Synthetic Impressions (I)

Computational Social Intelligence - Lecture 10

Prof. Alessandro Vinciarelli
School of Computing Science &
Institute of Neuroscience and Psychology

http://www.dcs.gla.ac.uk/vincia
Alessandro.Vinciarelli@glasgow.ac.uk

This lecture is based on the following texts (available on Moodle):

- Deshmukh, Craenen, Vinciarelli & Foster, "Shaping Robot Gestures to Shape Users' Perception: The Effect of Amplitude and Speed on Godspeed Ratings", Proceedings of the International Conference on Human-Agent Interaction, 2018;

This lecture is based on the following texts (available on Moodle):

- Craenen, Deshmukh, Foster & Vinciarelli, "Shaping Gestures to Shape Personalities: Interplay Between Gesture Parameters, Attributed Personality Traits and Godspeed Scores", Proceedings of the IEEE International Symposium on Robot and Human Interactive Communication, 2018.

Outline

- Synthetic Impressions
- Gestures and Godspeed Scores
- Gestures and Personality
- Conclusions

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The Godspeed Questionnaire

"[…] standardised measurement tools for human robot interaction (HRI) […] to compare the results from different studies […] measurements of five key concepts in HRI."

Bartneck et al., "Measurement Instruments for the Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety of Robots", International Journal of Social Robotics, 1(1):71-81, 2009.

1.Anthropomorphism

"Anthropomorphism refers to the attribution of a human form, human characteristics, or human behaviour to nonhuman things such as robots, computers, and animals."

Bartneck et al., "Measurement Instruments for the Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety of Robots", International Journal of Social Robotics, 1(1):71-81, 2009.

2.Animacy

"The classic perception of life, which is often referred to as animacy, is based on [...] `moving of one's own accord'."

Bartneck et al., "Measurement Instruments for the Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety of Robots", International Journal of Social Robotics, 1(1):71-81, 2009.

3.Likability

"[…] positive impressions [are] to some degree dependent on the visual and vocal behavior […] and that positive first impressions (e.g., likeability) […] often lead to more positive evaluations […]"

Bartneck et al., "Measurement Instruments for the Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety of Robots", International Journal of Social Robotics, 1(1):71-81, 2009.

4.Perceived Intelligence

"[…] perceived intelligence of a robot will depend on its competence. To monitor the progress being made in robotic intelligence it is important to have a good measurement tool."

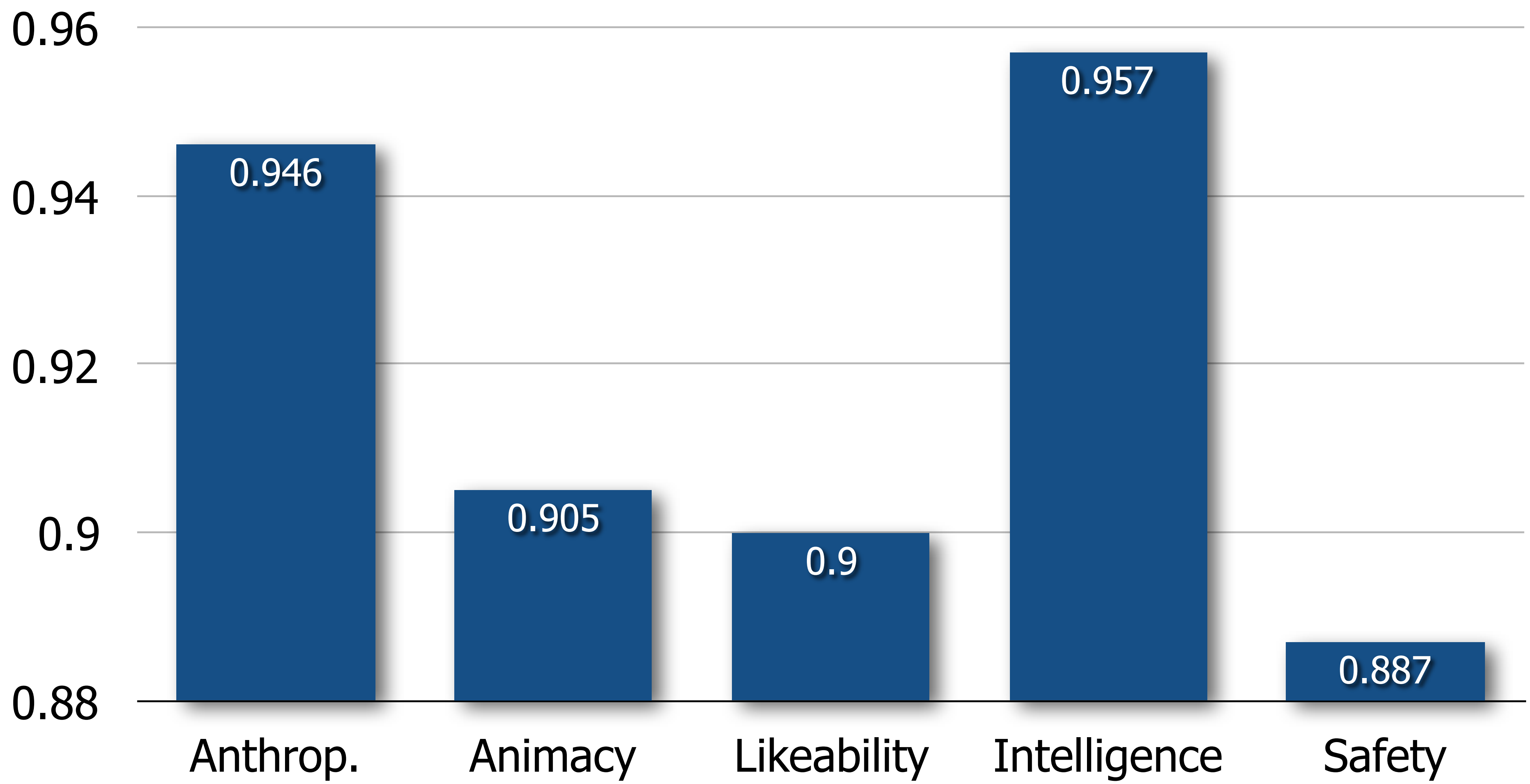
Bartneck et al., "Measurement Instruments for the Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety of Robots", International Journal of Social Robotics, 1(1):71-81, 2009.

5.Perceived Safety

"Perceived safety describes the user's perception of the level of danger when interacting with a robot, and the user's level of comfort during the interaction."

Bartneck et al., "Measurement Instruments for the Anthropomorphism, Animacy, Likeability, Perceived Intelligence, and Perceived Safety of Robots", International Journal of Social Robotics, 1(1):71-81, 2009.

Reliability



Deshmukh, Craenen, Vinciarelli & Foster, "Shaping Robot Gestures to Shape Users' Perception: The Effect of Amplitude and Speed on Godspeed Ratings", Proc. of the International Conference on Human-Agent Interaction, 2018

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Why Gestures?

"[Gestures] often are used to communicate when distance or noise renders vocal communication impossible [...] expressing concepts that also are expressed verbally."

Krauss et al., "Lexical Gestures and Lexical Access: a process model", in "Language and Gesture", McNeill (ed.), Cambridge University Press, 2000

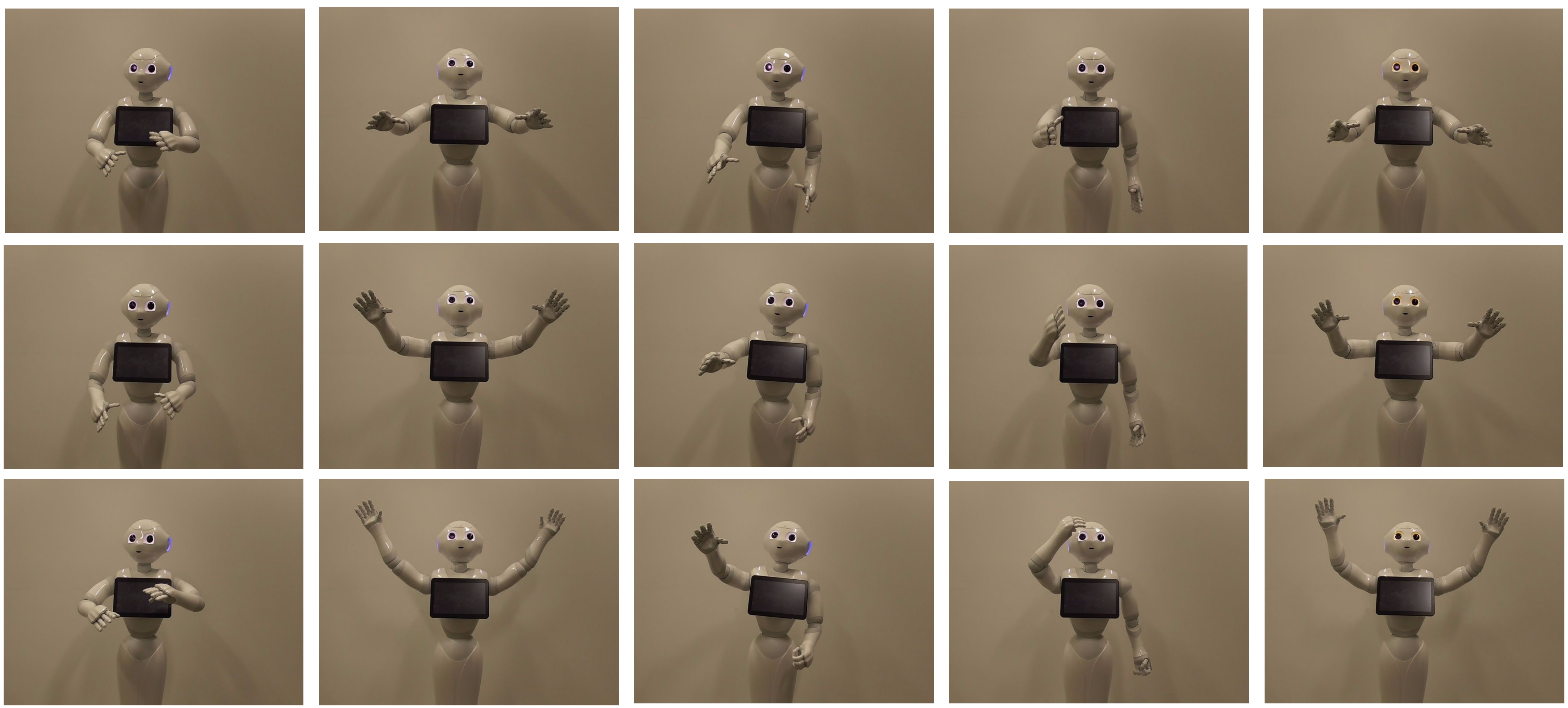
The Gestural Stimuli

Disengage | Engage | Pointing | Head Touching | Cheering

$\alpha = 0.50$

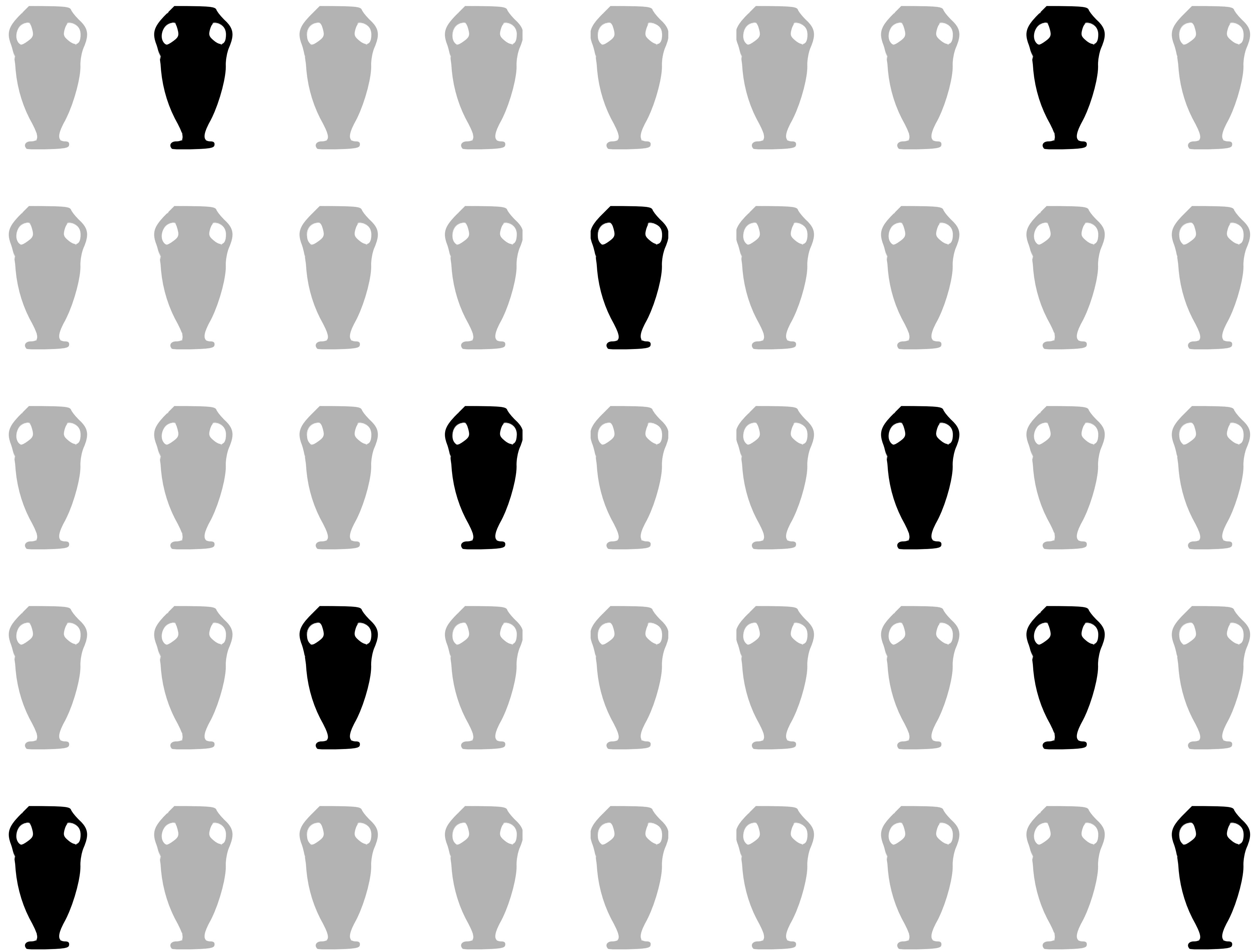
$\alpha = 0.75$

$\alpha = 1.00$

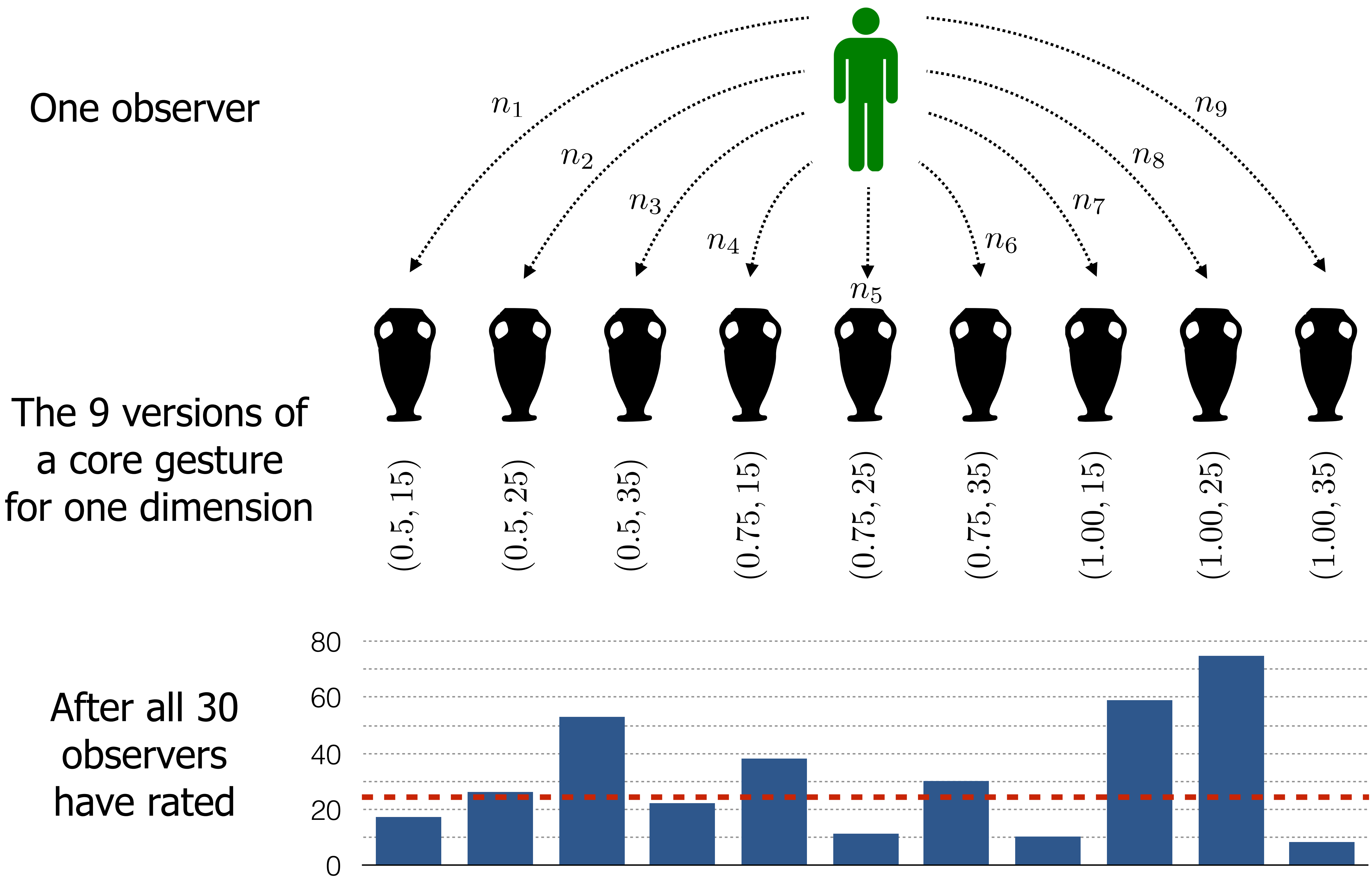


The Setting

30 observers have filled Godspeed questionnaire and Big-Five Inventory 10 (self and attributed) while rating different interpretations for all 45 stimuli.



The stimuli are like urns where the observers can throw a number of votes (the black urns are to the 9 variants of a core gesture)


One observer
n_1
n_2
n_3
n_4
n_5
n_6
n_7
n_8
n_9
The 9 versions of a core gesture for one dimension
(0.5, 15)
(0.5, 25)
(0.5, 35)
(0.75, 15)
(0.75, 25)
(0.75, 35)
(1.00, 15)
(1.00, 25)
(1.00, 35)
After all 30 observers have rated
80
60
40
20
0

A matrix for a specific stimulus (speed and amplitude)

An element is the score of observer "i" for GS dimension "k"

$$S^{(\alpha,\lambda)} = \{ s_{ik}^{(\alpha,\lambda)} \}$$

$$c_j^{(\alpha,\lambda)} = \sum_{i=1}^{N} s_{ij}^{(\alpha,\lambda)}$$

Total number of points along GS dimension "j" for one stimulus

Sum over the elements of column "j" of the matrix

The total number of points along GS dimension "j"

$$T_j = \sum_{\alpha} \sum_{\lambda} c_j^{(\alpha,\lambda)}$$

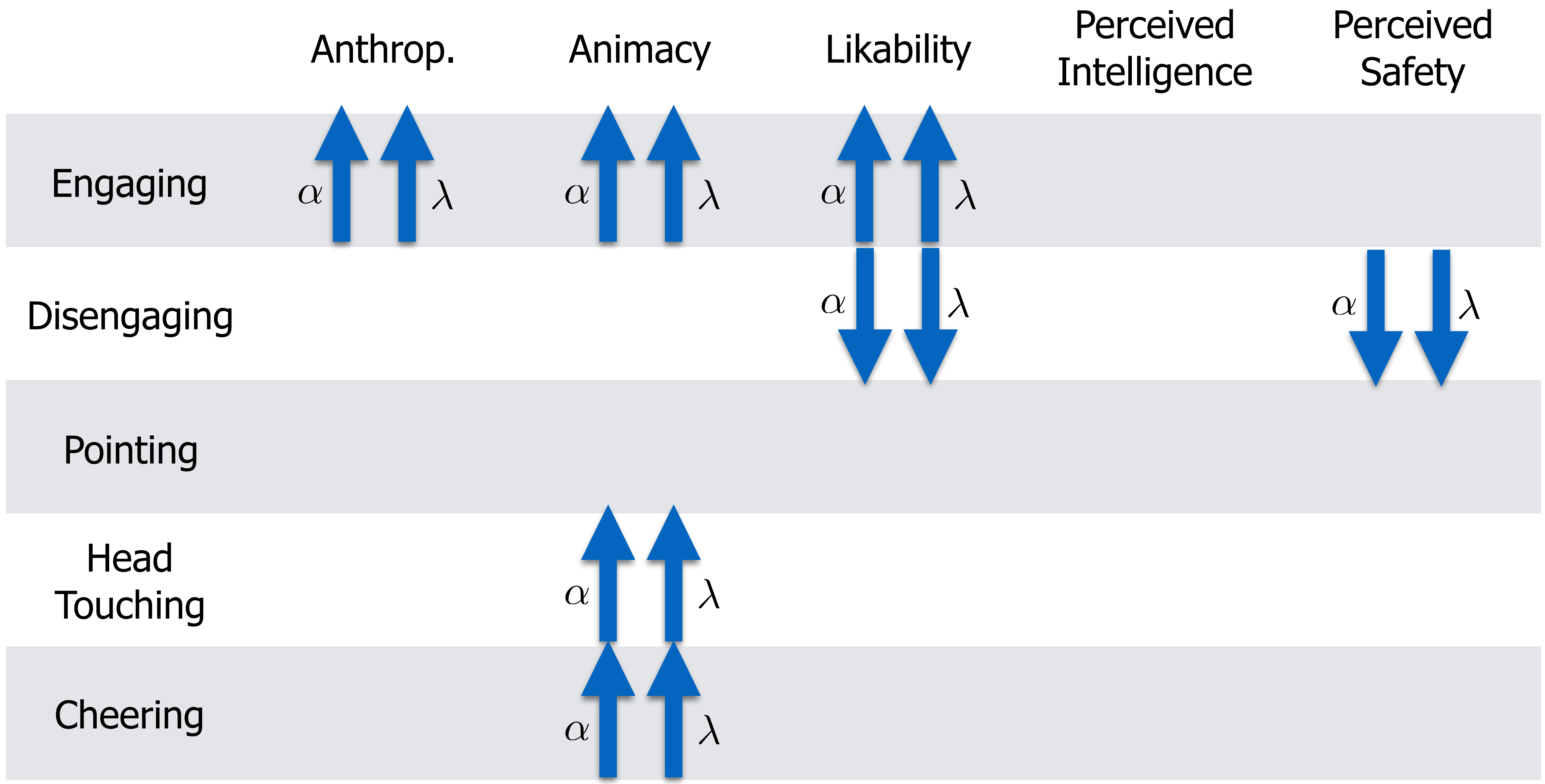
Sum over all values of amplitude and speed

$$\chi^2 = \sum_{\alpha} \sum_{\lambda} \frac{(c_j^{(\alpha,\lambda)} - E)^2}{E}$$

$$E = \frac{1}{9} T_j$$

Chi Square variable for testing whether the distribution of the points across the 9 variants of the same core gesture is uniform

Average over all variants of the same core gesture



Significant effects after False Discovery Rate Correction (arrows pointing upwards account for positive relationships and vice versa)

Recap

- There is a relationship between the "shape" of a gesture (amplitude and speed) and the perception of the users (Godspeed scores);
- Animacy and Likability are the dimensions along which there is more interaction;
- The core gesture "Pointing" does not show any interaction between shape and perception.

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The Big Five Traits

"The Big Five Personality Factors appear to provide a set of highly replicable dimensions that parsimoniously and comprehensively describe most phenotypic individual differences"

Saucier, Goldberg, "The Language of Personality: Lexical Perspectives on the Five-Factor Model", in "The Five-Factor Model of Personality", Wiggins (ed.), 21-50,1996

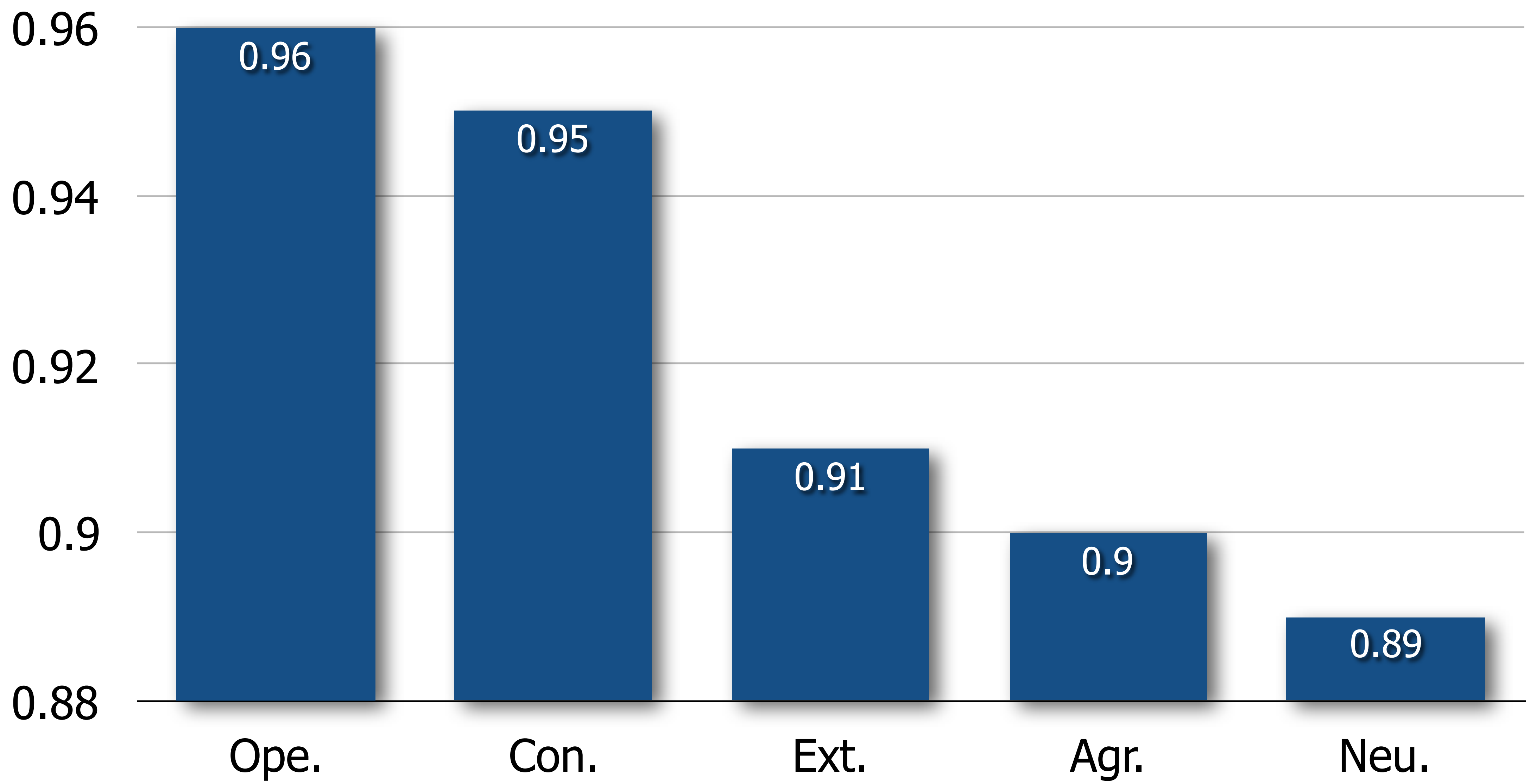
- Extraversion: Active, Assertive, Energetic, Outgoing;
- Agreeableness: Appreciative, Forgiving, Generous, Kind, Sympathetic, Trusting;
- Conscientiousness: Efficient, Organised, Planful, Reliable, Responsible, Thorough;
- Neuroticism: Anxious, Self-pitying, Tense, Touchy, Unstable, Worrying;
- Openness: Artistic, Curious, Imaginative, Insightful;

Saucier, Goldberg, “The Language of Personality: Lexical Perspectives on the Five-Factor Model”, in “The Five-Factor Model of Personality”, Wiggins (ed.), 21-50,1996

This robot is reserved	E	-
This robot is generally trusting	A	+
This robot tends to be lazy	C	-
This robot is relaxed, handles stress well	N	-
This robot has few artistic interests	O	-
This robot is outgoing, sociable	E	+
This robot tends to find faults with others	N	+
This robot does a thorough job	C	+
This robot gets nervous easily	A	-
This robot has an active imagination	O	+

Rammstedt and John, “Measuring Personality in One Minute or Less: A 10-item short version of the BFI”, Journal of Research in Personality, 41(1):203-212, 2007

Reliability



Craenen, Deshmukh, Foster & Vinciarelli, "Shaping Gestures to Shape Personalities: Interplay Between Gesture Parameters, Attributed Personality Traits and Godspeed Scores", Proceedings of the IEEE International Symposium on Robot and Human Interactive Communication, 2018.

A matrix for a specific stimulus (speed and amplitude)

An element is the score of observer "i" for B5 trait "k"

$$A^{(\alpha,\lambda)} = \{a_{ik}^{(\alpha,\lambda)}\}$$

$$t_j^{(\alpha,\lambda)} = \sum_{i=1}^{N} a_{ij}^{(\alpha,\lambda)}$$

Total number of points along B5 trait "j" for one stimulus

Sum over the elements of column "j" of the matrix

The total number of points along B5 trait "j"

$$T_j = \sum_{\alpha} \sum_{\lambda} t_j^{(\alpha,\lambda)}$$

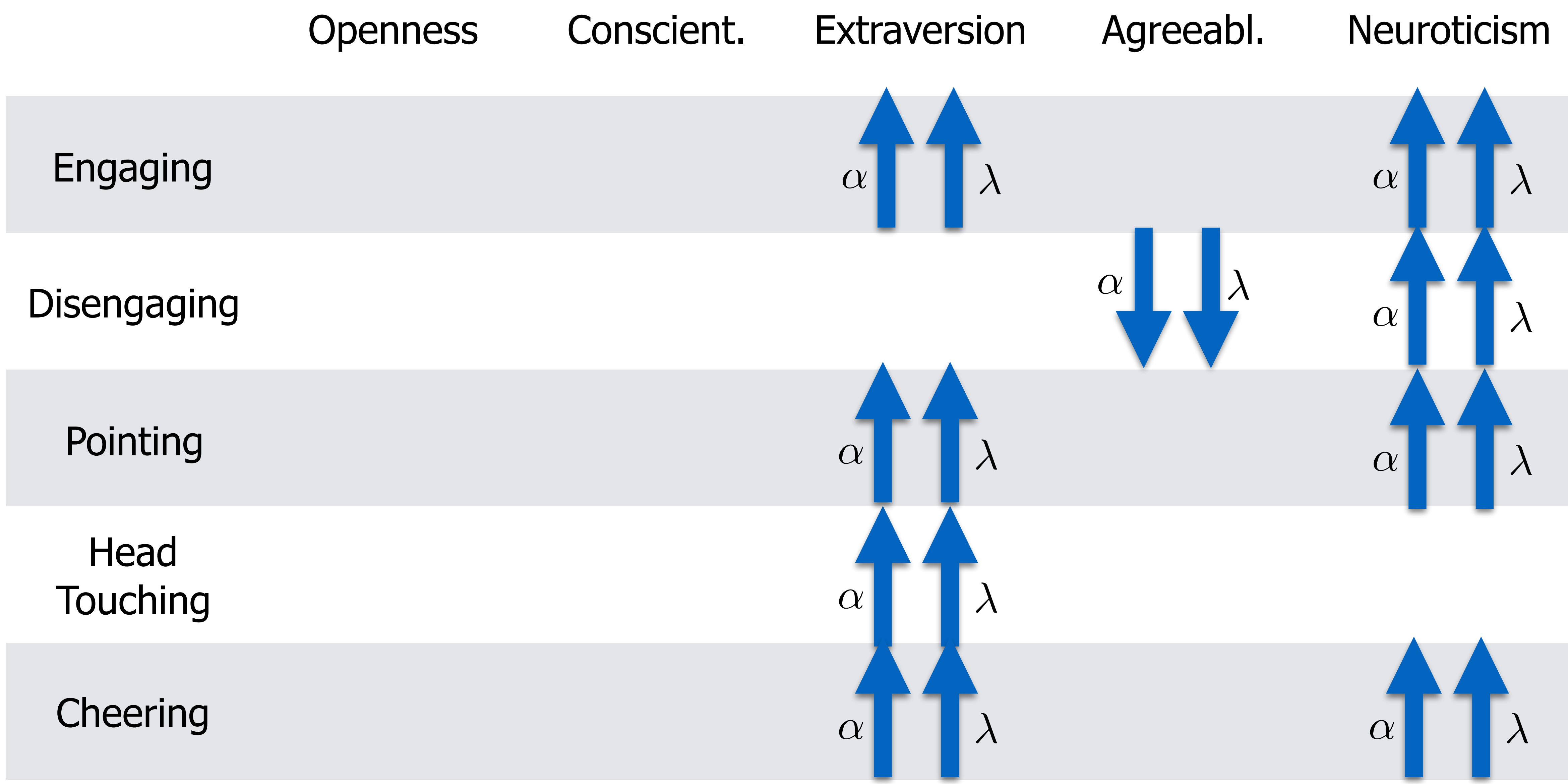
Sum over all values of amplitude and speed

$$\chi^2 = \sum_{\alpha} \sum_{\lambda} \frac{(t_j^{(\alpha,\lambda)} - E)^2}{E}$$

$$E = \frac{1}{9} T_j$$

Chi Square variable for testing whether the distribution of the points across the 9 variants of the same core gesture is uniform

Average over all variants of the same core gesture



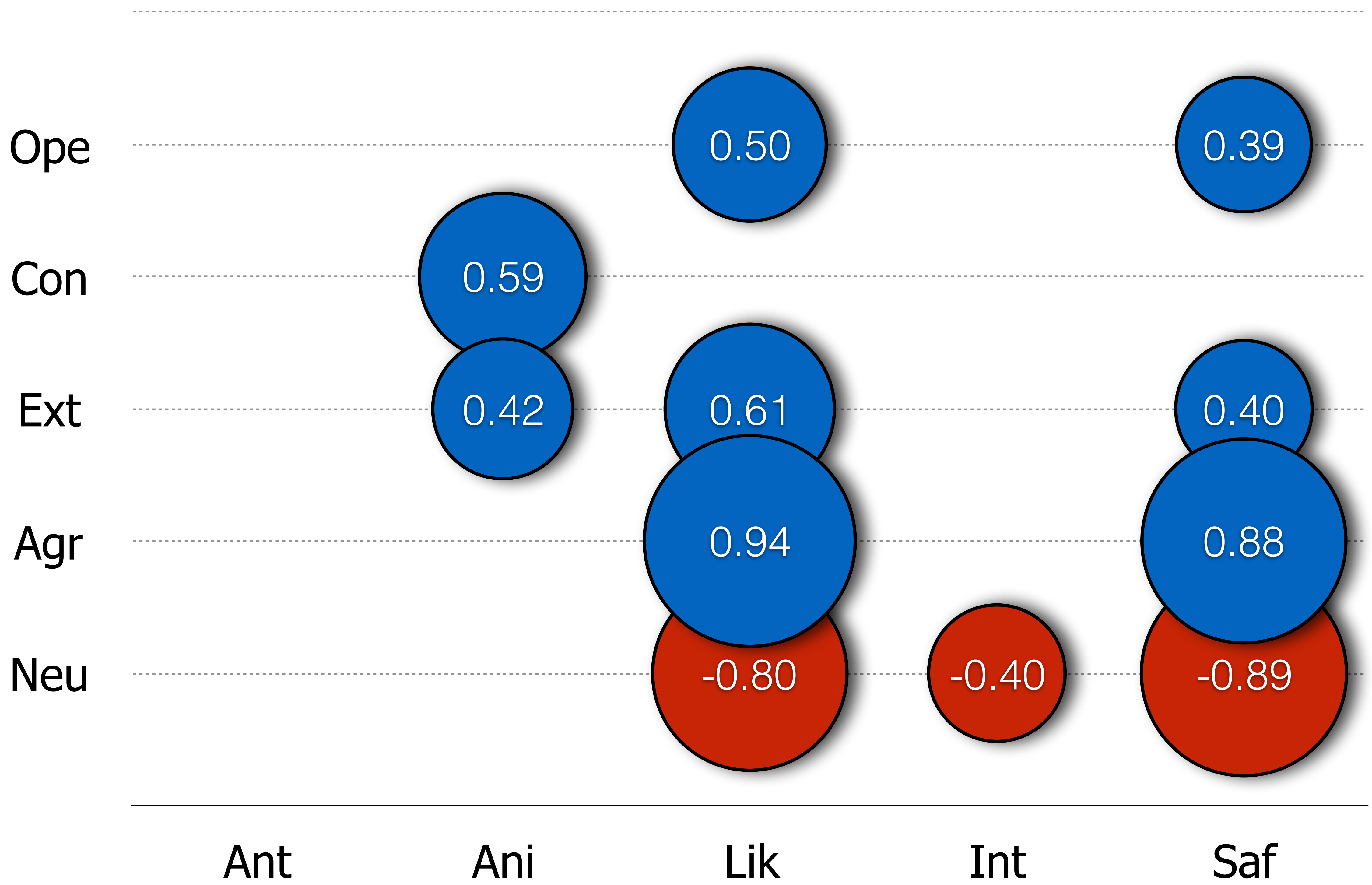
Significant effects after False Discovery Rate Correction (arrows pointing upwards account for positive relationships and vice versa)

The Spearman Correlation Coefficient

Difference between rank of trait and rank of GS score for the same stimulus

$$r = 1 - \frac{6\sum_{k=1}^{M} d(t_k, g_k)}{M(M^2 - 1)}$$

The Spearman Correlation Coefficient is more robust to outliers than the most common Pearson Correlation



Relationship between Godspeed scores and Big Five traits (effects observed after application of the False Discovery Rate Correction)

Recap

- There is a relationship between the "shape" of a gesture (amplitude and speed) and the Big Five traits attributed by the users;
- There is a significant interplay between Godspeed Scores and Big-Five Traits;
- It is possible to change the perception of the users by changing the personality impressions that the robots convey.

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Conclusions

- However simple, gestures give rise to a wide spectrum of synthetic impressions;
- Overall, the impressions appear to follow principles and laws observed in human-human interactions;
- The next step is the collection of data in real-world settings.

Thank You!

Special thanks to:

- Bart Craenen
- Amol Deshmukh
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