

Towards emotion-sensitive multimodal interfaces

The challenge of the European Network of Excellence
HUMAINE

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humaine

<http://emotion-research.net>

Emotion-oriented Computing: The Goal

- ◆ General goal: Make interaction between humans and machines more natural for the humans
- ◆ One aspect: Machines should become able
 - ➔ to register human emotions (and related states)
 - ➔ to convey emotions (and related states)
 - ➔ to “understand” the emotional relevance of events
- ◆ Principled steps towards that goal: HUMAINE

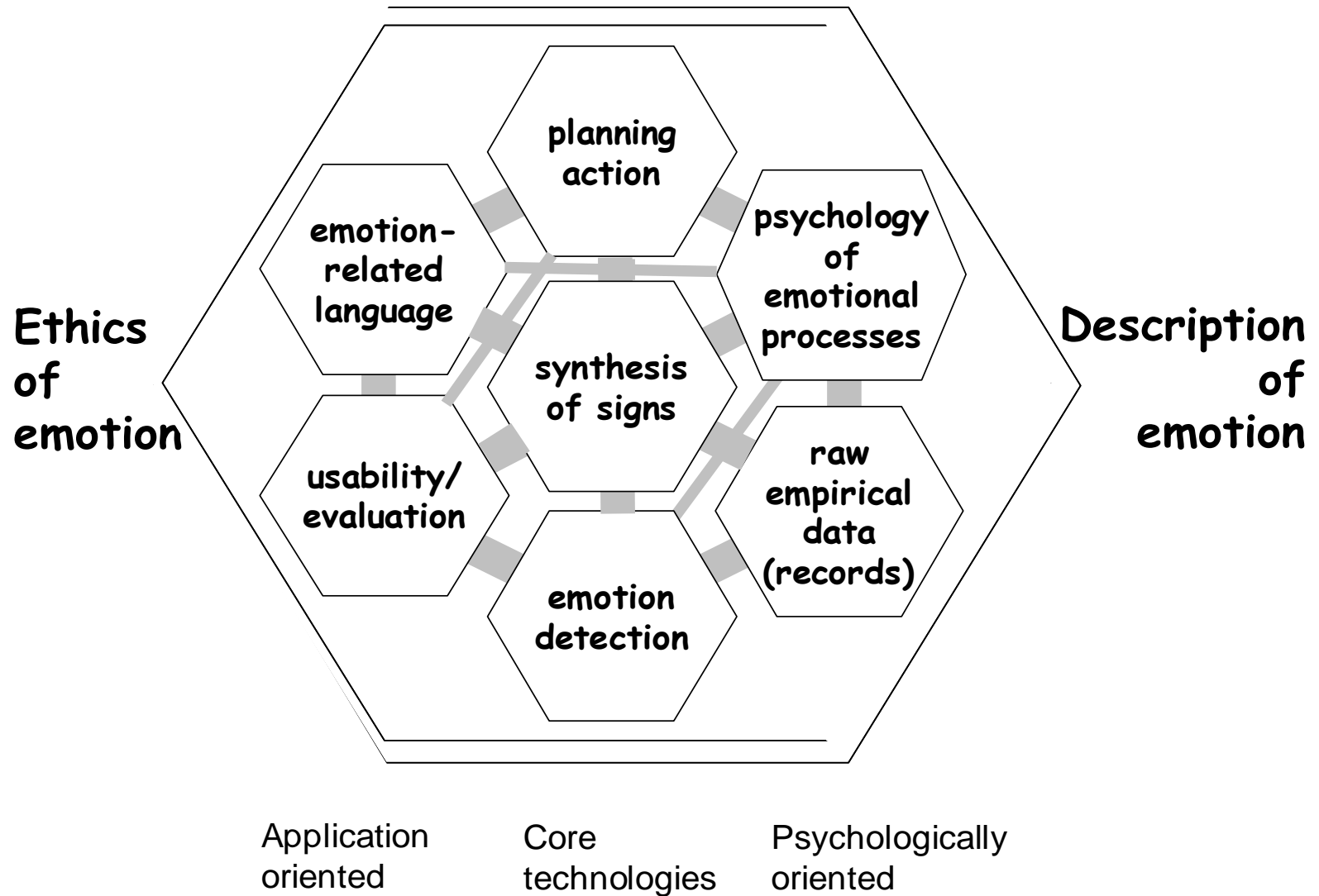
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- ◆ Network of Excellence, 01/2004 - 12/2007
- ◆ 33 partner institutions from many disciplines
- ◆ Building a community working jointly on emotion-oriented systems
 - ➔ phase 1: establish common language and research directions
 - ➔ phase 2: exemplars to show “how to do things in a principled way”
 - ➔ not an IP! We are not building systems!

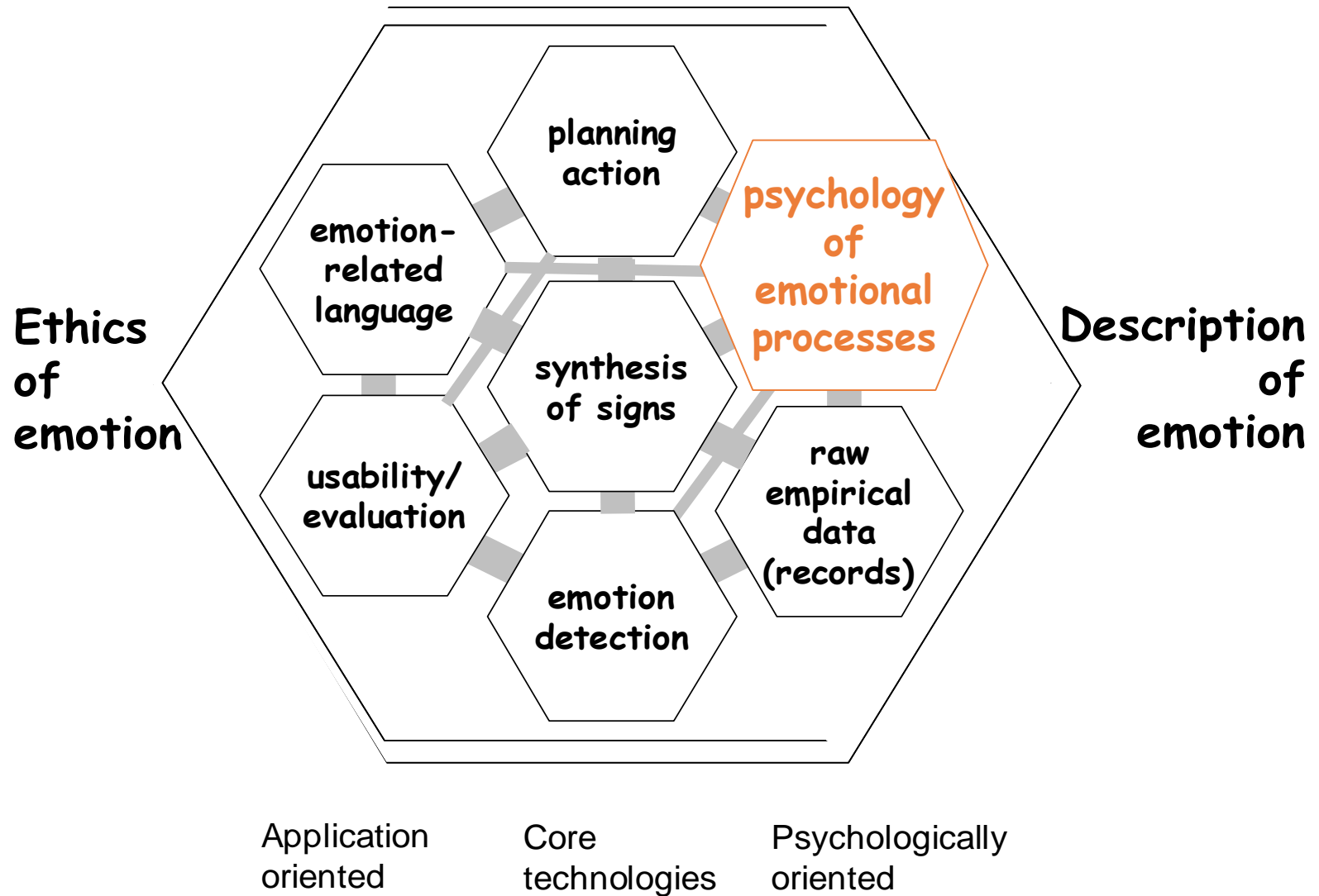
HUMAINE main deliverables

- ◆ A community!
- ◆ Joint awareness of suitable methods
- ◆ Scientific basis for making research cumulative (which it was often not in this area)

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Psychology of Emotion-oriented Processes

- ◆ terminological clarification: clear definition of “emotions”, “moods”, ...
- ◆ what to study: states that are relevant to emotion-oriented computing
- ◆ practically useful methods for describing emotional states

Defining types of affective states

<i>Design Features</i>	Intensity	Duration	Synchr- nization	Event focus	Appraisal elicitation	Rapidity of change	Behavior impact
Types of Affect							
Emotions: <i>angry, sad, joyful, fearful, ashamed, proud, elated, desperate</i>	●	●	●	●	●	●	●
Moods: <i>cheerful, gloomy, irritable, listless, depressed, buoyant</i>	●	●	●	●	●	●	●
Interpersonal stances: <i>distant, cold, warm, supportive, contemptuous</i>	●	●	●	●	●	●	●
Preferences/Attitudes: <i>liking, loving, hating, valuing, desiring</i>	●	●	●	●	●	●	●
Affect dispositions: <i>nervous, anxious, reckless, morose, hostile</i>	●	●	●	●	●	●	●

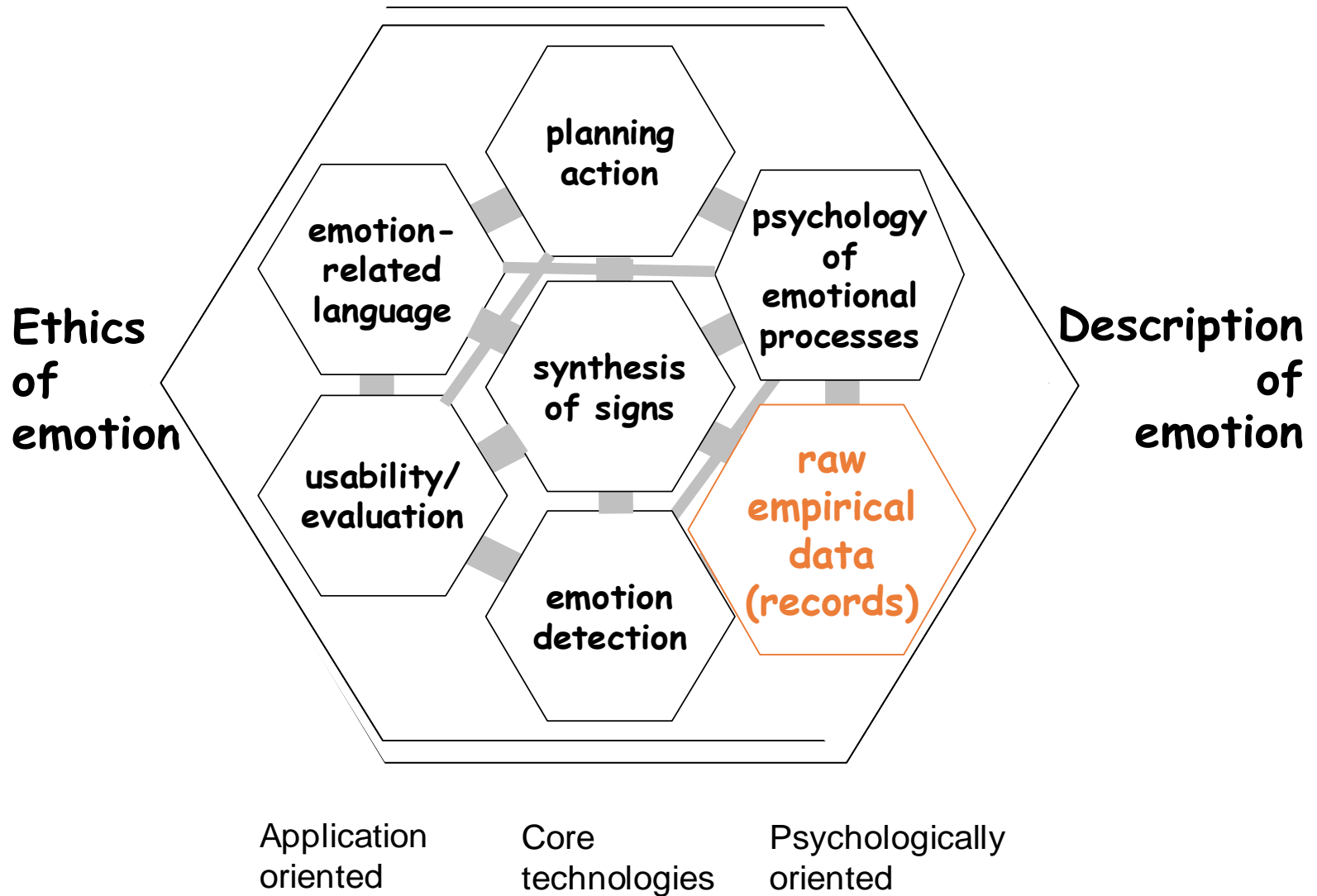
Scherer et al.,
Univ. Geneva

An empirical subset suitable for describing emotions in human-machine interaction

- ◆ Preliminary list of 55 terms, from HUMAINE summer school 2004, Belfast:

stress, annoyance, boredom, panic, impatience, disapproval, hot anger, anxiety, disappointment, fear, satisfaction, sadness, surprise, shock, amusement, worry, excitement, pleasure, cold anger, interest, effervescent happiness, nervousness, approval, embarrassment, distraction, disagreeableness, disgust, despair, indifference, neutrality, hurt, friendliness, weariness, relief, confidence, contentment, shame, contempt, affection, sympathy, relaxation, mockery, pride, resentment, calm, guilt, jealousy, determination, serenity, coldness, cruelty, hopeful, wariness, greed, admiration

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Emotions in Empirical Data (1)



Acted emotion
Bänziger et al.,
Univ. Geneva



Emotion induction
Sensitive Artificial Listener
Douglas-Cowie et al.,
Queen's Univ. Belfast

Emotions in Empirical Data (2)



Emotional episodes
from TV
Martin, Devillers et al.,
LIMSI, Paris

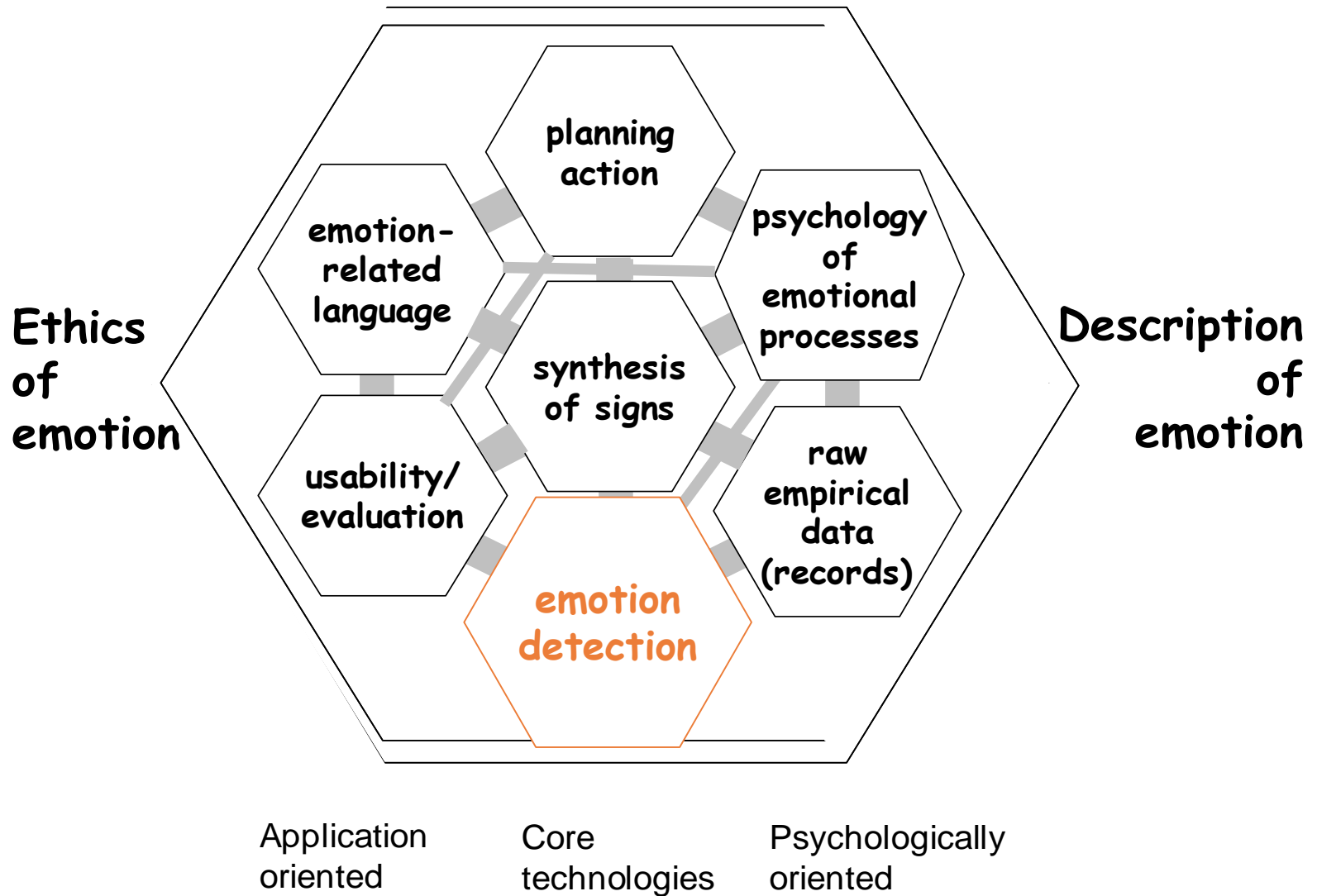


Emotion in action
Performing physical tasks
Sneddon et al.,
Queen's Univ. Belfast

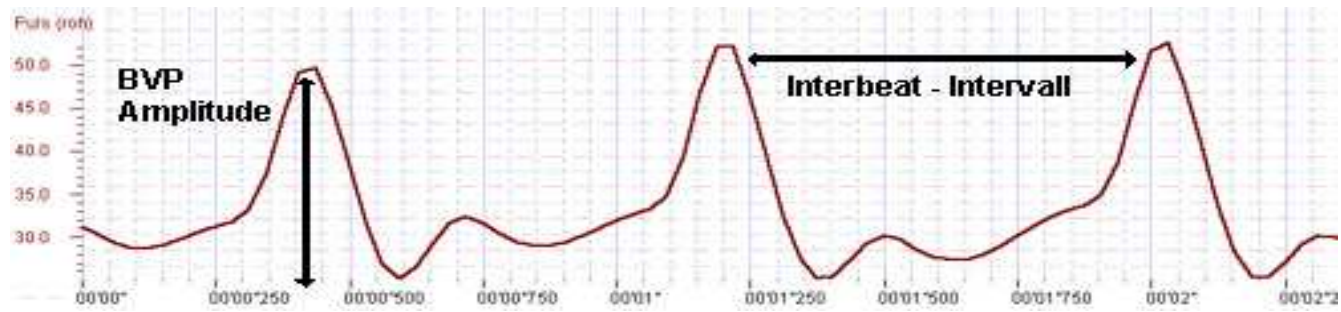
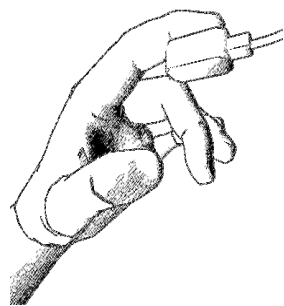
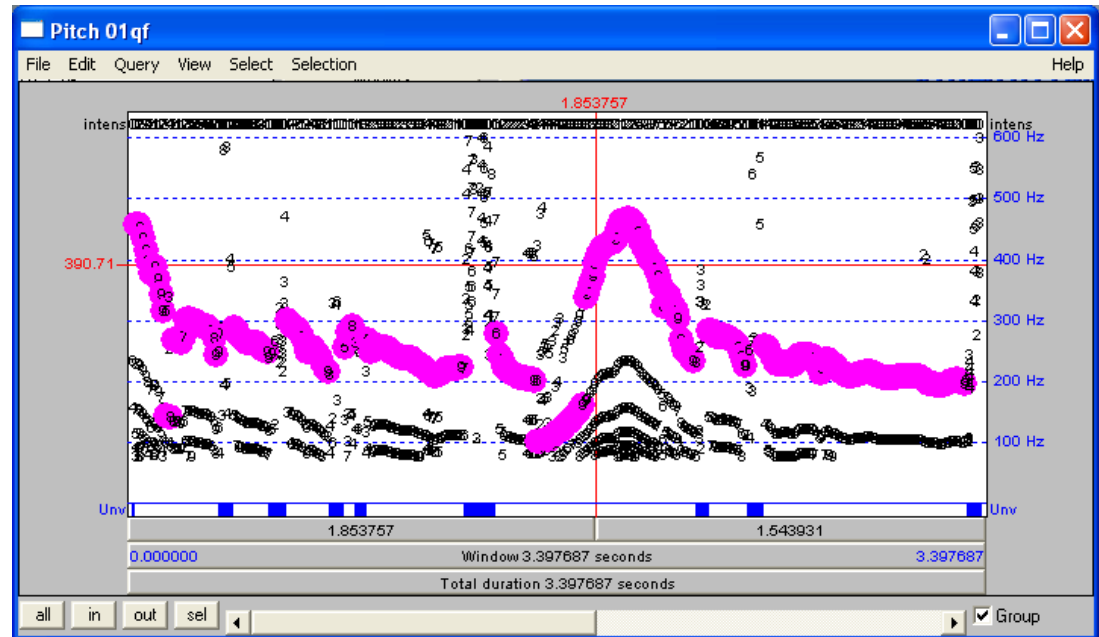
Emotions in Empirical Data

- ◆ “supportive” data
 - ➔ to fill in gaps in theory
- ◆ “provocative” data
 - ➔ to challenge preconceptions

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Emotion Detection: Multimodal Features



Emotion Detection: Selected Challenges

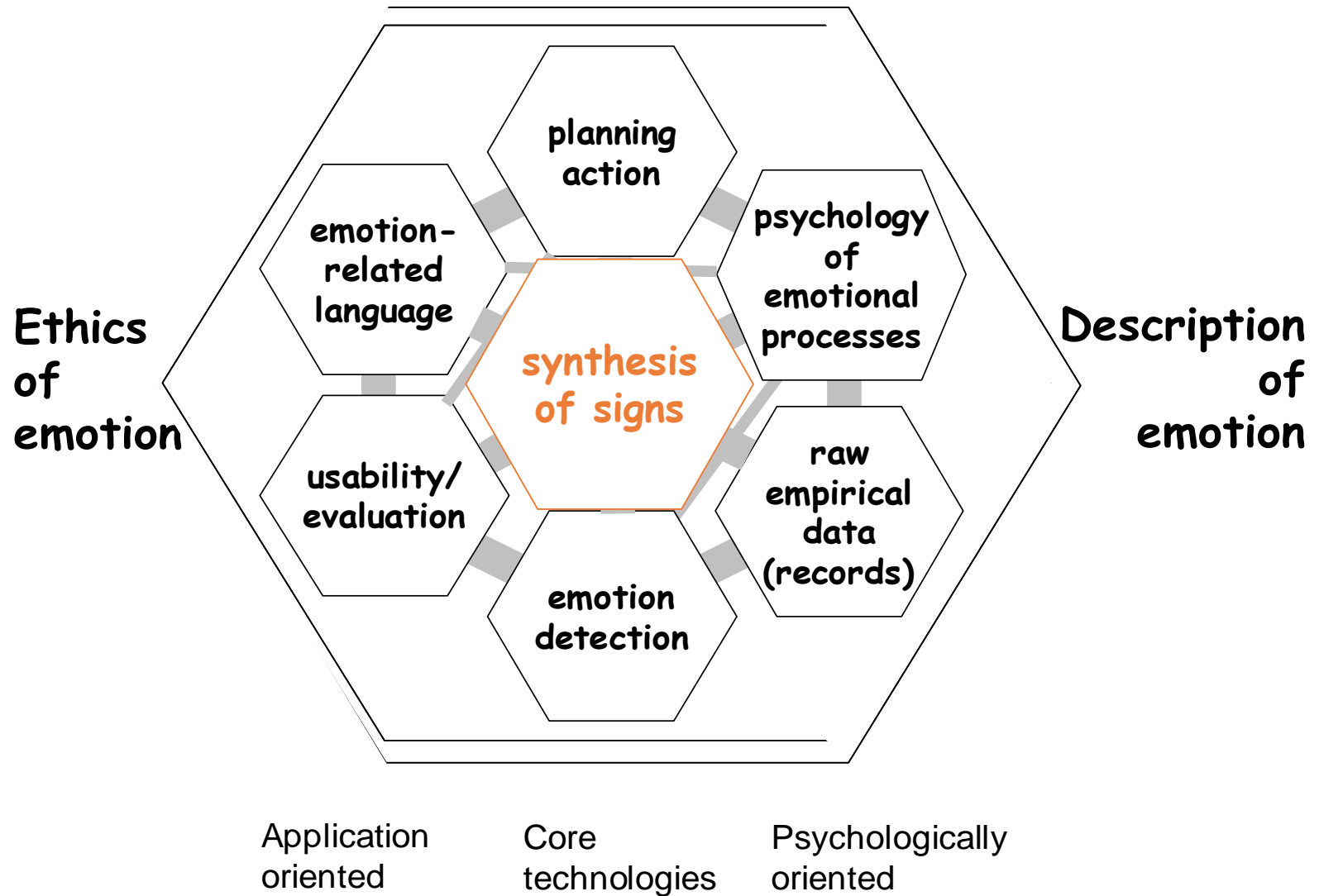
◆ Integration of modalities

- ➔ different time scales for analysis
 - face = still pictures
 - voice = discrete chunks on time scale
 - physiology = slow, continuous variation over time

◆ Measure of success?

- ➔ same errors as humans?
 - dialogue system
- ➔ more accurate than humans?
 - stress detection

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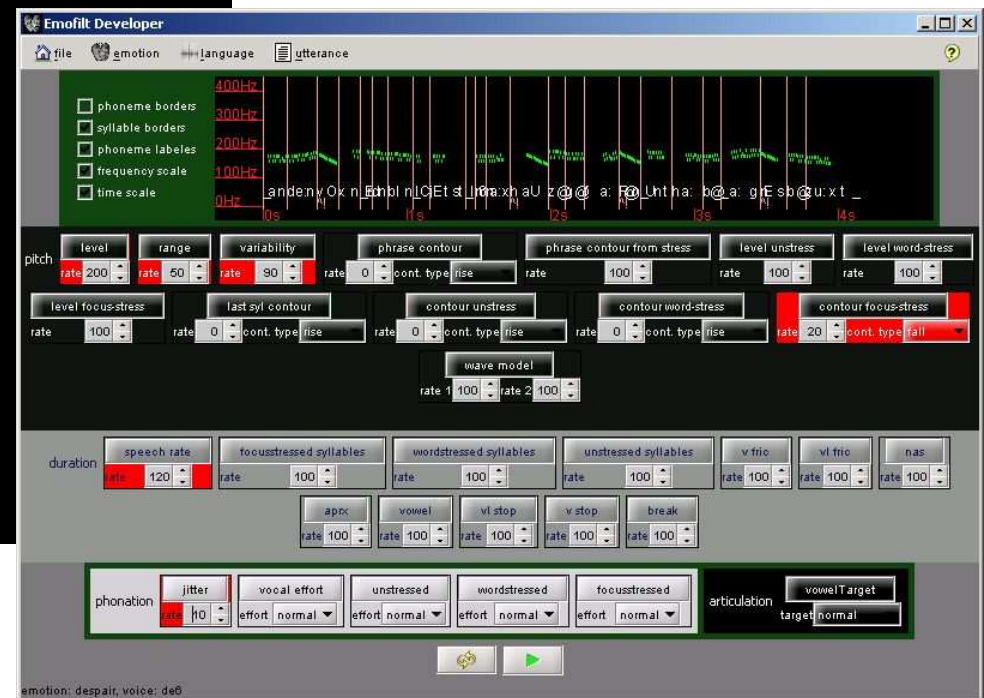


Synthesis of Signs of Emotion: Parametrisable Models of Body, Face and Voice



Greta agent
Pelachaud et al.,
Univ. Paris 8

Emofilt speech synthesis filter
Burkhardt, T-Systems



Synthesis of Signs of Emotion

- ◆ make embodied conversational agents (ECAs) behave emotional
 - ➔ required key capabilities:
 - Coordination of signs in multiple modalities
 - Expressivity
 - Cognitive influences on action (attention model)
 - Creating affective awareness
 - Backchanneling
 - ➔ specify architecture requirements
 - ➔ towards proof-of-concept sub-systems

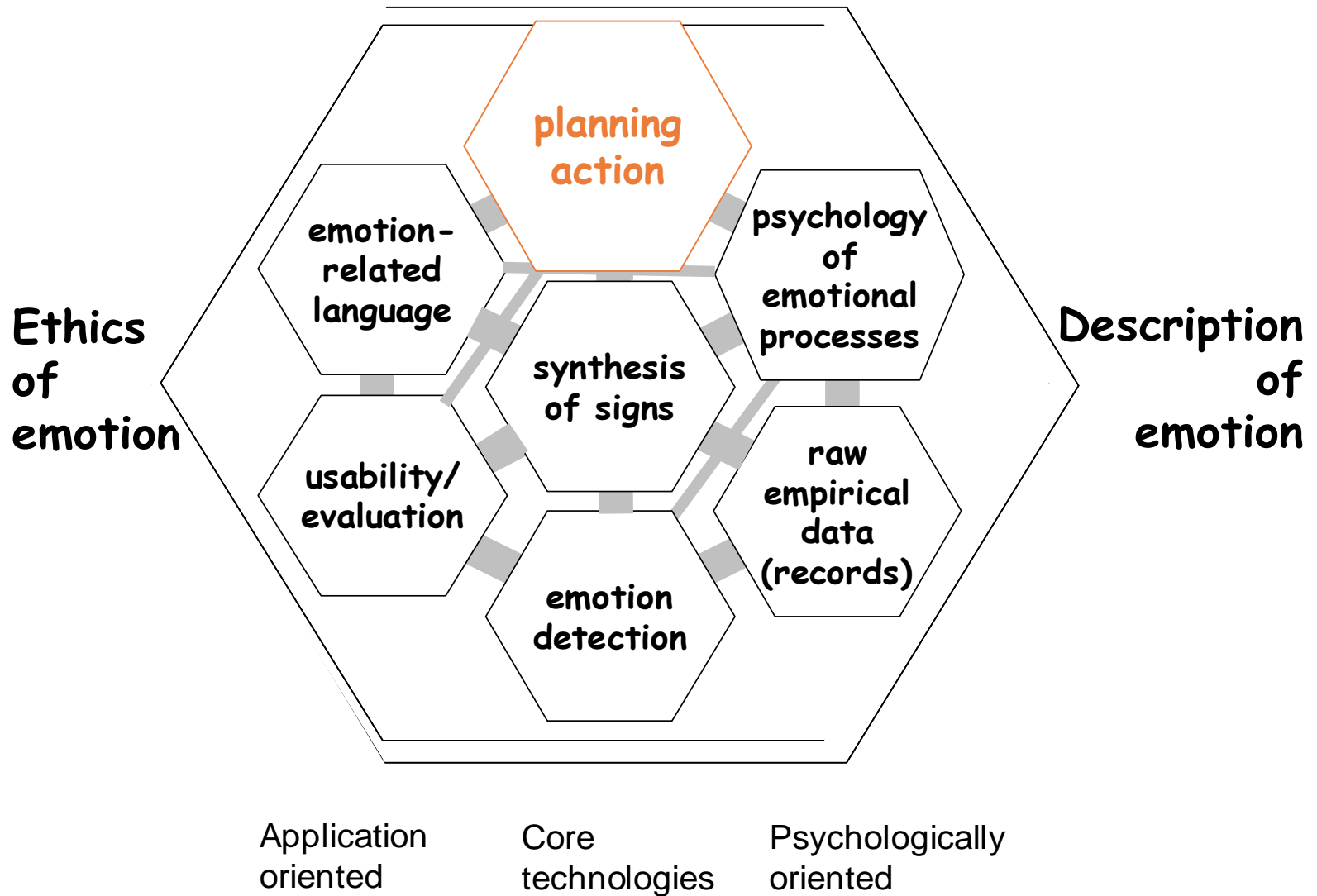
Attention modelling for ECAs

- ◆ crucial for initiating and maintaining communication
- ◆ visual salience
 - ➔ contrast, color, ...
 - ➔ faces
 - ➔ emotional expressions



Peters et al., Univ. Paris 8

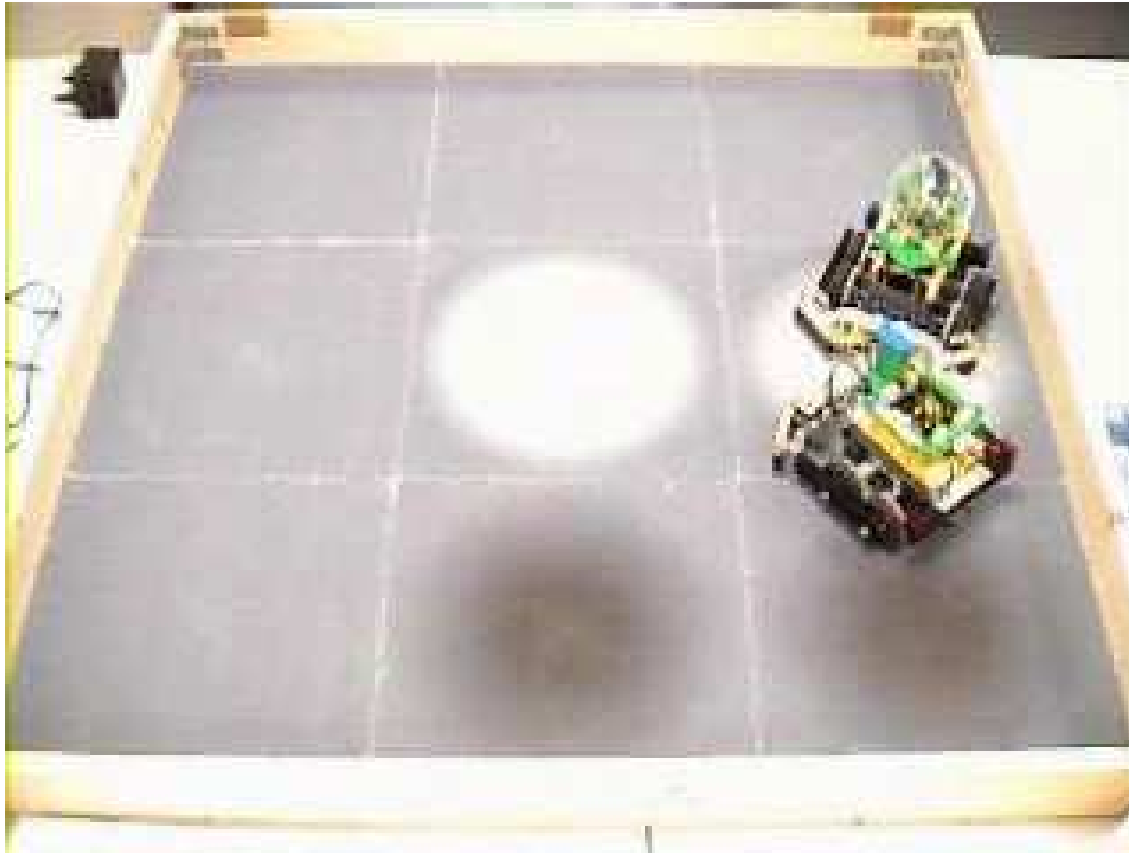
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Emotion in Planning and Action

- ◆ conceptual “blueprint” description of an affectively competent agent
- ◆ practical work with cognitive systems
 - ➔ low-level / sub-symbolic / reactive
 - ➔ high-level / symbolic / deliberative
 - ➔ hybrid

Low-level perception-action loop: Emergent “aggression”



Cañamero et al.,
Univ. Hertfordshire

- robots need two resources to survive
- wander around avoiding objects
- blue robot: bumper sensitivity reduced when deficit too large
- resulting behaviour: pushing the other away from resource
- ethological analysis: “aggressive” behaviour

Low-level perception-action loop: Imprinting a “desired perception”



K. Lorenz



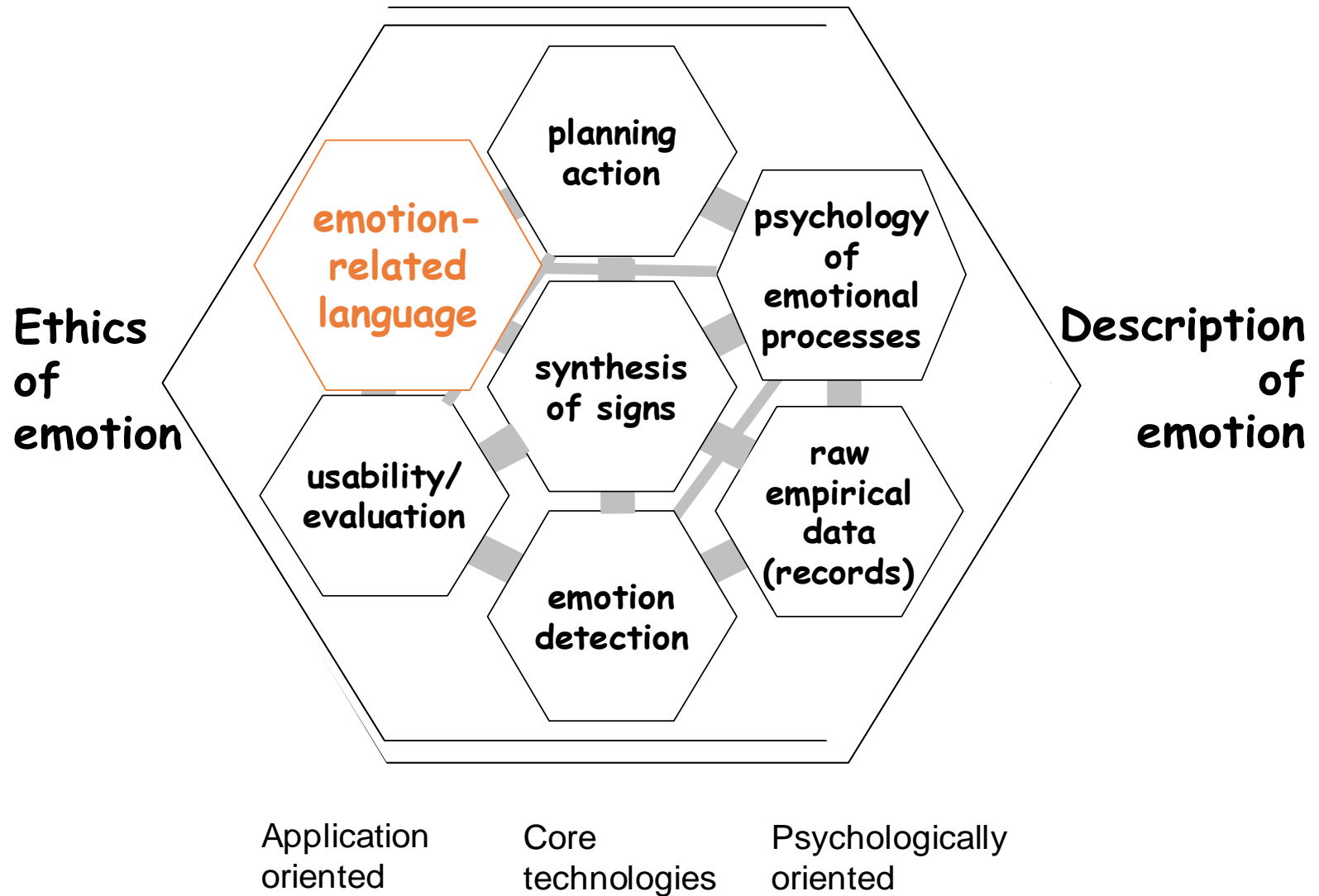
- Imprint visual perception of “optimal” box distance
- Robot will follow box in this distance, goal = re-establish desired perception

Blanchard &
Cañamero,
Univ.
Hertfordshire

High-level: Emotions in BDI models

- ◆ Reasoning about emotions
 - ➔ *interpret* emotional impact of previous dialogue move
 - ➔ *guess* possible emotional impact of next dialogue move
- ◆ Based on an appraisal model (e.g., OCC)
 - ➔ link events to emotional meaning

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Emotion in Language and Persuasion

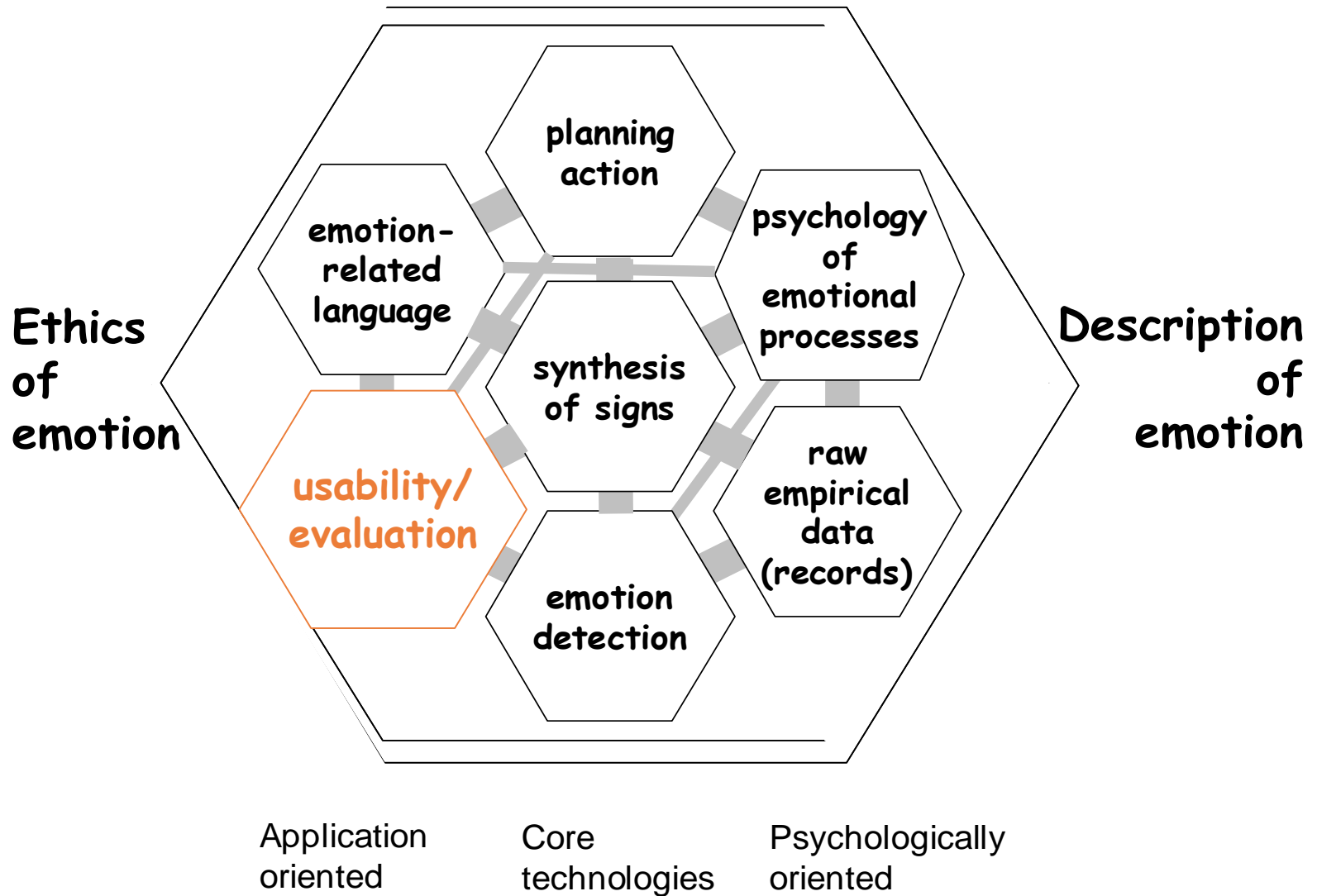
- ◆ closest to applications
- ◆ exploratory work
 - ➔ automatic generation of potentially funny slogans
 - playing with semantic ambiguities in language
 - human has to decide which slogans are funny
 - Example: slogan for soft drinks:
“Thirst come, thirst served!” (Stock et al., itc-IRST)
 - ➔ persuasive ECA communication
 - politeness
 - lying behaviour

Generating lying expressions in an ECA



GAMBLE dice game
Rehm et al.,
Univ. Augsburg

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Usability of Emotion-oriented Systems

- ◆ existing usability criteria do not apply
 - ➔ e.g., control, predictability, transparency
- ◆ Develop criteria and methods to evaluate affective interaction systems
 - ➔ “sensual” feedback methods
 - ➔ Wizard-of-Oz studies
 - ➔ extended think-aloud protocol

“Sensual” feedback methods for usability testing

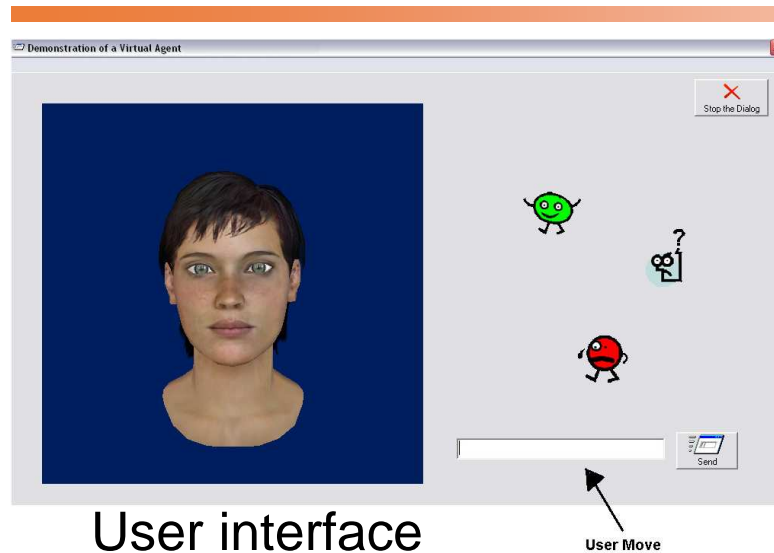
SenToy puppet
Paiva et al., INESC-ID



Colour and shape
Höök et al., KTH

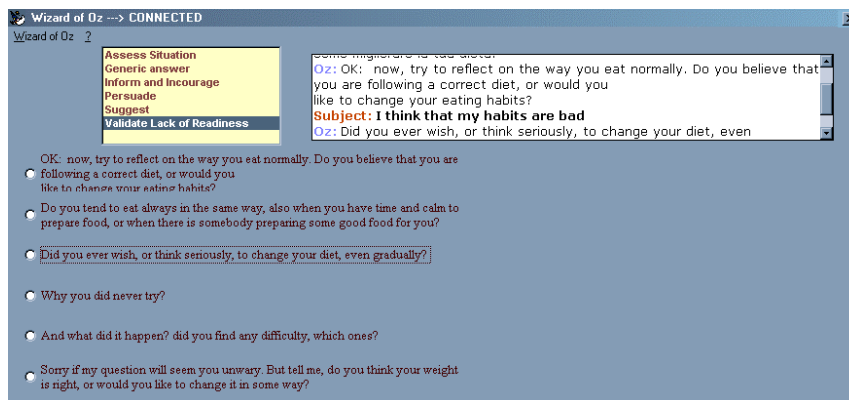


WoZ method: ECA-based dialogue



User interface

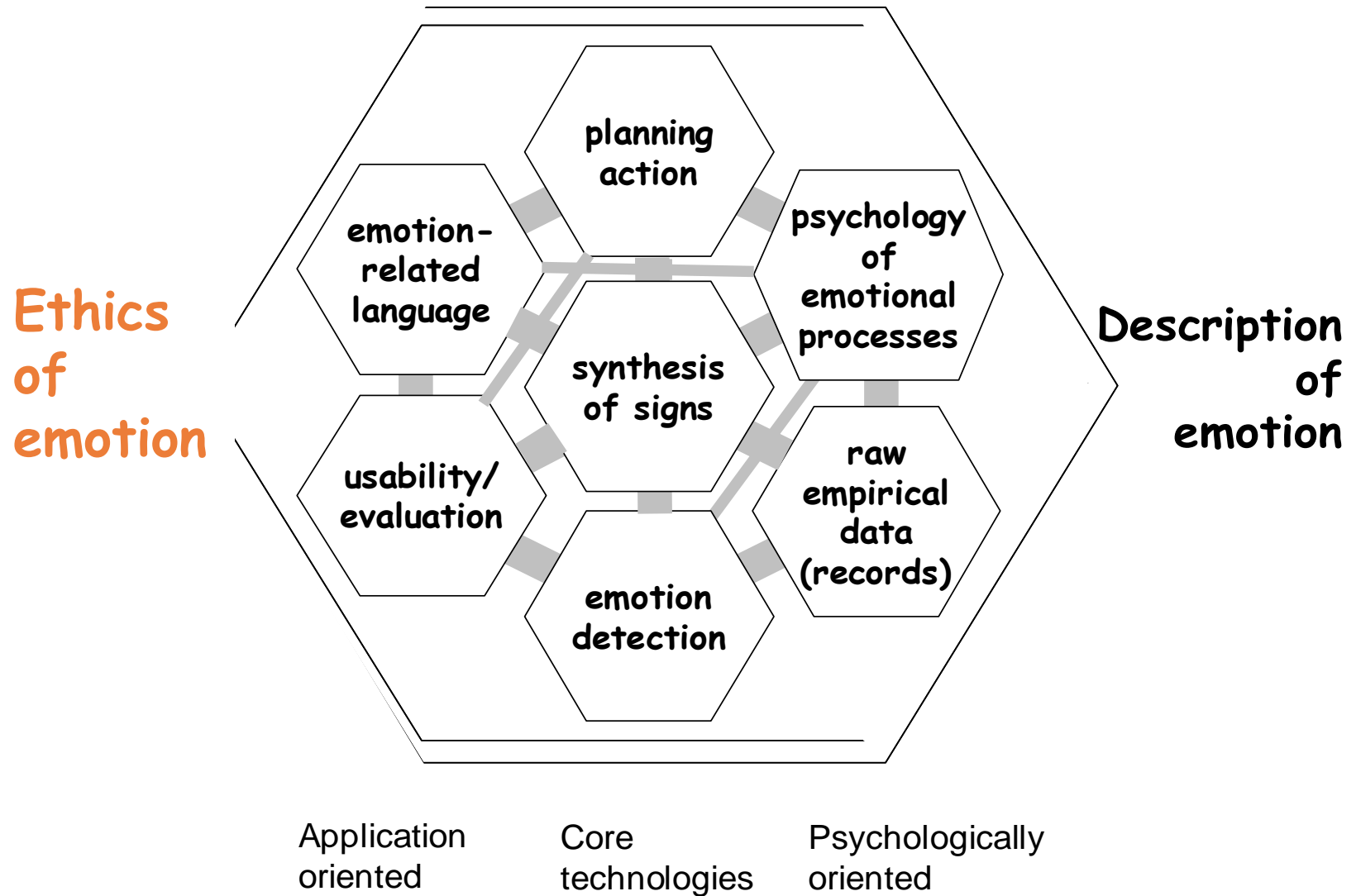
de Rosis et al.,
DI-BARI



Wizard interface

- study user behaviour
- user-centered design loop
 - design->test->redesign
- explore affective interaction
 - social relationship / empathy

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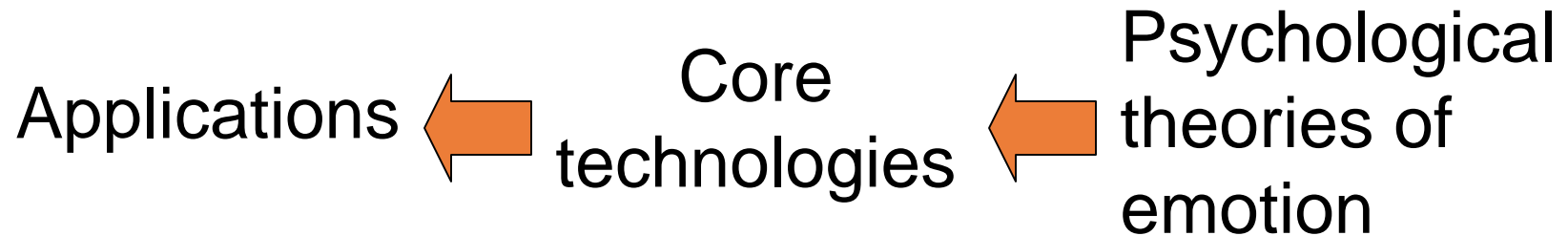
Ethics in HUMAINE

- ◆ Data collection: emotional data is sensitive
- ◆ Potential abuse of emotionally competent systems
 - ➔ automatic persuaders
 - ➔ surveillance systems
 - ➔ ...
- ◆ Address ethical issues proactively

Ethics in HUMAINE

- ◆ Ethics research is new to this community
 - ➔ unrealistic to formulate a closed set of criteria
 - ➔ approach: “Principlism” (Beauchamps & Childress, 2001)
 - ➔ Four Level Model
 - nonmaleficence, autonomy, beneficance, justice
 - universally shared ethical standards
 - relies on “seeing things right”
- ◆ Install ethical committee
 - ➔ because every case is different

Conclusions



- ◆ Working on these different levels
 - ➔ removing obstacles in cooperation (“make things fit together”)
 - ➔ building basis for future work
 - ➔ suggesting sensible research agendas

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Research on Emotions and Human-Machine Interaction

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This is the portal website of the [Network of Excellence HUMAINE](#), targeted to become a key resource in an exciting research area: emotions and human-machine interaction.

To learn more about HUMAINE, take a look at our [goals](#) and [partners](#), as well as our [press summary](#). Interesting content is building up in the [deliverables](#) section and in our "[know-how melting pot](#)" [wiki](#).

Foreseen Application of the day

Persuading machine

(by [Marc Schröder](#))

An ethically questionable application, targeted towards changing the user's emotions or attitudes. This has obvious attractions for sales and politics. Ethical guidelines will need to be established to make sure users are not subjected to skilled persuading machines with no conscience but infinite patience.

[Read comments on this foreseen application.](#)
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Contribute!

Researcher of the day



Christopher Peters
[University of Paris 8 ECAs](#)

Key research interests:

Real-time computational models of perception, attention, memory and emotion to act as animation controllers for virtual human behaviour, gaze in particular. Application of such models to initiation and control of social interactions between multiple ECAs.

[Learn more about Researcher of the day.](#)
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