

# Long-term affect sensitive and socially interactive companions

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# Artificial companions: the LIREC project



- Long-term affect sensitive and socially interactive companions
  - Robots, graphical synthetic characters, socially interactive toys, etc.
- EU FP7 LIREC (Living with Robots and IntEractive Companions) project
- Existing prototypes have limited functionalities
- Need to establish natural interaction with users
- Social and affective capabilities

# Affect sensitive and socially interactive companions

- A robot companion
  - Is useful, able to help and assist people
  - Is capable of entertaining and motivating
  - Acts in a socially acceptable manner (Dautenhahn, 2007)
- Not replace human contact but...
- ... provide additional functionalities
  - Users with special needs
- Long-term companionship: multidisciplinary perspective

# Requirements for companions

- Long-term interactions
- Adapt to unforeseen circumstances
- Robustness in real-world scenarios
- Capabilities
  - *Affect sensitivity*
  - *Memory and learning*
  - *Cognitive and expressive behaviour*
  - *Personalisation*
  - *Embodiment*

# Affect sensitivity (1)

- Understand the user's mental and affective states (Pantic et al., 2005)
  - Verbal and non-verbal behaviour
- Beyond prototypical emotions
  - More subtle states, such as interest, boredom, frustration, etc.
  - Affect-related expressions (e.g., willingness to interact)
- Spontaneous affective expressions

# Affect sensitivity (2)

- Multimodal affect recognition
  - Need to know relationships between modalities
- Capture the dynamics of human behaviour
  - Detection of temporal segments
  - Temporal evolution of affective expressions  
(Castellano, 2008)
- Robustness to real-life conditions
- Sensitivity to context and embodiment
  - Analysis of different information about the user

# Memory and learning (1)

- Dynamic framework for memory and learning
- What to remember, what to forget
  - User's input, context
- Model linking long-term and working memory
  - Emotional memory
  - Autobiographical memory (Ho et. al., 2007)
- *Reminding* driven by external stimuli and internal emotional state

# Memory and learning (2)

- Ability to recognise significant events...
- ... and to remember, recall and learn
- Episodic memory
  - Accuracy
  - Scalability
  - Efficiency
- Increasing believability of companions

# Cognitive and expressive behaviour (1)

- Mechanisms for generation of expressive behaviour
  - Facial and bodily expressions
  - Speech capabilities
- Integration with a framework including
  - Memory
  - Emotion
  - Personality
  - Adaptation
  - Autonomous action-selection

# Cognitive and expressive behaviour (2)

- Link between emotion modelling and behaviour generation (Dias et al., 2005)
- Autonomous decision making
  - Companion's internal state
  - Past experiences
- User modelling
- Modelling the relationship between companion and user

# Personalisation (1)

- Ability to recognise one or more users
- Adapt to a specific user over time
- Companion endowed with a model of the user's:
  - Personality
  - Goals
  - Beliefs
  - Emotional state

# Personalisation (2)

- Companions needs to know:
  - What the user likes and dislikes (e.g., proxemic preferences)
  - The user's current affective or mental state
  - The user's interaction styles
- Adapt to special needs

# Embodiment (1)

- Framework for socially acceptable embodiment
- Impact on the user's:
  - Experience
  - Level of engagement over time
- Robot appearance matters in how people perceive robots
- Human-like robots seem to be preferred (Walters et al., 2008)
- Personality of the user is important

# Embodiment (2)

- Perception of robots also depends on
  - Robot personality
  - Task and context of use (Khan, 1998)
- Links between perception of robots and the way people interact with robots (Hinds et al., 2004)
- Impact on other capabilities of companions

# Challenges

- Robustness in real-world scenarios
- Ability to work in real-time
- Ability to work over extended periods of time
- Need for dynamic models
- Migration
  - How can a companion change smoothly its embodiments?
  - Can a companion be perceived as the same entity while moving from one device to another?
  - How migration can impact the functionalities of companions?

# Social and ethical issues

- Design of affect sensitive companions may raise issues related to ethics and privacy
  - What does the companion have the right to know about the user's state?
  - What type of cognitive and affective behaviour can it express?
  - When can a companion persuade the user to engage in an interaction or be involved in a task?
- Impact on the user's experience and acceptance over the long term
- Improve quality of life