



LAUGHTER IN SOCIAL ROBOTICS WITH HUMANOIDS AND ANDROIDS

Christian Becker-Asano

Intelligent Robotics and Communication Labs,
ATR, Kyoto, Japan



OVERVIEW

- About research at ATR's IRC labs in Kyoto, Japan
- Motivation to study laughter in HRI
- Laughter and the “Robovie” humanoids
 - Design of an online study
 - Results
 - Discussion
- Laughter and the android “Geminoid HI-1”
 - Design of the study
 - Evaluation of the “Geneva Emotion Wheel” data
- Discussion / open questions

ABOUT JAPAN: KYOTO, THE WHERE AND WHY



ABOUT JAPAN RESEARCH AT ATR



- “Advanced Telecommunications Research Institute International”
- founded in March 1986 “with the support of various partners from industry, academia and government” (www.atr.jp)
- Since 1989 in Kansai Science City, south of Kyoto prefecture (close to Nara City)
- as of April 2008:
 - 287 employees (including 256 researchers)
 - 20% international researchers!
- Eight different laboratories, one of them is called
 - Intelligent Robotics and Communication Lab (IRC)

ABOUT JAPAN

RESEARCH AT ATR'S IRC LAB

- Overall goal of IRC:
 - “research on sense of robot's existence with the assumption that the robot will be in our town or live with us as a family” (Dr. Hagita, Director)
- Research topics and methodologies:
 - “human presence” of robot-like vs. human-like robots
 - robots as “communication media”
 - field experiments
 - international standardization
- In (very) short: studying HRI with a lot of different humanoid robots

ABOUT JAPAN

SOME OF IRC'S ROBOTS



PLEASE COME FOR A VISIT!

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MOTIVATION TO STUDY LAUGHTER

Human laughter (Owren; 2007):

- “helps foster and maintain positive, mutually beneficial relationships among individuals with genuine liking for one another”
- “is predicted to as easily have the opposite role among those who do not.”

→ Laughter:

- can “transmit” emotions
- can be used strategically
- is an interesting, understudied phenomenon in linguistics, phonetics, and social sciences
- can be “programmed” for humanoids?

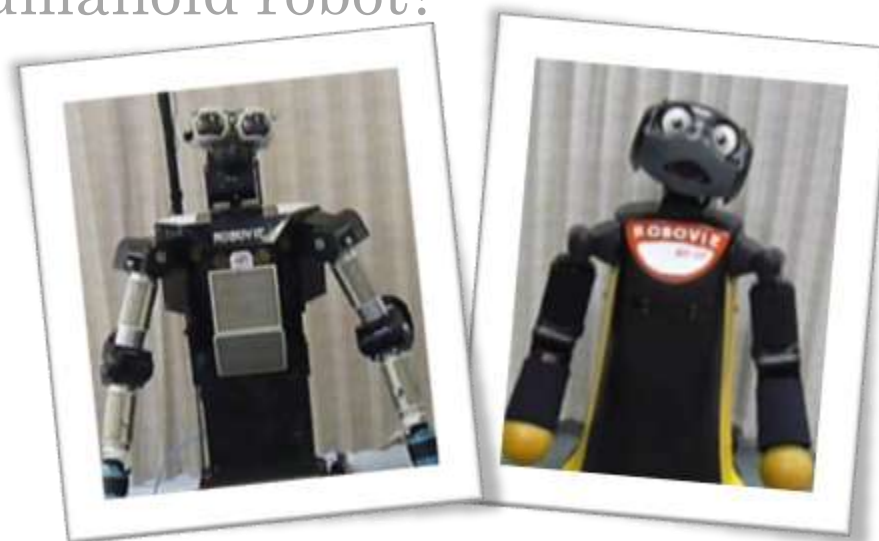
MOTIVATION LAUGHTER & ROBOVIE



Robovie II
Demovideo

Robovie (Kanda, Ishiguro, Ono, Imai, Mase; 2002):

- is an “interactive humanoid robot”
- “is designed for communication with humans.”
- Would a laughing Robovie appear more social?
- Which kind of laughter fits best to a (or which kind of) humanoid robot?



MOTIVATION

LAUGHTER & GEMINOID



Geminoid HI-1 (Nishio, Ishiguro, Hagita; 2007):

- “from the *Mechanical Love* (Ishiguro, 2007)”
- “[A] geminoid is a duplicate of a human being”
- How can we study human laughter?
 - which situations?
 - which contexts?
- How do we study human laughter in different situational contexts?
- Using Geminoid to study human laughter
 - “Android Science” (Ishiguro; 2005)



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LAUGHTER & ROBOVIE

DESIGN OF AN ONLINE STUDY

Laughter 2



- We chose the following five samples:

Laughter 2 	Laughter 3 	Laughter 4 	Laughter 5 	Laughter 6 
				
1.25 seconds, 6 pulses	1.47 seconds, 7 pulses	1.48 seconds, 8 pulses	1.74 seconds, breath voice	0.9 seconds, 4 pulses

- .. and pitched “Laughter 2” up by 25% →
- Each laughter was combined with one motion per version of Robovie (II & R2):
 - moving head backward to the left
 - lifting arms (“open-hand” gesture)
 - returning to initial position
 - saying “Ariehen!” (unbelievable)

Laughter 1 



1.25 seconds,
6 pulses

LAUGHTER & ROBOVIE

DESIGN OF AN ONLINE STUDY

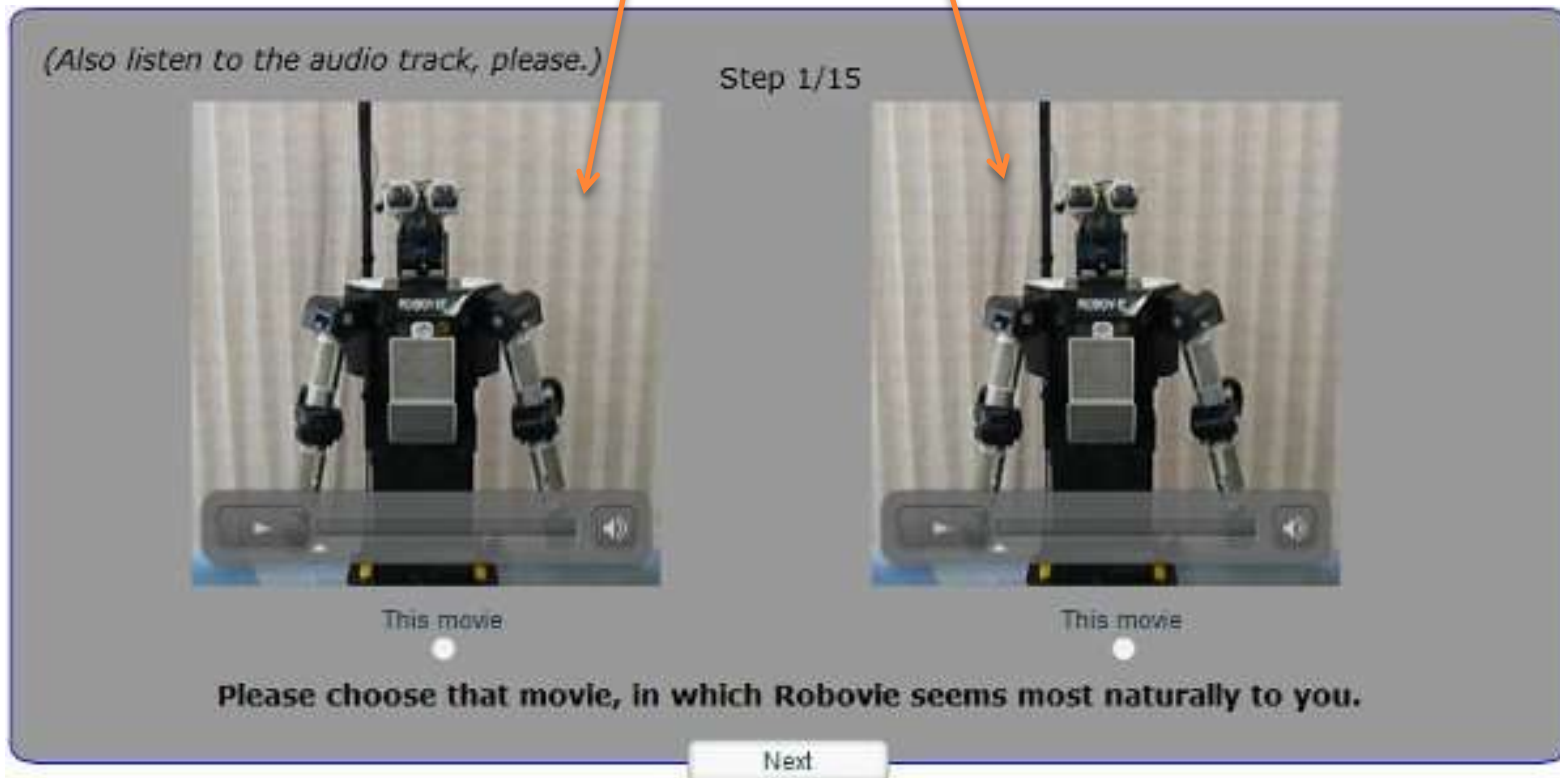
- Instructions provided in Japanese, English, and German language online
- Participants should imagine that Robovie (II / R2) laughs in response to a joke:
 - Complete joke known to the participants
 - Last sentence of the joke always played in Japanese at the beginning of each video
- All possible pairings of laughter presented once, randomized between participants
→ 15 pairs per robot
- Instruction:

“Please choose that video,
in which Robovie seems most naturally to you.”

LAUGHTER & ROBOVIE DESIGN (SCREENSHOT)



For example
laughter 2 vs. laughter 4



(Forced choice design)

LAUGHTER & ROBOVIE DEMOGRAPHIC DATA

Robovie II

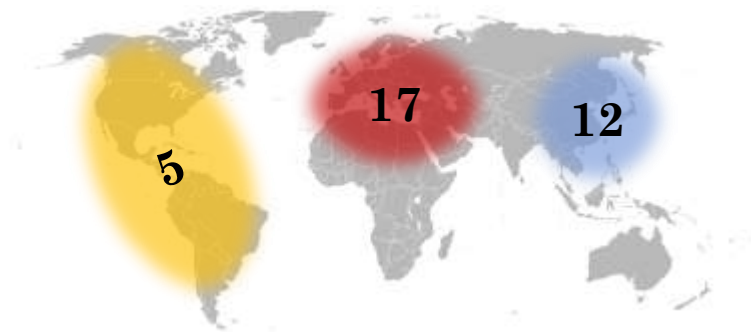
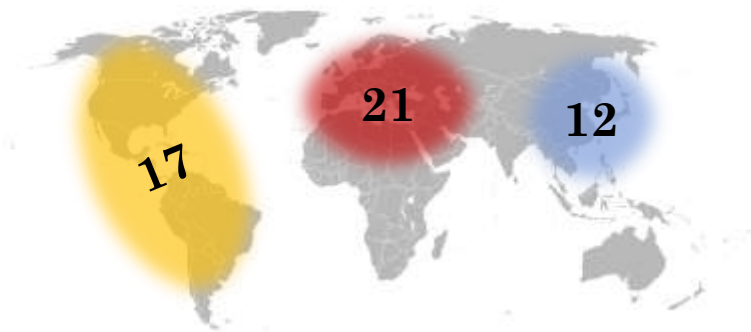


- 50 participants
 - 20 female
 - 30 male

Robovie R2



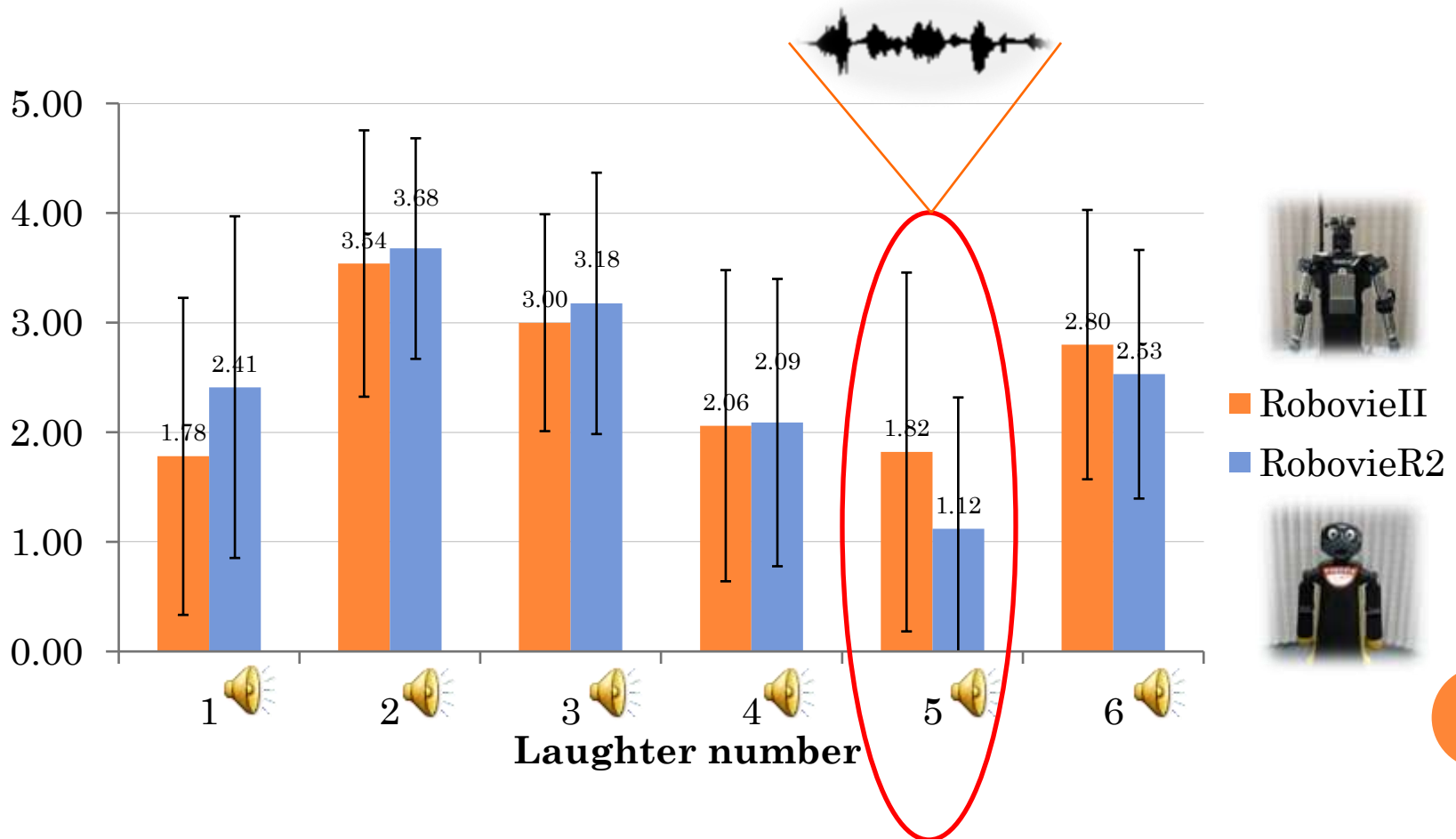
- 34 participants
 - 8 female
 - 25 male



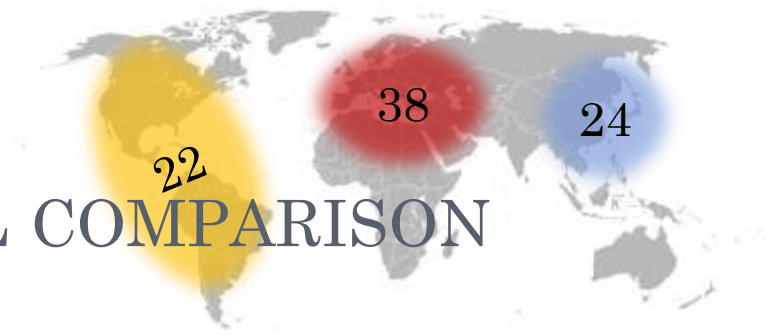
LAUGHTER & ROBOVIE

RESULTS: BETWEEN ROBOTS COMPARISON

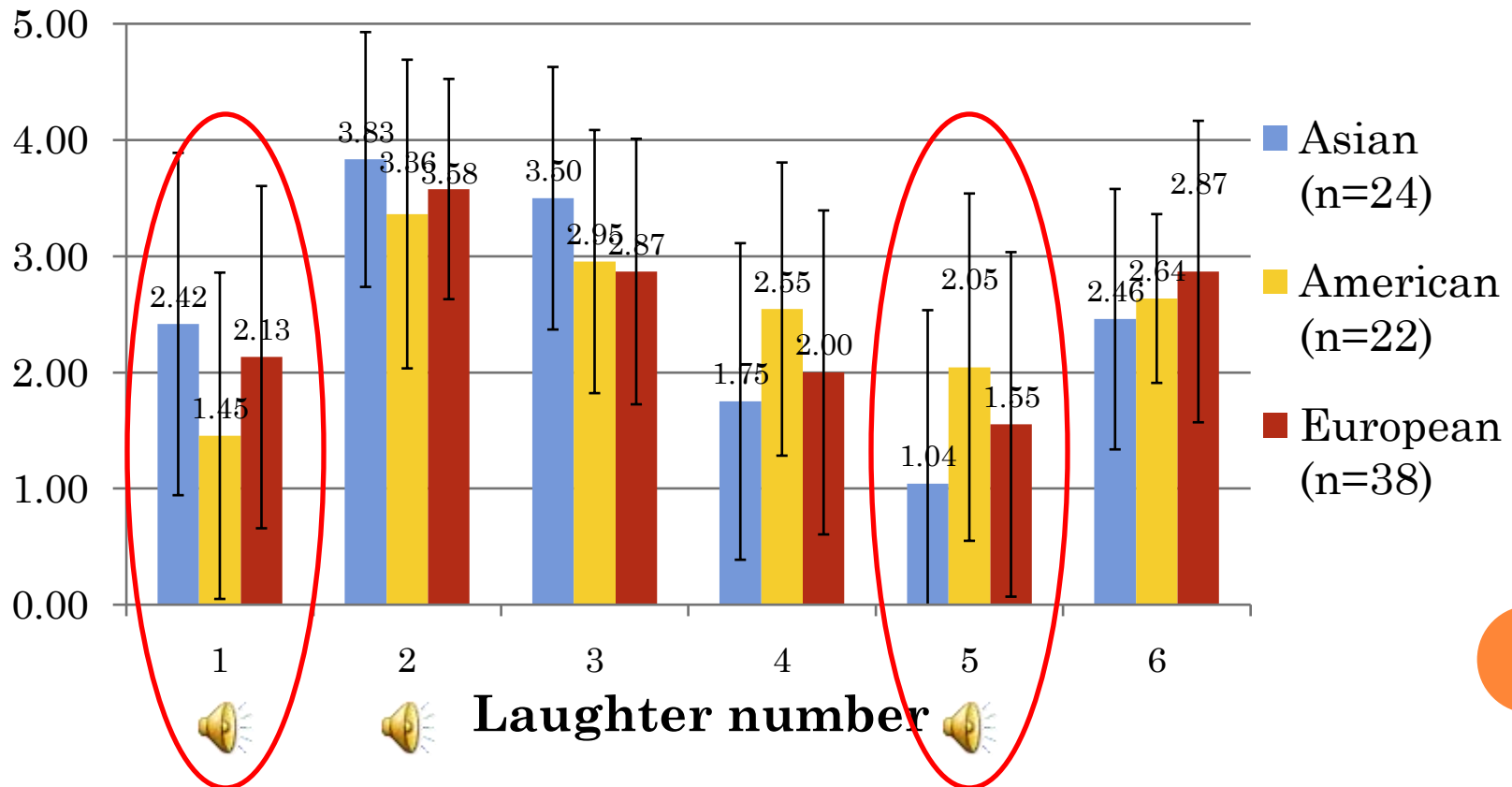
- Differences between types of robots:



LAUGHTER & ROBOVIE RESULTS: INTERCULTURAL COMPARISON



(regardless of robot type)



LAUGHTER & ROBOVIE

DISCUSSION

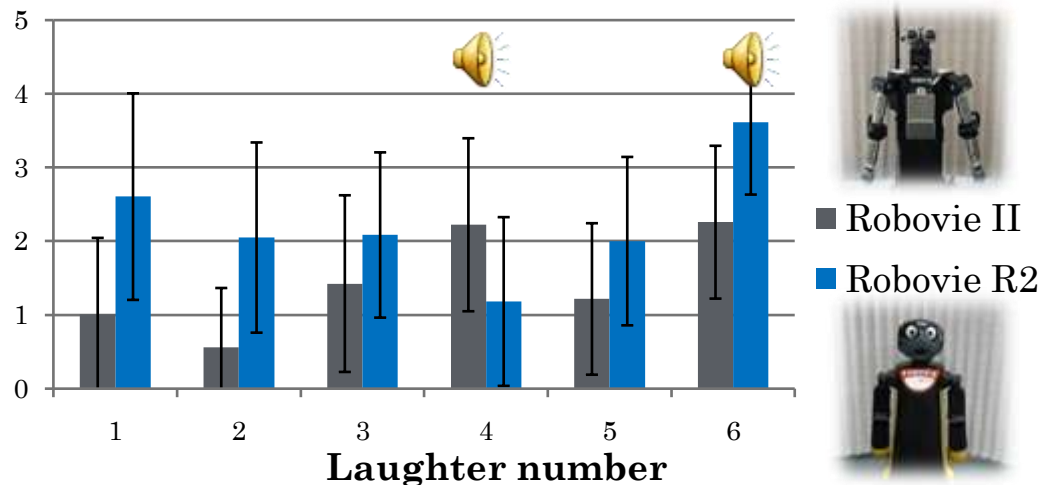
- Robots' laughter not evaluated as differently as expected between robots:
 - Robovies are quite similar to each other?
 - comparing Robovie with Geminoid
 - forced-choice design inappropriate?
 - using different type of experimental design
 - Video-based survey inefficient?
 - testing real-life interaction
- Results limited by situational context:
 - “Reacting to a joke” is a non-serious situation
 - No dynamic human-robot interaction
- Only female laughter presented so far
 - Participants expected male laughter for Robovie II
 - Data on male laughter just acquired in Bielefeld



LAUGHTER & ROBOVIE DISCUSSION



- Robovies are similar to each other?
 - 36 Japanese high school students
 - 26 male, 10 female, ~17 years old
 - Videos presented with Robovie II and R2 in sequence
 - “How well does this laughter fit to each robot?”



- Preliminary interpretation: No, they are not.
- Similar survey just conducted in Bielefeld!

OVERVIEW

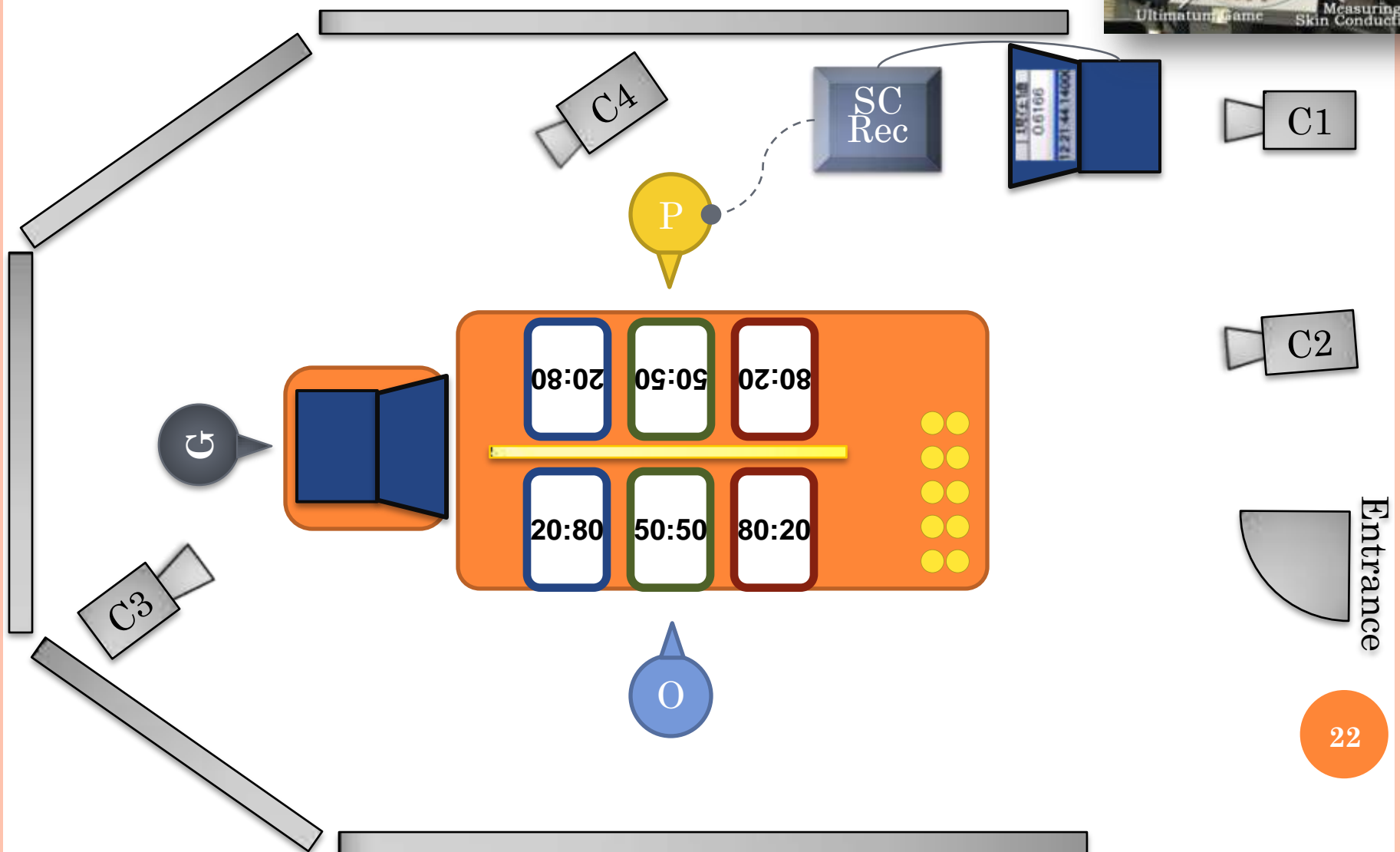
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LAUGHTER & GEMINOID DESIGN OF THE STUDY



- Motivation (slide 10):
 - How can Geminoid produce “natural laughter”?
 - which kind of laughter voice?
 - which body movements & gaze direction?
 - How do people interpret Geminoid’s laughter in different situational contexts?
 - Using Geminoid to study human laughter
 - “Android Science” (Ishiguro; 2005)
- Playing the “Ultimatum Game” with Geminoid
 - Can Geminoid produce natural laughter?
 - How do people react, when Geminoid laughs?
- Geminoid as non-neutral experimenter during the game

LAUGHTER & GEMINOID DESIGN OF THE STUDY (SETUP)



LAUHTER & GEMINOID

SETUP: TWO EXPERIMENTAL CONDITIONS



- Control condition (C):
 - P and O take turns in proposing (i.e. being the decider D) how to split a total of 100 Yen
 - Possible choices: 20:80, 50:50, or 80:20 (D: \neg D)
 - Geminoid announces the decision to \neg D and waits for him/her to accept or decline the offer of D (10 times)
- Laughter condition (L):
 - Same as above, but..
 - When O only offers 20 Yen to P:
 - Geminoid nods to O, turns head to P, **laughs**, announces O's decision to P
- Order of conditions counter-balanced

LAUGHTER & GEMINOID

SETUP: ASSESSING FEELINGS

- Assessing P's feelings towards Geminoid by:
 1. Biometry: Measuring P's skin conductance level (SCL) on the inner palm of the non-dominant hand
 2. Questionnaire: Using the “Geneva Emotion Wheel” (GEW) of Prof. Scherer
- GEW, Prof. Scherer (2005):
 - “The Geneva Emotion Wheel (GEW) is a theoretically derived and empirically tested instrument to measure emotional reactions to objects, events, and situations.”
- Instruction to P:

“Please use the Geneva Emotion Wheel (GEW) on the next page to indicate **how you felt towards Geminoid during the [first/second] session of the experiment.**”

emotion family's intensity (1 – 5)

emotion families

Irritation Anger

Involvement Interest

Contempt Scorn

Amusement Laughter

Disgust Repulsion

Pride Elation

Envy Jealousy

Happiness Joy

Disappointment Regret

Enjoyment Pleasure

Guilt Remorse

Tenderness Feeling love

Embarrassment Shame

Wonderment Feeling awe

Worry Fear

Feeling disburdened Relief

Sadness Despair

Astonishment Surprise

Geneva Emotion Wheel (Scherer; 2005)

Unpleasantness/Obstruc-tiveness Appraisal

Pleasantness/Con-duciveness Appraisal

High Control/Power Appraisal

Low Control/Power Appraisal

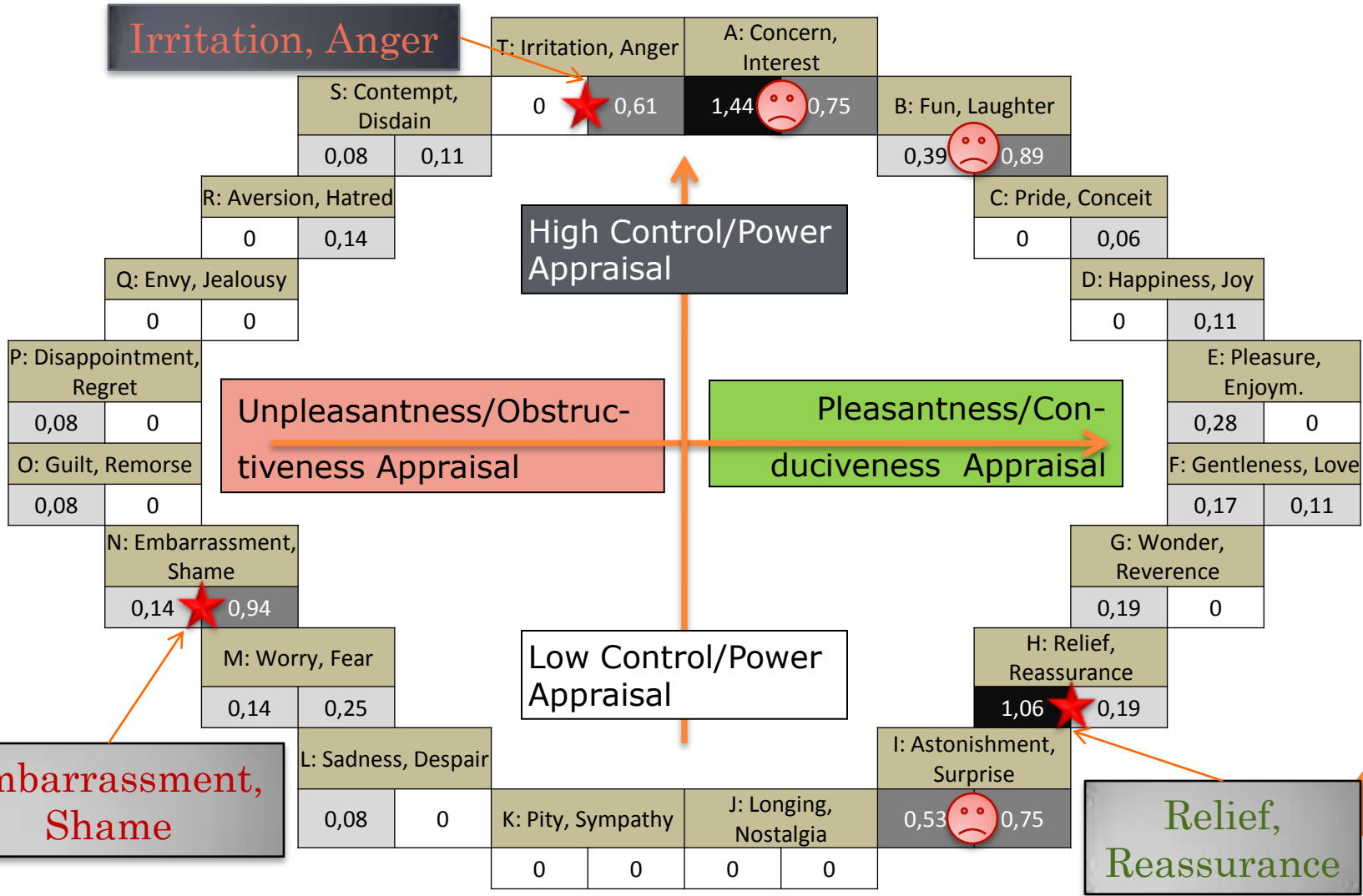
No emotion felt
Other emotion felt

Pity Compassion

Longing Nostalgia

LAUGHTER & GEMINOID RESULTS OF THE GEW

<emotion family>	
Control	Laughter



Embarrassment, Shame

Relief, Reassurance

★ = statistically significant difference (two-tailed t-test assuming unequal variances, p<0.05)

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DISCUSSION / OPEN QUESTIONS

- What we have learned about (human(oid)) laughter:
 - A complex audiovisual event
 - Social signaling function
 - interlocutor's attention
 - behavioral feedback
 - cultural
 - Laughter as a response to a laughable event itself
 - Nonverbal and verbal behavior accompanying a laughter's expression, i.e. facial expression, gaze, etc.
- Given a certain situational context, how much are we allowed to simplify?
- How can we detect, when better not to laugh?
- ...?

**THANK YOU
FOR YOUR ATTENTION!**