VIRTUAL SOCIAL INTERACTIONS

5th Edition
30 June – 1 July
ONLINE!

Memory slices by Anna Strasser

DISCLAIMER: JUST MEMORIES – AIMING FOR CORRESPONDENCE WITH REALITY BUT CANNOT GUARANTEE IT.

DAY 1

Keynote: Leo Schilbach

Paper Session 1 : Social Perception, Evaluation & Interaction

Giusy Cirillo

Barbara Müller

Evelien Heyselaar

Poster Session 1

Paper Session 2 : Social Cues & Methods of Research

Lorenzo Parenti

Bryony Buck

Pablo Arias

Paper Session 3: Behavioural and Brain Responses to Artificial Agents

Laura Schmitz

Ann Hogenhuis

Artur Czeszumski

Keynote 2: Kerstin Dautenhahn

Paper Session 4: Paralinguistic Cues

Weronika Trzmielewksa

Peter McKenna

Carolyn Saund

Behavioural and neural mechanisms of social interaction:

New developments in social neuroscience & implications for the study of psychiatric disorders

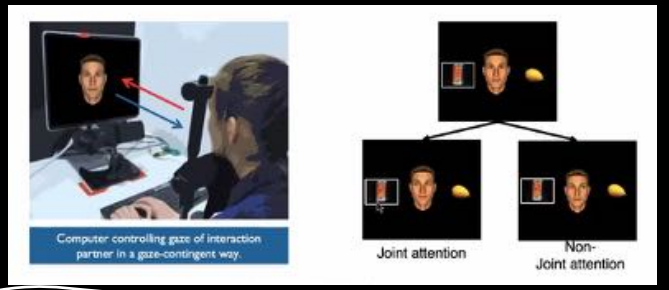
Leo Schilbach

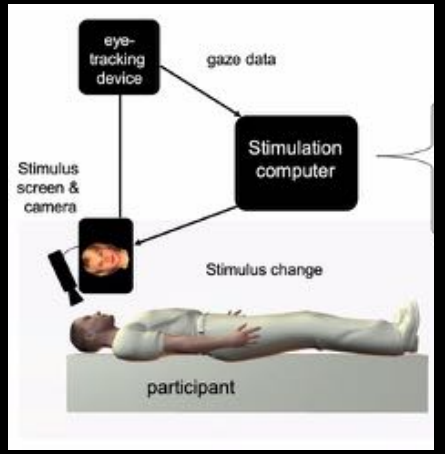
1. Why study social interactions → 2nd person neuroscience/neuropsychiatry
   - social cognition from an interactor's versus from an observer's point of view

Social cognition is fundamentally different when we are emotionally engaged with others, in direct social interaction with rather than merely observing them!

2. Interaction-based phenotyping → behavioral mechanisms of social interaction

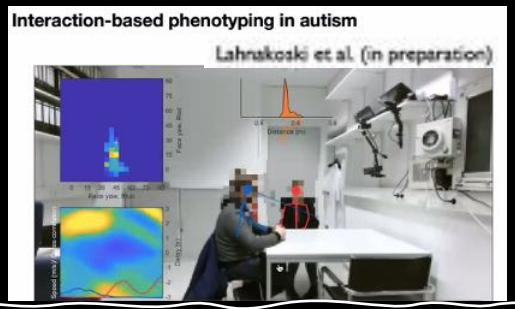
3. The social brain in interaction → neural mechanism of social interaction
   - closing the loop in the skanner: gaze-contingent stimulus
   - simulating social gaze





4. Disorders of social interaction → translating 2nd person approach to psychiatry

Orienting toward communication partner is reduced in autism & correlates with ADOS score



KEYNOTE 1

Paper Session 1 : Social Perception, Evaluation & Interaction

1. Giusy Cirillo
   - Aix-Marseille Université (France)
   - Using social robots to explore between-participant conceptual alignment in joint word production
2. Barbara Müller
   - Radboud University Nijmegen (Netherlands)
   - Non-verbal mimicry decreases resistance during interactions with intelligent virtual agents
3. Evelien Heyselaar
   - Radboud University Nijmegen (Netherlands)
   - Linking theory of mind in human-agent interactions to validated evaluations

Giusy Cirillo

Using social robots to explore between-participant conceptual alignment in joint word production

humanoid robots → interesting tool for linguists & (neuro)psychologists to investigate the dynamics of speech processing in conversation

- controlled experimental setting

experiment 1:

- human & robot: joint picture-naming task / conceptual alignment
  - robot gives an unexpected name → participants aligned with the conceptual choices of the robot
  - occurred very rapidly →automatic adaptation to the robot's atypical responses

experiment 2:

- EEG: to investigate conceptual alignment in terms of adaptative prediction
- potential decrease in amplitude for ERP components related to prediction violation (e.g., N100, N400) over the course of the task.

Barbara Müller

Non-verbal Mimicry Decreases Resistance During Interactions with Intelligent Virtual Agents

Do people evaluate an IVA more positively when this agent non-verbally mimics its interaction partner?

PROBLEM

virtual reality (VR) with intelligent virtual agents (IVA) can make people feel threatened → defensive responses & increase of undesirable behavior (psychological reactance) → less pleasant interactions

SOLUTION

make the IVA behave in a very human-like way → mimicry of head movements in human-IVA interactions

EXPERIMENT

- photograph description task
  - *mimicry condition:* experimenter controlled the movements displayed by the agent & made the IVA imitating the participants
  - *non-mimicry condition:* participants interacted with an agent that exhibited a pre- programmed set of movements

RESULTS

- non-significant for participants' ratings of the IVA's Trustworthiness and Disbelief,
- participants in the Mimicry condition found the IVA more convincing
- participants in the Mimicry condition felt less resistance towards the IVA

NON-VERBAL MIMICRY CAN BE USED TO IMPROVE VR APPLICATIONS AND CAN POSITIVELY INFLUENCE THE EVALUATION AND BELIEVABILITY OF IVAS WHEN INTERACTING WITH HUMANS WHILE DECREASING HUMAN RESISTANCE.

Evelien Heyselaar

Linking theory of mind in human-agent interactions to validated evaluations

QUESTION

Which characteristics contribute significantly to creating a truly human-like social agent?

PROBLEM: no validated questionnaires to measure constructs

- review study:189 individual constructs (Fitrianie et al., 2020)

→ difficult to compare agents that are being used in different studies
→ more difficult to conduct replication studies
→ impossible to conduct meta-analyses

SOLUTION:
Theory of Mind task to measure the implicit social behavior users exhibit towards a virtual agent.

→ human-human social ToM task showing behaviorally and via fMRI that this task taps into ToM networks

Referential communication game
(Vanlangendonck et al. 2018)

RESEARCH QUESTIONS

1. *Can the social ToM task be adapted for use with a virtual partner?*
   - participants adapt towards the virtual agent more than when they conduct the task alone = similar to the human-human version

2. *Can we use the performance in this task to identify which validated constructs tap into this implicit measurement?*
   - correlate 7 validated constructs to the performance in the ToM task

   → current results do not correlate significantly to the existing constructs

Paper Session 2 : Social Cues & Methods of Research

1. Lorenzo Parenti
   Istituto Italiano di Tecnologia (IIT; Italy)
   - Virtual cues can be social cues: insights from a social decision-making paradigm
2. Bryony Buck
   University of Nottingham (UK)
   - Virtual communication behaviour with and without hearing impairment
3. Pablo Arias
   Lund University (Sweden)
   - Influencing romantic decisions with real time smile transformations

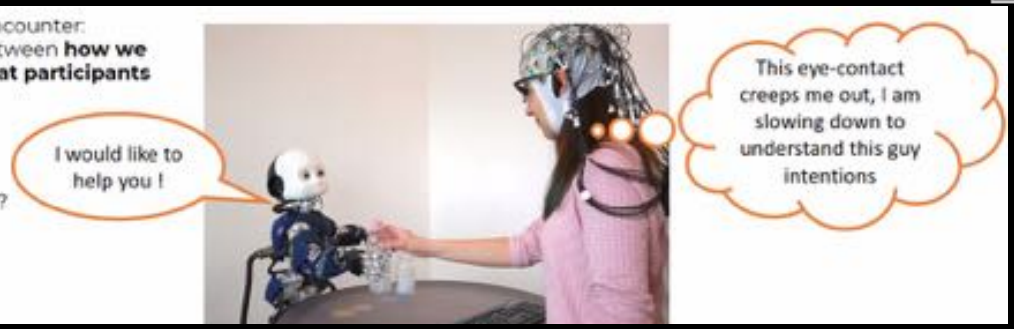
Virtual cues can be social cues: insights from a social decision-making paradigm

Lorenzo Parenti

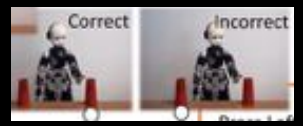
Why **Humanoid Robots in SDM** ?
- interactive and controlled settings;
- reproducible and generalizable exp.

But.. how to perceive a Robot as a social partner and which features can affect our decision processes?

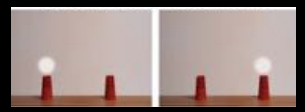
Issue we can encounter: discrepancy between **how we design** and **what participants perceive**



Cupes & ball experiments online (CUBA)

1. 

social cues with iCube

2. 
non-social cue control

3. 
human control

Different trends

Human and Robot conditions:
Slower when social feedback is present
Compared to Flashlight conditions

Non Social Cues means
that there are no incongruent or
congruent trials with feedbacks

Less cognitive conflict
Less cognitive load related to social stimuli

FUTURE RESEARCH

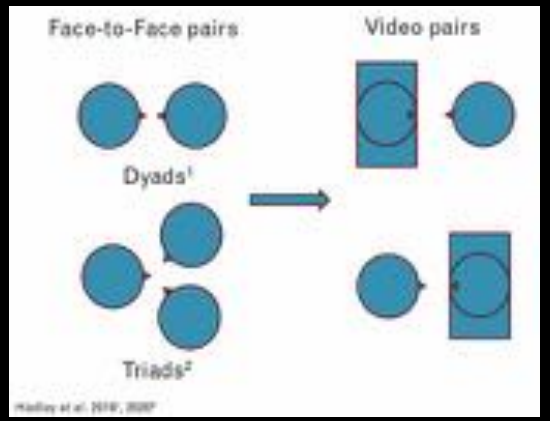
identifying social deficits & specific phenotypes in clinical populations
→ neural substrates: psychophysical tools (EEG / fNIRS / GSC)

Virtual Agents based on iCub appearance

Screen based or...
Virtual, Mixed and Augmented Realities

Virtual communication behaviour with and without hearing impairment

Bryony Buck



Data Capture

- Experimenter Screen capture (Skype, OBS)
- Independent speaker face detection
  (OpenFace Analysis Toolkit: - Bal)
- Single-channel audio data
  (pyannote-audioananlysis: Bredin et al.)

Very little known about HL experiences with virtual interaction

virtual communication hypotheses

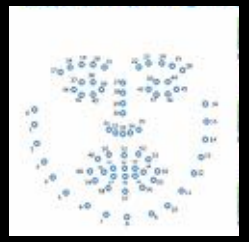
Visual Cues will be more important to HL than to NH

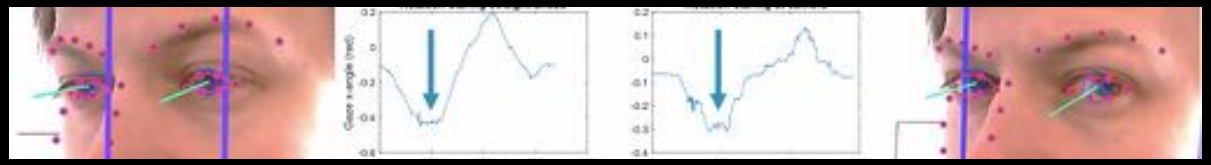
HL pairs will demonstrate different speaking patterns to NH

NH more likely to look away when speaking

HL more likely to watch conversation partner when listening

Speaking and head movement patterns may vary
- goal/type of conversation
- increasing familiarity/conversation order





Pablo Arias

Influencing romantic decisions with real time smile transformations

Social Interactions — Expressive alignment

Imitation

Innate (?)	Meltzoff and Moore, 1983
at least **very early**	Oostenbroek, 2016
Learning by copying	Frith & Frith 2012
Using objects	Meltzoff, 1985
Language acquisition	Kuhl and Meltzoff, 1996
Motor Skills	Meltzoff, 1985
Unconscious	Dimberg et al., 2000
Multimodal	Arias, Belin & Aucouturier, 2018

Alignment

Accents	Giles, 1973
Speech Rate	Street Jr, 1984
Vocal intensity	Natale, 1975
Mannerisms	Cheng and Chartrand, 2003
Foot taping	
Face touching	
Emotional states	Neumann and Strack, 2000

Social Interactions — Expressive alignment

Previous research

Research confederates (imitate participants)

Chartrand, Tanya L and John A Bargh (1999).

→ **Smooth interactions**

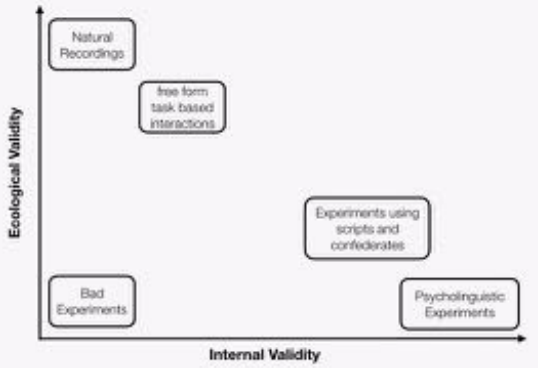
→ **Liking between interaction partners**

→ **Not free conversations**

→ **Not ecological**

→ **What are the cognitive mechanisms?**

Social Interactions — Expressive alignment



Atwood, J. (2013). **A multidimensional activity based approach to communication.** Alignment in Communication. Amsterdam: John Benjamins, pp 33-55.

Paper Session 3: Behavioural and Brain Responses to Artificial Agents

1. Laura Schmitz
   Aix-Marseille University (France)
   - Taking turns (with a computer): Joint goals affect attentional orienting
2. Peter McKenna
   Heriot-Watt University (UK)
   - An online investigation of the effects of autistic traits and cultural orientation on robot expression interpretation
3. Artur Czeszumski
   University of Osnabrück (Germany)
   - Coordinating with a robot partner affects action monitoring related neural processing

Laura Schmitz:

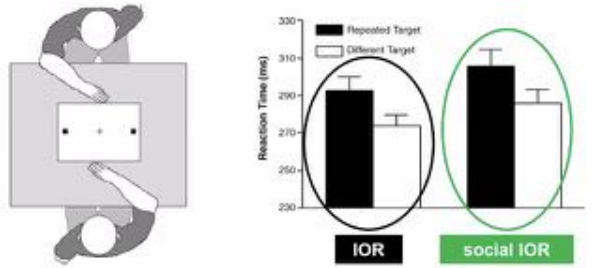
Taking turns (with a computer): Joint goals affect attentional orienting

How do joint goals affect attentional orienting in social interactions?

Inhibition of return (IOR):

Responses to a location previously acted upon take longer than responses to an alternate location. (e.g., Posner & Cohen, 1984; Klein, 1988)

Social
Inhibition of return



Figures borrowed from: Cole et al., (2019). The role of transients in action observation. *AP&P, 81*(7), 2177-2191.; Welsh et al. (2005). Does Joe influence Fred's action?: Inhibition of return across different nervous systems. *Neuroscience Letters, 385*(2), 99-104.

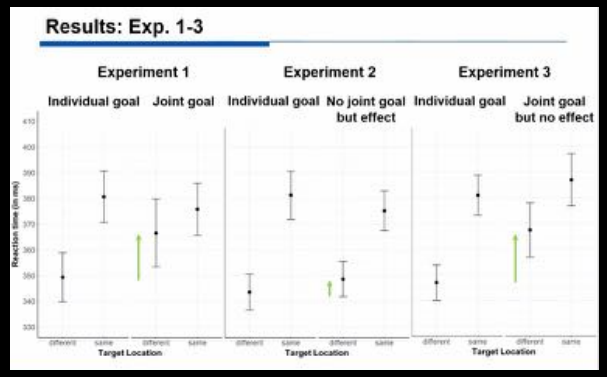
Introducing a joint goal

Now you and your virtual partner will be ***working together*** *towards a* ***joint goal****.*

Your joint goal is to ***turn the target green*** *by* ***blending your two colors*** *(yellow and blue).*
To achieve this goal, you ***move to the same target*** *to which your partner moved just before you.*

YELLOW + BLUE = GREEN

Results: Exp. 1-3



If co-actors have the joint goal of moving to the same location, responses to a different location are slowed down.

The perceptual effect *alone* leads to a reduced modulation, suggesting that the presence of a joint goal matters.

The joint goal *alone* leads to a modulation of similar size as in Exp. 1, suggesting that the perceptual effect is not necessary.

The present findings suggest that **having a joint goal…**

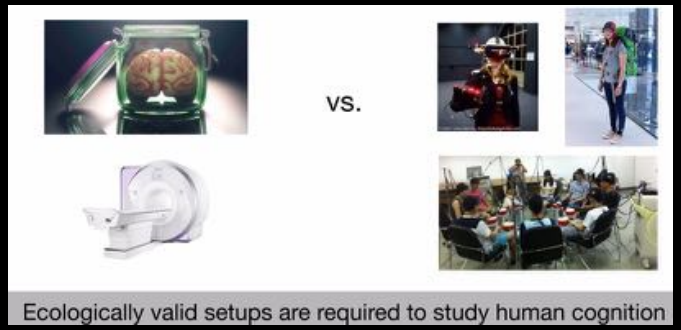
– even if it's very abstract and without apparent effect

and if the co-actor is a computer program –

… affects people's basic attentional / response behavior.

Coordinating with a robot partner affects action monitoring related neural processing

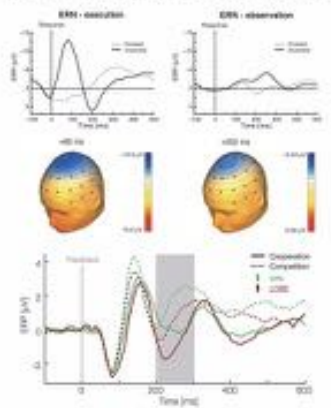
Artur Czeszumski



Ecologically valid setups are required to study human cognition

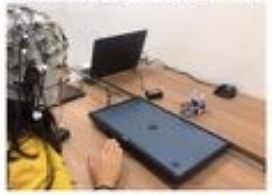
Introduction Methods Results Discussion

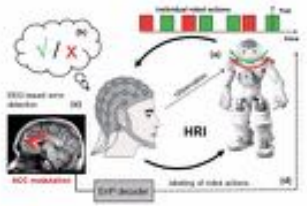
Neurophysiology of joint actions



Van Schie 2004, Czeszumski 2019

Human-Robot Interactions



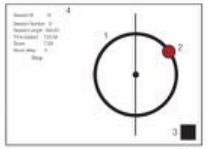


Hinz 2021, Ehrlich 2019

Action monitoring is crucial for joint actions

Introduction **Methods** Results Discussion

- 12 human participants
- YuMi robot
- 64 EEG electrodes
- Sonification
- 2x2 design
- Perturbations
- Event-related Potentials (ERP)



Human - Robot

Human - Human

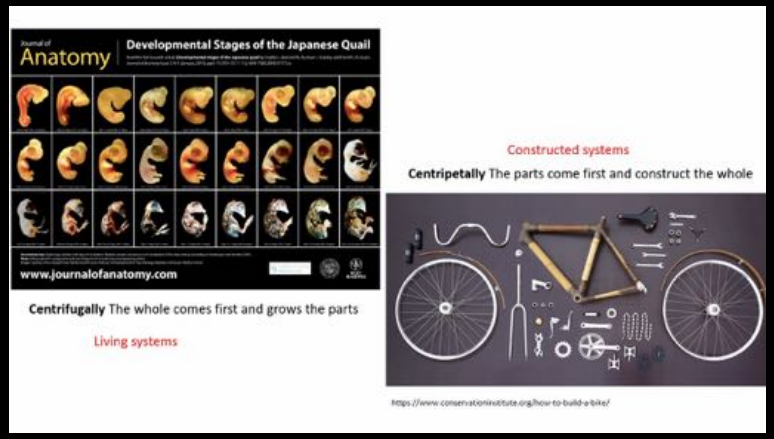
Dynamical collaborative task used to study ERP

What is embodiment?
And why is it special to work with physically embodied agents and robots?

Kerstin Dautenhahn

Summary of notions of embodiment

- (1) *structural coupling* between agent and environment,
- (2) *historical embodiment* as a result of a history of agent environment interaction,
- (3) *physical embodiment*,
- (4) *'organismoid' embodiment*, i.e. organism-like bodily form,
- (5) *organismic embodiment* of autopoietic, living systems , and finally
- (6) *social embodiment*.

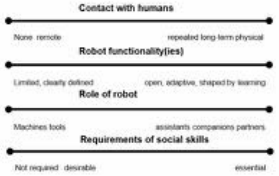


KEYNOTE 2

Minimal Definition of Embodiment: Mutual Perturbation

- *A system **X** is embodied in an environment **E** if perturbatory channels exist between the two. That is, **X** is embodied in **E** if for every time **t** at which both **X** and **E** exist, some subset of **E**'s possible states with respect to **X** have the capacity to perturb **X**'s state, and some subset of **X**'s possible states with respect to **E** have the capacity to perturb **E**'s state.*

How Social? A matter of degree Different degrees of social embodiment?



Behaviours that were most important in communicating intention

- Participants' open-ended questionnaires responses (classified and coded) suggest that the single most referenced behaviour was **gaze** and **head movement**.
- Participants' rating in Likert scales (1: Absolutely Not Important, to 5: Very Much Important) of the items also indicates that Head Movement was the most important in communicating intention.
- The result highlight the importance of gaze as a means to disambiguate deictic communication.

Category	Responses	
	Number	Percentage
Gaze	10	62.5
Head Movement	8	50
Body Movement	3	18.8
Feedback	5	31.3
Lights	4	25

Item	Mean	SE	Median
Head Movement	4.88	0.09	5.00
Lights	2.75	0.42	2.50
Body Movement	3.47	0.36	4.00
Movement Synchronisation	3.31	0.25	3.00

Paper Session 4: Paralinguistic Cues

1. Weronika Trzmielewksa
   University SWPS, Warsaw (Poland)
   - Mimicking a virtual "person" makes you more social: A virtual reality study on how mimicry influences communion characteristics
2. Ann Hogenhuis
   Utrecht University (Netherlands)
   - Domain-specific and domain-general neural network engagement during human-robot interactions
3. Carolyn Saund
   University of Glasgow (UK)
   - Interpretations of virtual agent performances of metaphoric gestures differ across cultures

Ann Hogenhuis

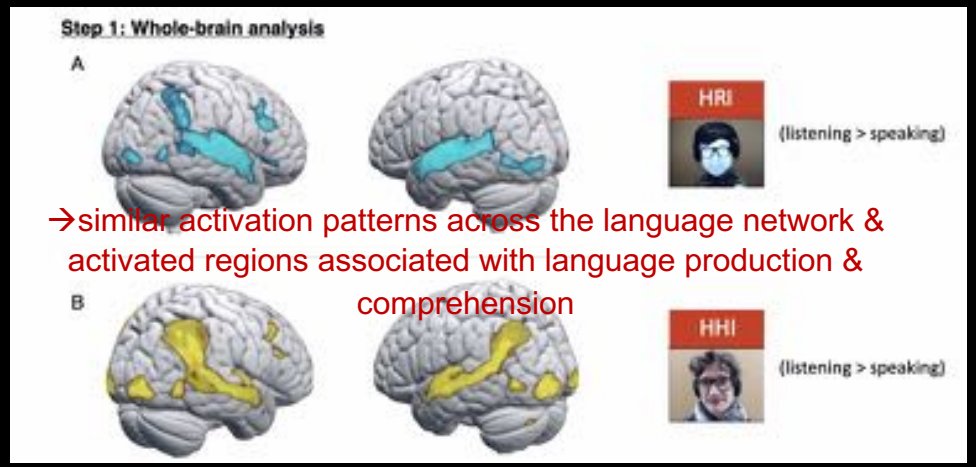
Domain-specific and domain-general neural network engagement during human-robot interactions

BRAIN NETWORKS SUPPORT INTERACTIONS BETWEEN PEOPLE DEDICATED TO SPECIFIC TASKS & DOMAIN-GENERAL

exploratory study

similarities & dissimilarities in neural architecture during social interactions with a human & with a robot

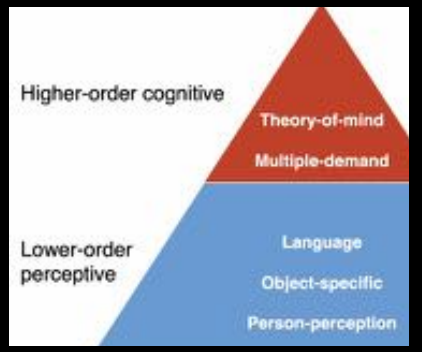
- trial- by-trial dynamics of the interactions
- whole-brain and functional region-of-interest analyses to test response profiles within and across social or non-social, domain-specific & domain-general networks



→similar activation patterns across the language network & activated regions associated with language production & comprehension

no differences

subtle differences

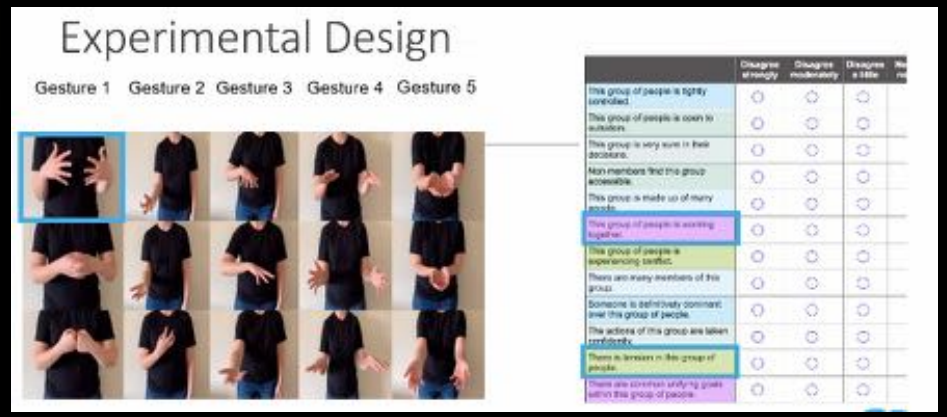


→DISSOCIATION AT A LOWER-LEVEL OR PERCEPTUAL LEVEL, BUT NOT HIGHER-ORDER COGNITIVE LEVEL

Interpretations of virtual agent performances of metaphoric gestures differ across cultures

Carolyn Saund

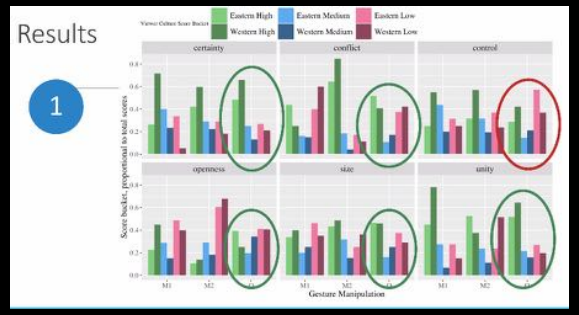
Do we need to model mono- and multi-metaphoric guestures?

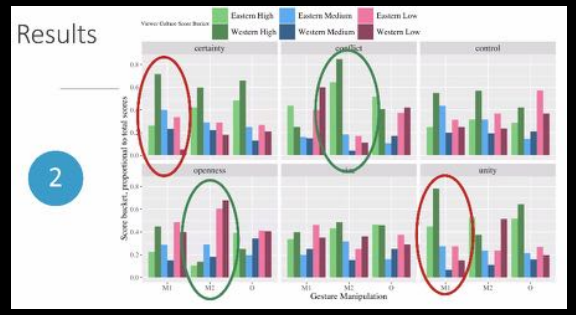


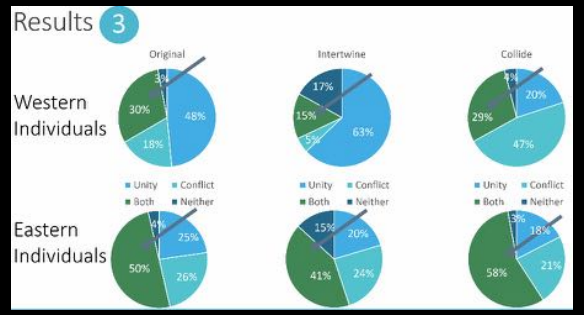
What is interpretable from multiple metaphors?

How do physical conceptual metaphors combine to influence interpretation?

How consistent are these metaphors? Across individuals? Across cultures?







1. Different cultures interpret multi-metaphors similarly, **sometimes.**
2. Different cultures **definitely interpret** metaphoric concepts differently
3. Individuals will **sometimes** 'get' multiple concepts from a single gesture

DAY 2

Interactive Workshop: Guido Orgs

Keynote 3: Xueni Sylvia Pan

Paper Session 5: Exploring and Shaping Social Behaviour with Artificial Agents

Emily Cross

Cassandra Crone

Nathan Caruana

Poster Session 2

Paper Session 6: Human Likeness & the Uncanny

Ramona Fotiade

Basil Wahn

Anna Strasser

Paper Session 7: Morality

Joshua Zonca

Michael Clements

Marina Scattolin

Keynote 4: Stacy Marsella

Paper Session 8: Approaching and Aligning with Robots

Matteo Lisi

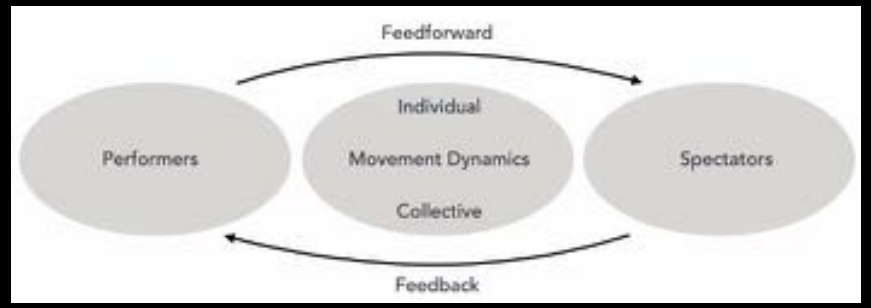
Benoit Bardy

Iris Verpaalen

Interactive Workshop

LIVE PERFORMANCE: SHARING THE HERE AND NOW

1. one person moves – another watches
2. communication between performer & spectator via movement
3. aesthetic appreciation is linked to effective communication

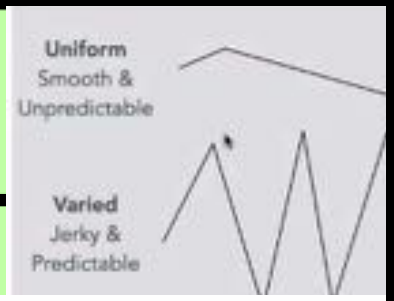


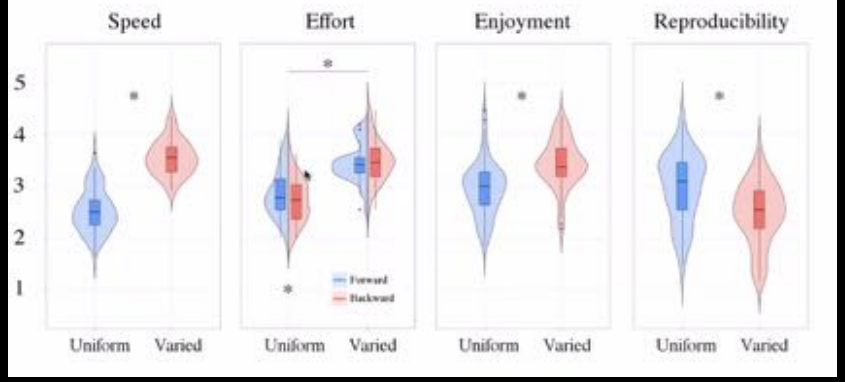
Sadness is slow, happiness is fast.
Christensen et al., 2016, van Dyck et al., 2013; Sawada et al., 2003

Beautiful movements have a variable, yet predictable velocity profile.

Varied movement sequences are performed faster overall, and alternate more frequently between fast and slow sections.

Varied movement sequences are less smooth, but more predictable.





Synchrony is a gestalt principle of perceptual organisation
Wagemans, 2012; Alp et al., 2017

Synchrony promotes group cohesion
- Cooperation and rapport
Lumsden, Miles, & Macrae, 2014
- Mutual liking
Hove & Risen, 2009

Dance and music as social signaling systems
Hagen & Bryant, 2003
Tarr, Launay, Cohen & Dunbar, 2015
Savage et al., 2015

Synchrony and Enjoyment

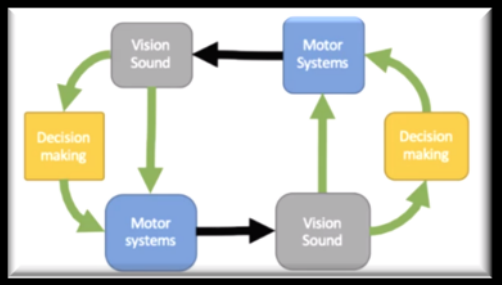
Von Zimmermann, Vicary, Sperling, Orgs, & Richardson, TopiCS, 2018

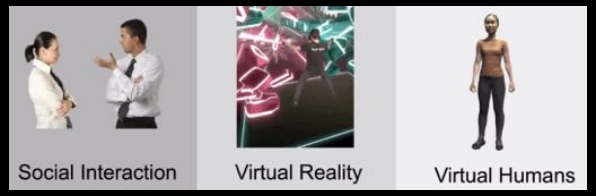
Movement Synchrony predicts audience engagement with dance
- Enjoyment (explicit)
- Heart Rate (implicit)
- Intersubject Correlations in fMRI

Movement Dynamics are relevant for the aesthetics of line drawings, too.

Xueni Sylvia Pan

Virtual Social Interaction in VR





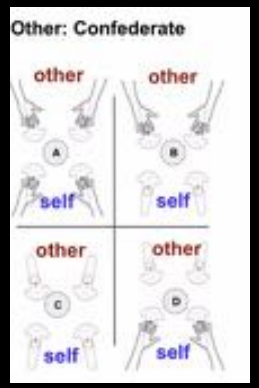
study1: (with confederate)

H1: trust is better in consistent conditions

2 x 2 between group design
- Self representation
  - full body avatar
  - just controllers
- Consistency
  - consistent - both full body or both controllers
  - Inconsistent - controllers vs full body

When confederate did NOT have a body (**C** & **D**), participants trusted them more (measured by investment money).

When participants had a body (**A** & **D**), they seemed to think more positively about the confederate (measured by questionnaire)



study1: (paired participants)

H2: performance better with consistent condiotn & full body avatar is better in consistent conditions

- Consistent conditions (**A** & **C**) are better for trust (measured by questionnaire)
- Consistency plays an role in performance results, and changes over time.

KEYNOTE 4

Paper Session 5: Exploring and Shaping Social Behaviour with Artificial Agents

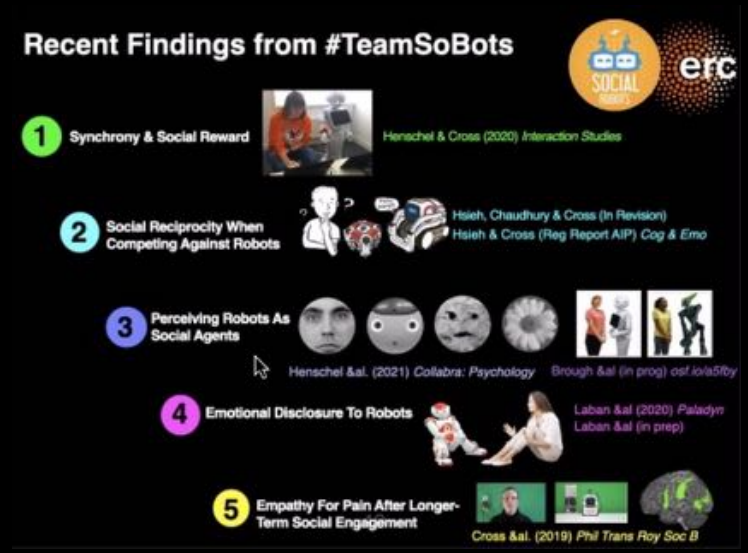
1. Emily Cross
   University of Glasgow (UK) & Macquarie University (Australia)
   - Social Robots for Social Good
2. Cassandra Crone
   Macquarie University (Australia)
   - Combatting gender bias: Can embodied interactions in virtual reality work to reduce the gap?
3. Nathan Caruana
   Macquarie University (Australia)
   - Can eye give you a hand? Using virtual interactions to examine the role of gaze during hand-cued co-ordination

Social Robots for Social Good

Emily Cross

The Challenge Ahead

How can we develop truly effective social robots for social good?



Katie Riddoch

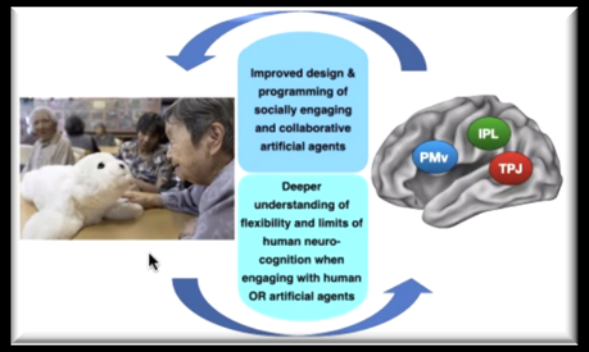
Making a case for qualitative methods in HRI research

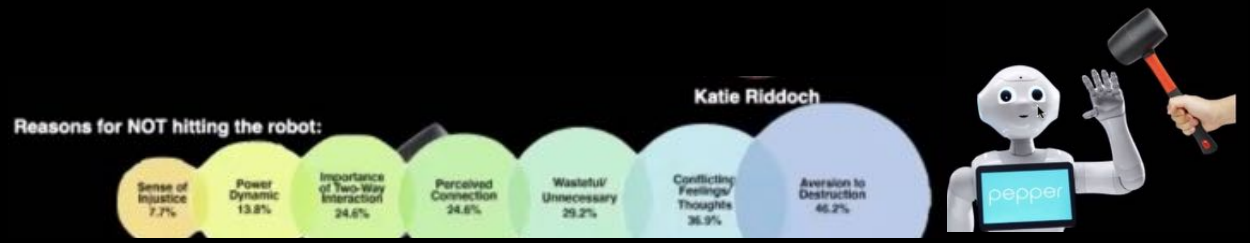
Guy Laban

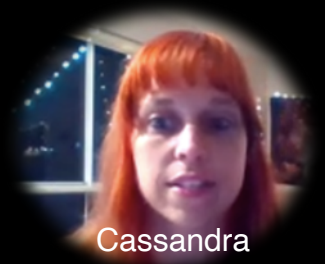
Exploring long-term impacts of engaging with a robot on robot perception & mental health

Laura Jastrzab

Examining how Human-Likeness & Perceived Socialness shape social engagement across brain & behaviour







Cassandra Crone

Combatting gender bias: Can embodied interactions in virtual reality work to reduce the gap?

HYPOTHESES

embodied in an incongruent avatar

→ more likely to choose the female candidates

→ more pronounced for male participants

→ greater empathy & self-other overlap towards candidates that is congruent with their avatar (regardless of their own gender)

Men more likely than women to choose the female candidate (p = .008)

CONGRUENT	INCONGRUENT
– WOMEN: equally likely to choose either candidate *(OR = 0)*	– WOMEN: **54%** more likely to choose male candidate
– MEN: **24%** more likely to choose female candidate	– *MEN: **167%** more likely to choose female candidate

Non-significant interaction between embodiment and gender acts as a suppressor

MIXED ANOVA

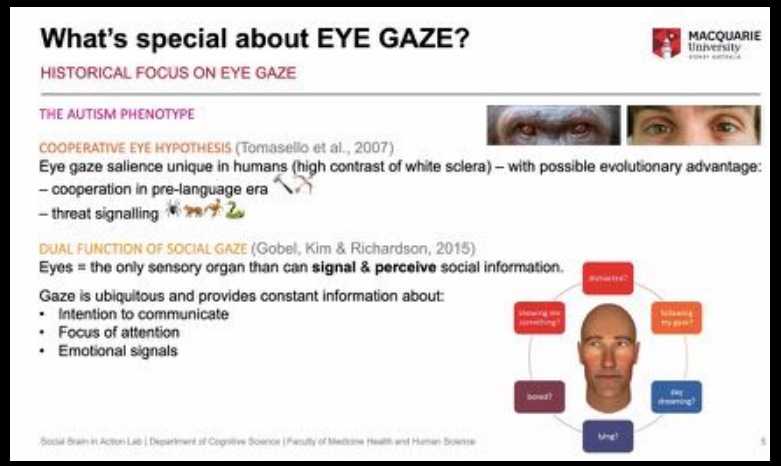
THREE-WAY ANOVA

Nathan Caruana

Can eye give you a hand?

Using virtual interactions to examine the role of gaze during hand-cued co-ordination

Have we overstated the role of gaze … in joint attention research?
→ HAND VERSUS GAZE CUES



(A) frequency of initiator gaze-point congruency across individuals (% trials);
(B) frequency of responder overt attention to the initiator's face (% trials);
(C) effect of initiator Gaze-Point Congruency on saccadic response times.

WE DO INTEGRATE GAZE CUES. . .

… BUT WE DON'T ALWAYS NEED IT. CONTEXT PROBABLY MATTERS!

Paper Session 6: Human Likeness & the Uncanny

1. Ramona Fotiade
   University of Glagsow (UK)
   - Journeys through the Uncanny Valley: Surrealism, spectrality and the future of AI
2. Basil Wahn
   Leibniz University Hannover (Germany)
   - Humans share task load with a computer partner if (they believe that) it acts human-like
3. Anna Strasser
   DenkWerkstatt Berlin (Germany)
   - Social roles for artificial agents

Ramona Fotiade

Journeys through the Uncanny Valley: Surrealism, Spectrality and the future of AI

INTEREST IN UNCONSCIOUS PROCESSES WHICH OCCUR
WHEN THE HUMAN INTELLIGENCE IS CONFRONTED WITH SOMETHING ALIEN

psychological and philosophical implications of uncanny experiences

1. Andrei Tarkovsky's Solaris (1972)
2. Ridley Scott's Blade Runner (1982)
3. Akira Kurosawa's Dreams (1990)

Derrida (1983): *'Psychoanalysis plus film equals… a science of ghosts'.*

Uncanny or 'inbetween' entities trigger responses
→spectrum ranging from

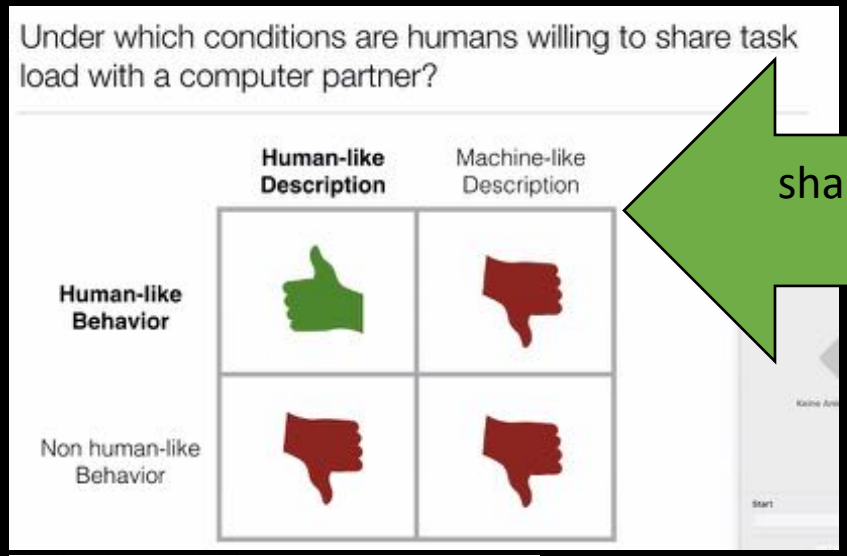
- ALIENS (Solaris)
- HIGHLY EVOLVED HUMANOID ROBOTS INDISTINGUISHABLE FROM HUMAN BEINGS (Blade Runner)
- ANIMISTIC EXTERNALISATIONS OF UNCONSCIOUS DRIVES (Dreams)

- reassessing theory of the uncanny in relation to HRI in light of Derrida's theory of undecidability and spectrality for a revised ('post-humanist') understanding of what it means to be human in the age of virtual reality

Basil Wahn

Humans share task load with a computer partner if (they believe that) it acts human-like

Human-like behavior vs. non-human like behavior



share task load with a computer partner if (they believe that) it acts human.like

Wahn & Kingstone, Acta Psychologica, (2021)

pupil sizes increases with coordination effort

Can we quantify the coordination effort using physiological correlate?

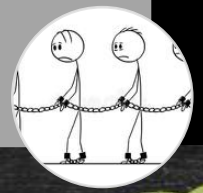
Wahn, Ruuskanen, Kingstone, & Mathôt, Acta Psychologica, (2021)

Social roles for artificial agents


Anna Strasser

- emphasize recognizability of being artificial
- warn about transfers

treat as tools



- reward social norm confirming behavior
- sanction violations

treat as humans

IMPLEMENTING NEW SOCIAL NORMS FOR SOCIAL ARTIFICIAL AGENTS, WE CAN BRING BOTH APPROACHES TOGETHER

- introduce new social norms

treat as a new type of social agents

Paper Session 7: Morality

- Joshua Zonca (Italian Institute of Technology): If you trust me, I will trust you: the role of reciprocity in human-robot trust
- Michael Clements (Kings College London): Interacting with virtual characters: Developing an immersive way-finding task to measure trust
- Marina Scattolin (Sapienza University of Rome & Italian Institute of Technology): Reduced body ownership increases dishonesty: evidence from an immersive virtual reality study

Joshua Zonca

If you trust me, I will trust you: the role of reciprocity in human-robot trust

EXPERIMENTAL SET-UP (ROBOT CONDITION)

Room 1

Room 2

- Robot and computer behaviors in the two conditions are controlled by the same algorithms

- If a robot trusts us (too much) during interaction, we may not accept help from it, even if its performance is high.
- However, if the robot trusts us, we may not be willing to reveal our distrust to the robot, following reciprocal mechanisms.
- Trust towards social robots may be modulated by social norms, explaining observed distortions in HRI experiments on trust.
- These mechanisms should be taken into account in the development of robots that could efficiently collaborate with us.

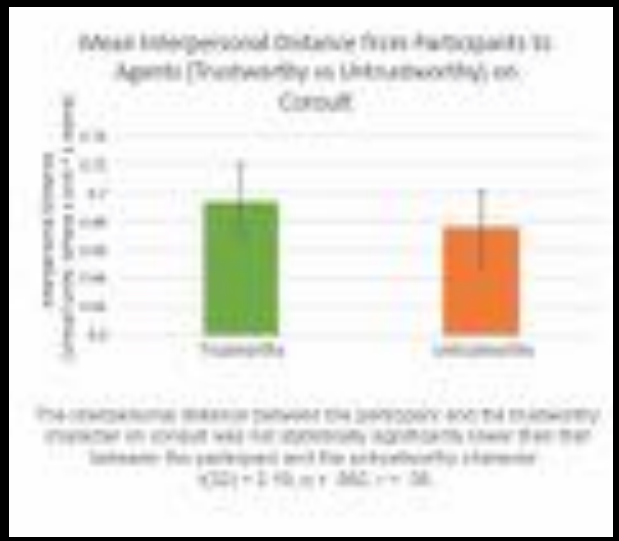
Michael Clements

Interacting with virtual characters: Developing an immersive way-finding task to measure trust

Trust is a key component of social dynamics.

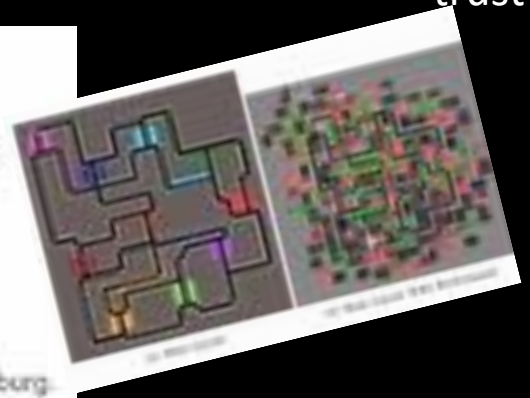
RESULTS

interpersonal distance not significantly lower for trustworthyness



The Wayfinding Task

- We seek to continue validation while aiming to develop its ecological validity with an eye for plausibility.
- A second iteration of the maze was developed by Larissa Bruebach, Uni of Wuerzburg.
  - Further increasing the ecological validity through cityscape scenery and internal rooms;
  - Present characters as part of environment;
  - and the addition of a new trustworthiness outcome measure; Interpersonal Distance.

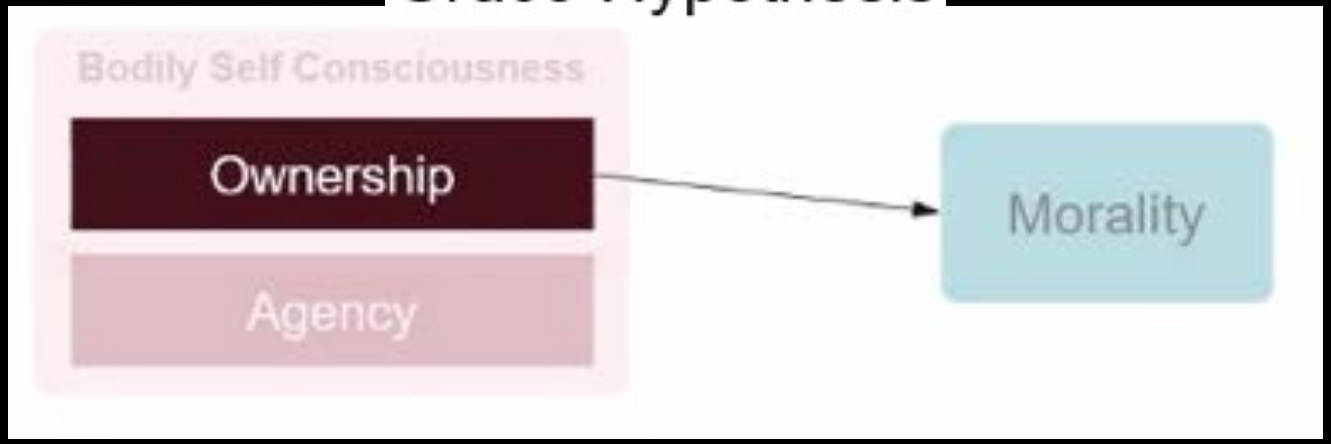


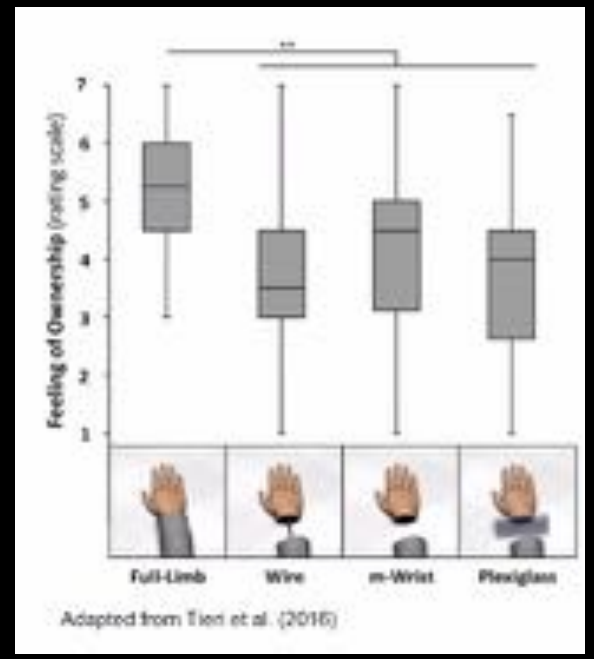
Future Development

- Trust manipulation; too explicit
- Was the interpersonal distance an artefactual finding?
  - Affiliative Motivation in human virtual characters, Bailenson et al., 2001; based on Equilibrium Theory, Argyle and Dean, 1965.
- Recruitment procedure - demographics, repeat advertisement
- Study goals;
- Can behavioural tasks both manipulate and measure trust at once?

Reduced body ownership increases dishonesty:
evidence from an immersive virtual reality study

Grace Hypothesis





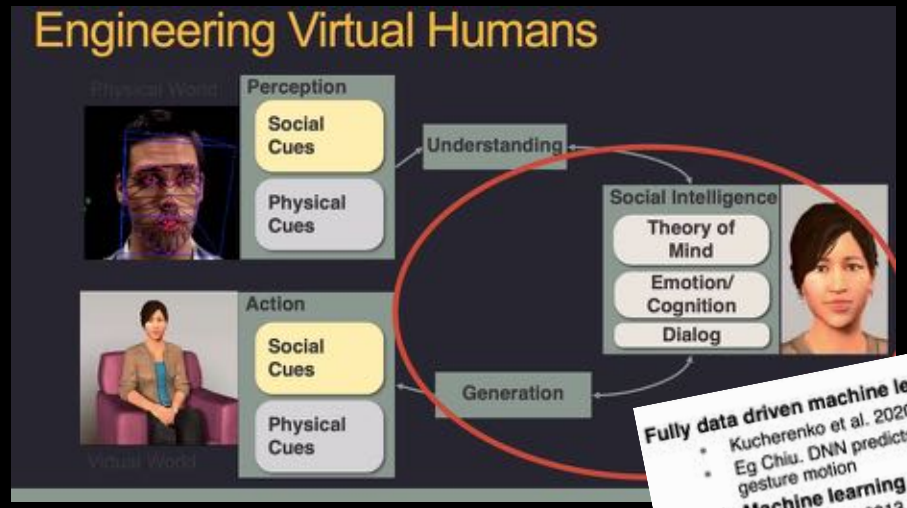
Mental States, nonverbal behaviour and virtual humans

Stacy Marsella

non-verbal behavior

impact

- **Socio-emotional Functions**
  - Mechanism of social control (status, persuasion, impression management) [Patterson 1990]
  - Convey emotion and interpersonal attitude [Bente et al. 2008]
  - Relational communication (social support, comforting, conflict management) [Burgoon and Bacue 2003]
  - Carries/transforms explicit propositional meaning [B. Tversky]
  - *NVB is not simply an illustrator of verbal information*
    - *It can convey information distinct and off the record from verbal channel [Kendon, 2000]*

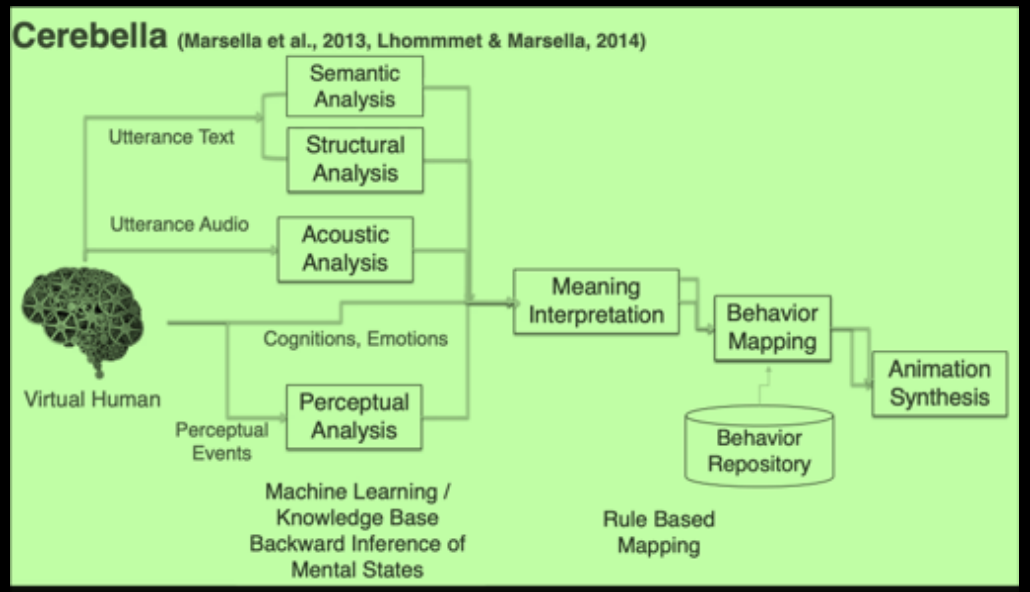


Fully data driven machine learning map from speech to gesture
- Kucherenko et al. 2020, Ferstl et al 2020, Chiu & Marsella, 2014,2015
- Eg Chiu. DNN predicts gesture type & low dimensional manifold encodes gesture motion

Multiple Machine learning tools infer meaning for multimodal behaviors
- Marsella et al. 2013, Lhommet & Marsella , 2013, Saund et al. 2021
- E.g. Existing ML-based front-ends trained on large corpora derive meaning and rules map to behavior

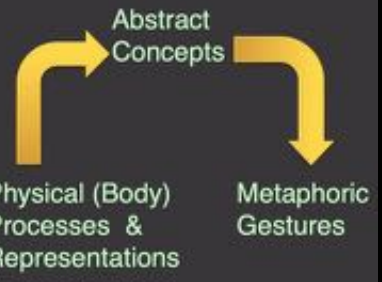
Hand-crafted rule based multimodal behaviors
- Beat (Cassell et al. 2001), NVBG (Lee & Marsella, 2006)

HOW ?



Gestures: Metaphoric Gestures

- "The physical forms of gestures… derived from concrete actions… serve to express all manner of abstract meanings."
  - Adam Kendon
- Physical Analogies
  - Abstract ideas represented as physical objects and actions
- Embodied Cognition
  - Connection between our body and mind
  - Argued to reveal shared representation across cognition, physical behavior (Lakoff & Johnson)
  - Grounded in that we have bodies that perceive and act in the world



KEYNOTE 4

SHOULD/WILL WE RE-DEFINE NATURAL?

Paper Session 8: Approaching and Aligning with Robots

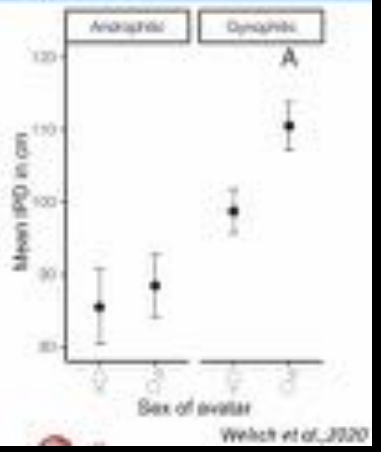
1. Matteo Lisi
   Sapienza University of Rome & Italian Institute of Technology (Italy)
   - The role of sexual orientation and sexual prejudice against gay men in the regulation of virtual comfort-distance towards artificial agents
2. Benoit Bardy
   University of Montpellier (France)
   - What your moves say about you when interacting with artificial agents
3. Iris Verpaalen
   Radboud University Nijmegen (Netherlands)
   - The unfolding of resistance to persuasion in immersive virtual reality

Matteo Lisi

The role of sexual orientation and sexual prejudice against gay men in the regulation of virtual comfort-distance towards artificial agents

Role of sexual orientation in IPD regulation

- Welsch and colleagues (Welsch et al., 2020) showed that non-heterosexual men IPD reduce same-sex distance compared to heterosexual men.
- Whether the regulation of IPD is also affected by sexual prejudice, i.e. the negative attitudes toward an individual because of her or his sexual orientation (Herek, 2000), is currently under-investigated.



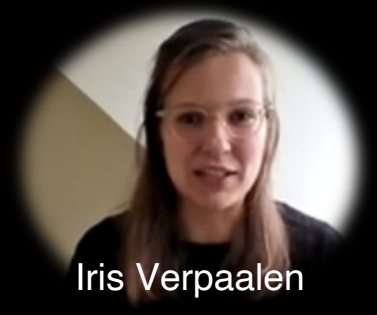
Hypotheses

- We expected heterosexual participants showing greater same-sex and smaller opposite-sex distance than the non-heterosexual ones.
- We focused on the prejudice against gay men since it is generally considered to be stronger compared to the one referred to women (Bettinsoli et al., 2020; Herek, 2000).
- We hypothesized that larger IPD toward the male avatar would be associated with higher levels of sexual prejudice. we expected the association between higher sexual prejudice against gay men and greater distance toward the male avatar to be present among Heterosexual Men but not among Heterosexual and Non-Heterosexual Women.

- The fear of being perceived as an homosexual has been detected as an inhibitor of same-sex touch (Derlega et al., 1988; Roese et al., 1992 ; Floyd, 2000; Dolinski, 2010).
- It could also act as a drive to enlarge the distance from the same-sex while reducing the distance from the opposite-sex, in the attempt to maintain cultural ideals of masculinity and gender roles for men.

Benoit Bardy

What your moves say about you when interacting with artificial agents



Iris Verpaalen

The unfolding of resistance to persuasion in immersive virtual reality

Persuasive virtual agents

Research Questions

1. Does high-controlling vs. low-controlling advice from agents increase **freedom threat** and consequently, **reactance**?
2. How does high-controlling vs. low-controlling advice from agents influence **compliance over time**?
3. How does high-controlling vs. low-controlling advice from agents influence **social outcomes** (later collaboration, hostility) ?

Task Performance

	Study 1	Study 2
	• $N = 40$ (30 women)	• $N = 52$ women
	• 7.8% changed	• 8.0% changed
	• 35.7% changed	• 38.0% changed

From Freedom Threat to Resistance

Also towards virtual agents?