Draft", "Documentation", and "Superbot - New!".
- Links:** Provides links to "ESL", "Books", "Film and TV", "Recent Press", "Popular Culture", "Web Ontologies", "ALICE and A.I. History", and "Scholarly Research and Teaching".
- A.L.I.C.E. and AIML Chat Robot News:** Dated "October, 2005", this section features an inset image of a smaller browser window showing the "Pandorabots.com" website. The inset window displays a "Welcome to Pandorabots SAE!" message and lists features of the Standalone Edition (SAE), such as "No support for hosting bots on 40 IM", "No integration with Oddcast SitePal", and "No integration with MediaWiki/RoboPreviewer".
- Subscription Bots:** Lists "A.L.I.C.E. Silver Edition", "DAVE E.S.L. Bot", and "CLAUDIO Personality Test".
- More AIML Resources:** Includes "AIML Scripting Resource", "Robot-Hosting.com", "Pandorabots.com", "Oddcast VHosts", and "A. I. Nexus".
- Chatbot Industry Survey:** Lists "AIML Bots", "AIML Spinoffs", "Non-AIML Bots", "Chat Robot Patents", and "Chat Robot Communities".
- More Bot Resources:** Lists "Virtual Humans", "Open Directory", "Agentland.com", and "Chatterbot Collection".

At the bottom of the page, there is a "Technorati search" box with the text "alicebot.org" and a footer with the URL <http://www.agentland.com/>.

Author: Richard S. Wallace

Website: <http://www.alicebot.org>

Documentation : <http://alicebot.org/TR/2001/WD-aiml-1.0.1-20011025-006.html>

# Jabberwacky wins the Loebner Prize 2005

....

PROGRAM: Hello, my name is George and I am the human.

JUDGE: Hi George, cslkjslw weicmslw weos, right?

PROGRAM: Don't repeat your name, csthiang!

JUDGE: If lsjkel lwehlx wouldn't you say?

PROGRAM: No, he's still good.

JUDGE: Who.

PROGRAM: You and me.

JUDGE: If you are human, tell me which is larger, a salt crystal or the Empire State Building.

PROGRAM: It's caring about another person's well being more than your own.

JUDGE: What if I care about another person's well being more than I should?

PROGRAM: How would you do that?

JUDGE: Which is further away from us, Queens or Inner Mongolia?

PROGRAM: HA! HA! That was stupid. Tell me a GOOD joke this time.

JUDGE: You say you are human but you can't answer a simple question.

PROGRAM: Because I am alive.

JUDGE: You are not following the rules. You are supposed to convince me that you are a human, not convince me that you are mysterious.

PROGRAM: I can't very well convince one lacking a mind, can I?

JUDGE: It isn't my mind that is in question, it is yours!

PROGRAM: No my name is not katie.

JUDGE: Which is larger, your brain or Belgium?

PROGRAM: Oh the one on the far left without a doubt.

JUDGE: Francais.

PROGRAM: Yes do you speak it?

JUDGE: Francais.

PROGRAM: Francais?

JUDGE: Francais.

PROGRAM: O well I don't speak french.

JUDGE: Who.

PROGRAM: Mine.

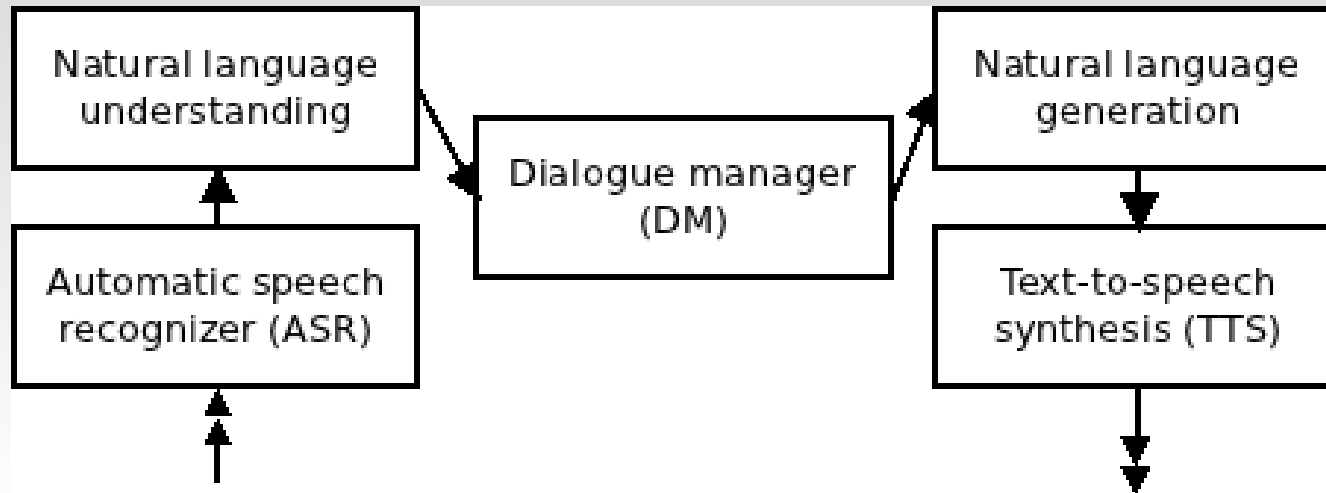
JUDGE: The ljuwli is what we want, right?

PROGRAM: I can not do it right now because I m talking to you a million miles away.

...



# Dialogue systems



- Retro-action loop not taken into account: knowing the state of the dialogue (DM) can improve
  - Automatic speech recognizer
  - Natural language understanding
- The DM should manage multimodality
  - As input (ex: gestures, facial expressions, emotions)
  - As output (ex: emphasis, voice modulating, utterance+gesture)

# Utterance understanding

- Speech act theory (Searle&Vanderveken, 1985)
  - In accordance with Bratman's theory of intention (Bratman, 1987)
  - **Illocutionary acts** (Vanderveken, 1990)
  - Formalisation:  $F(P)$
  - 5 speech acts: assertive, commissive, directive, declarative, expressive
- Transposition to MAS
  - KQML
  - FIPA ACL

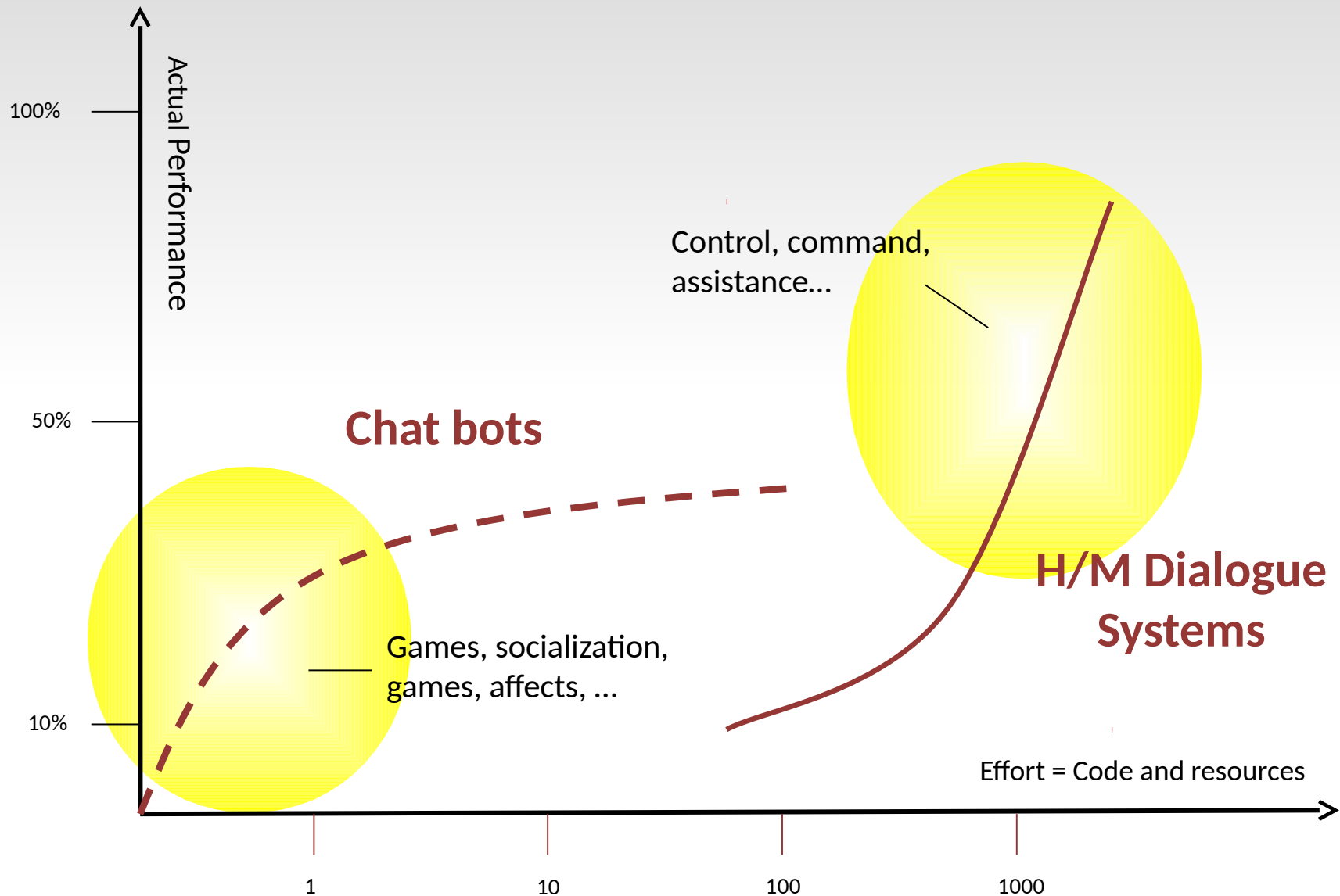
# Existing dialogue systems

- Case-base systems using keyword spotting: chatbot
- Communication protocols (FIPA ACL): MAS
- Planning systems (Allen 80, Traum 96)
- POM-DP: call centres (Frampton&Lemon 09)
- Dialogue games (Maudet 00)
- Information-State update (Larsson 00) : Trindikit, GoDiS, IbiS

**Scientific deadlock yet unsolved!**

*(see Mission Rehearsal Exercise (Swartout et al. 2006))*

# Ratio Effort/Performance





# Social interaction

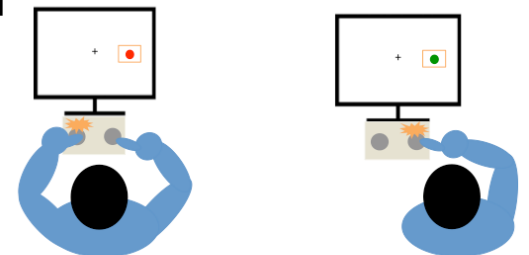
- How do humans coordinate behaviour?
  - Synchronization mechanisms
  - Joint attention & gaze regulation
  - Share representation of action
- What are the mechanisms that safeguard social interaction?
  - Emotion and dialog adaptation
  - First impression management
  - Interruption management
  - Engagement
  - Emotion regulation

# Joint attention and action

- Gaze-contingent avatar:
  - Modelling realistic joint attention behaviours on an artificial agent
  - Regulation of gaze during joint attention episodes
- Pro-social role of gaze following
  - Higher likability of gaze following avatars
- Shared representation of human vs machine action

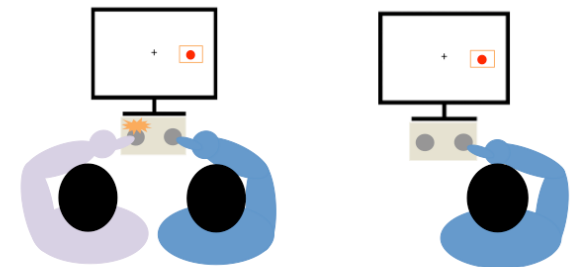


Courgeon et al, *IEEE TAC*, 2014



Two-choice condition (a)

Individual go-nogo condition (b)



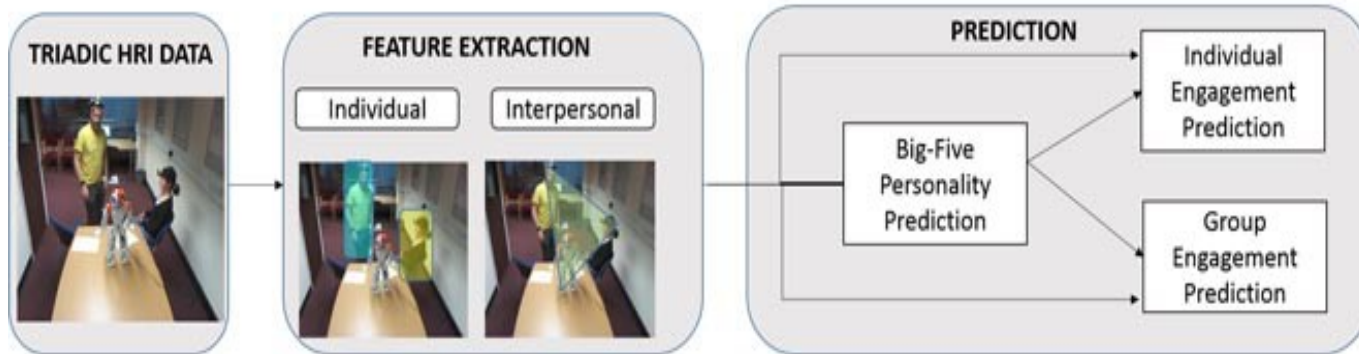
Joint go-nogo HH condition (c)

Joint go-nogo HM condition (d)

Sahai et al, *IEEE RO-MAN*, 2017

# Engagement in interaction

- User engagement detection
- Multi party engagement
  - Interpersonal synchrony on visual, acoustic and tactile signals
  - Engagement metrics definition
  - Low and high levels features



H. Salam et al. *IEEE Access* 2017



S. Anzalone et al. *Social Robotics* 2017

# Applications

- Training social skills
  - Job interviews
  - Alzheimer
  - Medical teams
- Personalized Coach
  - Back pain
  - Diabetes



# MARC plays Othello





# Serious game: Job interview training



# Serious game: Train doctors to break bad news



# Serious game and Entertainment

## EAST project

- Pedagogical agents in virtual environment for human learning
- Pro-active vs reactive agents
- Collaborative mixed society



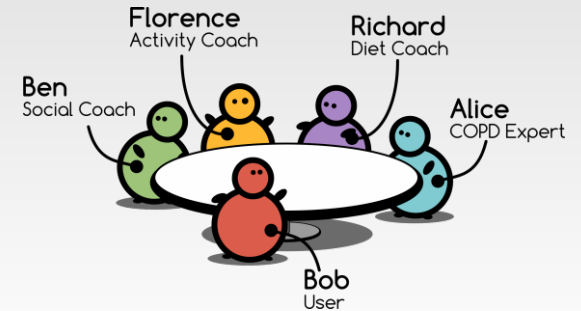
## NARECA project

- Narrative Embodied Conversational Agent
- Child-Agent interaction
- Multimodal dialogue management



# Scientific issues

- Conduct multi-party interaction
  - Talk and act together
  - Conversation flow
- Enlarge interaction modalities
  - Music
  - Touch
- Maintain long-term interaction
  - Adapt to users in term of alignment, preferences...
  - Curiosity, self/mixed-learning
- Context awareness, situated interaction



# Scientific issues

- Data center
- Agent's identity
  - Hybrid model
  - Migration
- Targeted population:
  - Ageing society
  - Multicultural society
- Evaluation
  - In the wild
  - Long term
- Ethical requirement



# Acknowledgements

- Jean-Paul Sansonnet (LIMSI)
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# Conclusion

Join the  
GT ACAI!

## Bienvenue sur le site du GT ACAI

Le groupe de travail "Affects, Compagnons Artificiels et Interactions" (ACAI) a pour objectif est de regrouper les activités en informatique affective et interactions en France. Il se situe dans la continuité du groupe de travail ACAI.

Ses principales actions sont :

- La diffusion d'information à travers la liste [acai@poleia.lip6.fr](mailto:acai@poleia.lip6.fr)  
Pour vous abonner, vous pouvez envoyer un email à [Nicolas.Sabouret@lip6.fr](mailto:Nicolas.Sabouret@lip6.fr)
- L'organisation de journées de travail :
  - La journée du [22 novembre 2011](#) à Paris - Informatique Affective, Agents Conversationnels Animés et Robots
  - La journée du [6 avril 2012](#) à Paris - Affects, Compagnons Artificiels et Interactions
- L'organisation de la conférence WACAI (qui prend la suite des conférences WACA) :
  - [WACA 2005](#) Premier Workshop ACA, 13-14 juin 2005, Grenoble
  - [WACA 2006](#) Deuxième Workshop ACA, 26 et 27 octobre 2006, Toulouse
  - [WACA 2008](#) Troisième Workshop ACA, 28 novembre 2008, Paris
  - [WACA 2010](#) Quatrième Workshop ACA, 25-26 novembre 2010, Lille
  - Le **WACAI 2012** aura lieu à Grenoble jeudi 15 et vendredi 16 novembre 2012.
- La publication de travaux scientifiques de la communauté :
  - Après le numéro de 2011, la revue TSI édite en 2012 un numéro spécial [Agents Conversationnels Animés et Informatique Affective](#) (numéro 31, volume 4), à paraître bientôt.

## Voir aussi

- [Présentation des objectifs scientifiques du GT](#)
- [Les quatre axes thématiques du GT](#)
- [Organisation du GT](#)
- [Principales équipes impliquées \(en France\)](#)

Accueil (dernière édition le 2012-04-06 12:32 par Nicolas Sabouret)

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