Social Acceptance of Humanoid Robots

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Contents

- Acceptance of Humanoid Robots
  - Technology Acceptance Model (TAM)
  - Limitation of TAM
- Influence of Culture
  - International comparison on assumptions about humanoid robots
  - Japan-UK comparison on opinions about humanoid robots
- Age effects on acceptance of humanoid robots
  - Interaction between age and experience

Acceptance of a Specific Technology within Society

- An important research subject to be tackled by:
  - Social sciences
  - Technological fields (application design)
- Social acceptance of humanoid robots
  - How the general public will accept this technology in their daily life
  - What factors prevent such acceptance of humanoid robots

Technology Acceptance Model (TAM)

- Psychological model of user acceptance of new technologies (Davis, 1989)
  - Prediction by “perceived usefulness” and “easy of use”
- Applications in acceptance of social robots
  - Addition of “perceived enjoyment”, “social presence”, and “perceived sociability” (Heerink, et al., 2008)
  - More unified model (Shin & Choo, 2011)

Limitation of TAM

- Criticism toward its user-centered approach (Salvini, et al., 2010)
  - Focus on users' cognition and perception
  - Lack of social levels (organizational, legal, socio-ethical levels)
- Properties specific to humanoid robots
  - Cultural differences (Frankenstein syndrome (Rollin, 1995)
- Interaction effects
  - Between age, gender, culture, experience

Needs of Survey Research on Humanoid Robots

- Investigation of general republic's expectation and anxiety toward humanoid robots before their widespread
  - Clarification of differences between humanoids and other types of robots
  - Exploration of personal and social factors influencing the acceptance (specific to humanoids)
  - Verification of interaction effects between these factors

Existing Survey-based Studies

- Scopelliti, et al. (2005):
  - Age effect on acceptance of domestic robots
    - (not specific to humanoids)
- Oestreicher & Eklundh (2006):
  - Task types expected of domestic household robots
- Kamide, et al. (2012)
  - Human perception of humanoids including acceptance (age effects)

Influences of Cultures

- A popular notion: “The Japanese people more prefer to robots than those in the other nations”
- Consideration about its cause
  - Influence of Confucianism (Yamamoto, 1983)
  - Epistemological difference on relationships between technologies and the nature (Kaplan, 2004)

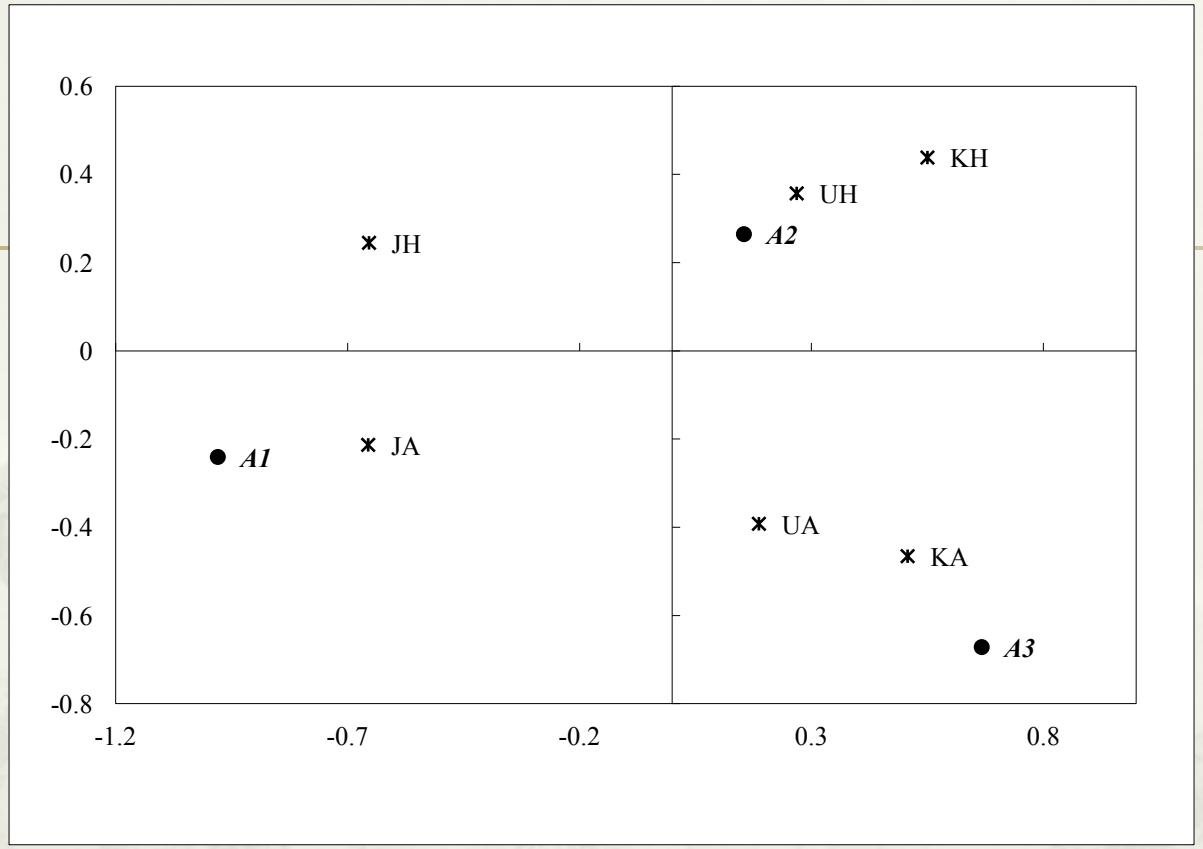
Cultural Differences on Attitudes toward Robots

- Comparison on attitudes toward AIBO between nations including Japan, UK (Bartneck et al., 2007)
- Comparison on explicit and implicit attitudes toward robots between Japan and the USA (MacDorman et al., 2009)
  - Explicit measure: Japan > the USA
  - Implicit measure: no difference
- (not focusing on humanoid robots)

International Comparison on Assumptions about Humanoid Robots

- A survey for university students in Japan, Korea, and the USA (Nomura et al., 2008)
  - Focus on assumptions about functions, tasks, and images of robots when people hear the word “robots”
  - Comparison with “pet-type robots”
    - Autonomy, relationships with humans, functions of emotions for humanoid and pet-type robots
    - Expected tasks
    - Images such as social influences

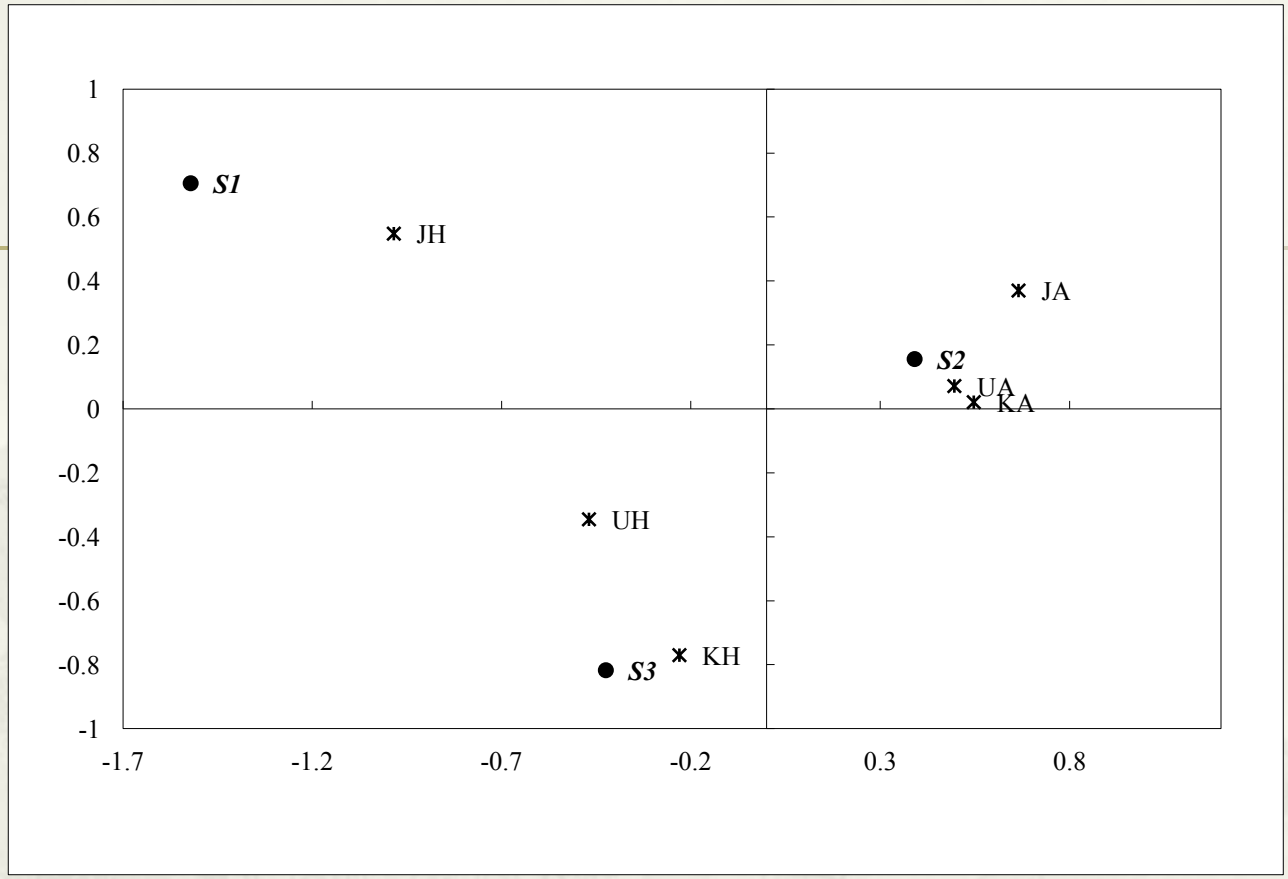
Assumption about autonomy



JH: humanoid for Japanese
JA: pet-type for Japanese
KH: humanoid for Korean
KA: pet-type for Korean
UH: humanoid for USA
UA: pet-type for USA

A1: completely autonomous
A2: partly autonomous
A3: no autonomy

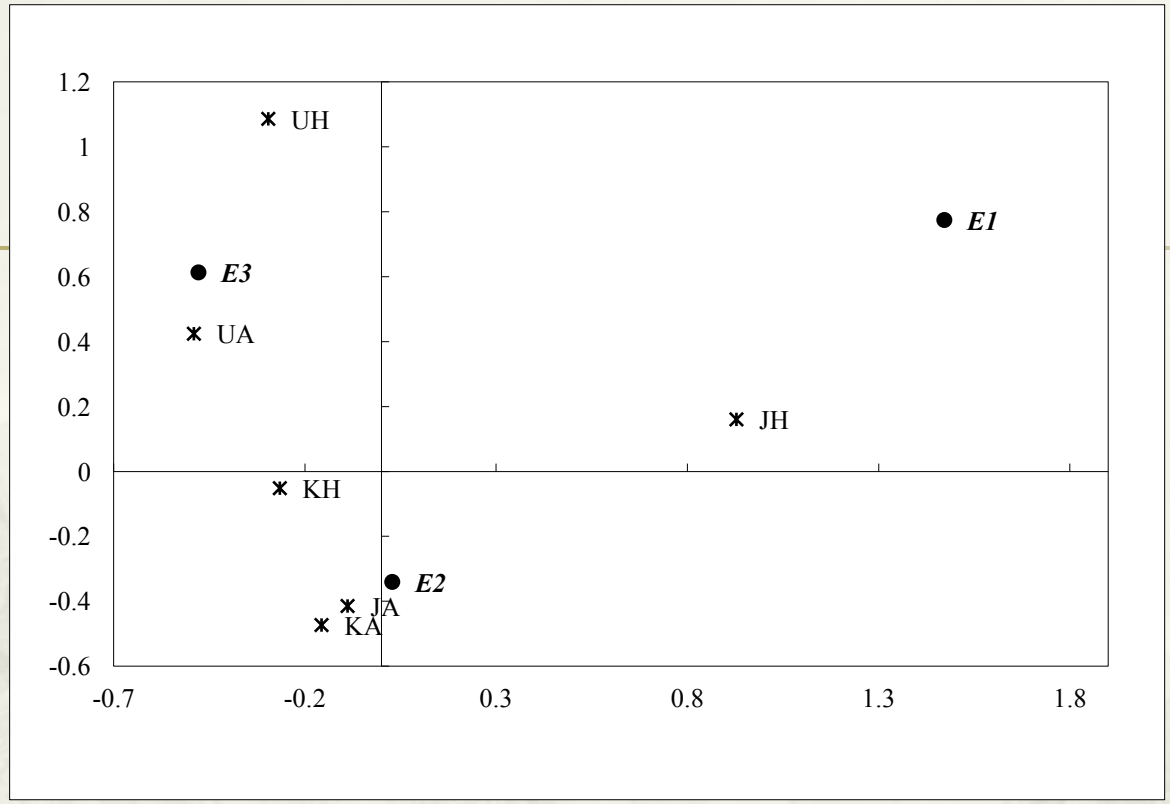
Assumption about Relationships with humans



JH: humanoid for Japanese
JA: pet-type for Japanese
KH: humanoid for Korean
KA: pet-type for Korean
UH: humanoid for USA
UA: pet-type for USA

S1: equal to humans
S2: equal to pet animals
S3: equal to tools

Assumption about Functions of Emotions



JH: humanoid for Japanese
JA: pet-type for Japanese
KH: humanoid for Korean
KA: pet-type for Korean
UH: humanoid for USA
UA: pet-type for USA

E1: equal to humans
E2: partly
E3: no emotion

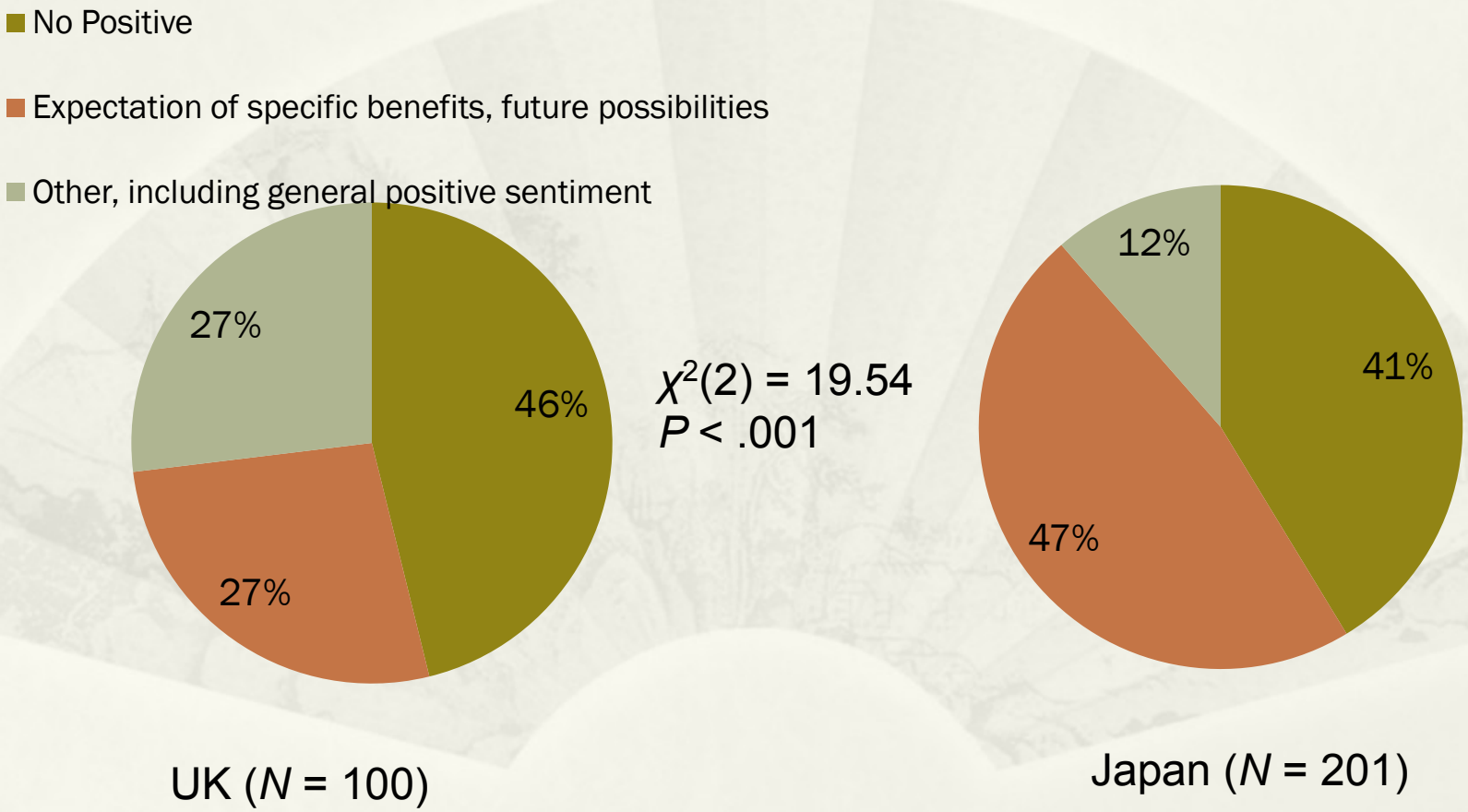
Differences on Assumptions about Tasks and Images

- Assumptions about tasks related to life-and-death situations such as hospitals :
  - Korean students > Japanese students
- Assumptions about tasks related to social works and education :
  - Japanese students > Korean students
- USA students: both interests and caution for the technology
- On the item “A blasphemous of nature”:
  - USA students < Japanese and Korean students
- Korean and USA: both positive and negative
- Japanese: ambiguous
  - Not consistent with the popular notion on preference of robots in Japan

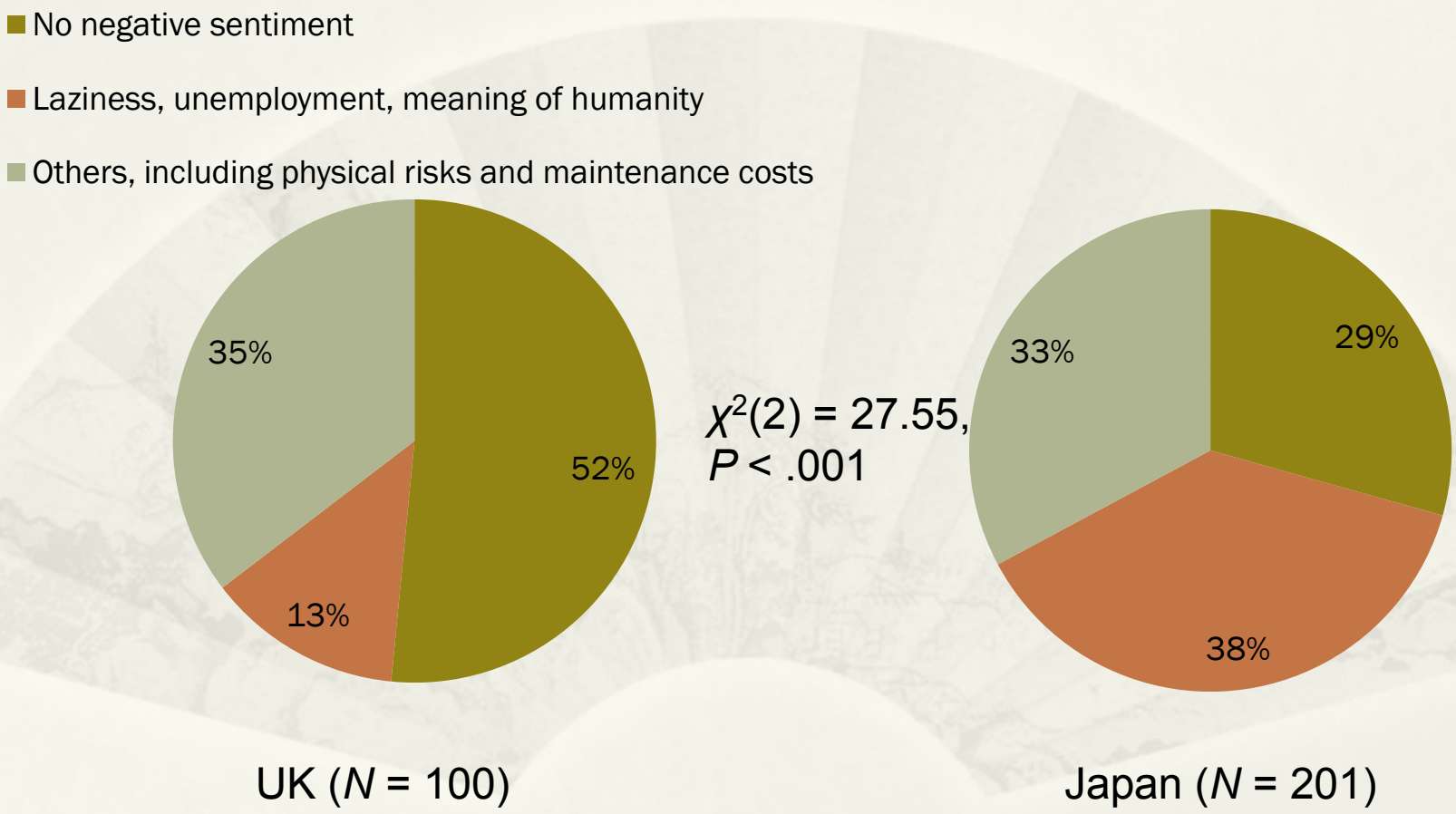
Comparison between Japan and the UK

- Verification of “Frankenstein syndrome” (Syrdal, et al., 2011)
  - Extraction of opinions about humanoid robots from an open-ended questionnaire
    - About widespread of humanoid robots in society
    - Sorts of activities humanoid robots should/should not perform in society,
    - Sources of impressions of humanoid robots
  - Respondents: general adults

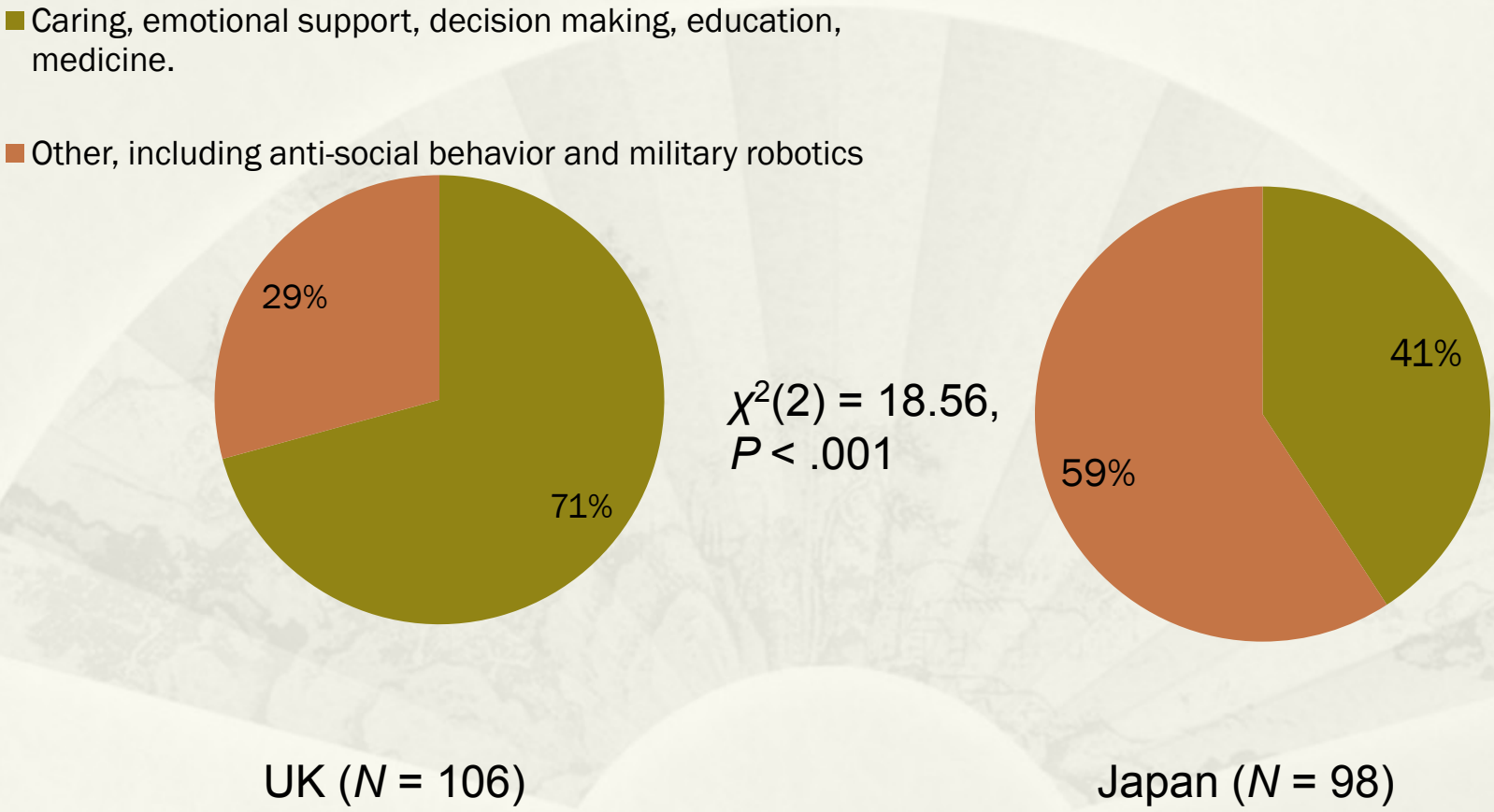
On Positive Sentiments toward Humanoid Robots



On Negative Sentiments toward Humanoid Robots



On Types of Tasks Humanoid Robots Should not Perform



Age Effect on Acceptance of Humanoid Robots

- Suggestion from the existing studies:
  - Younger people more preferred to robots than elder people in these studies
    - In other countries
- Possibility of the opposite trend in Japan

Age Difference on Robots in Japan

- Survey for visitors of a robot exhibition (Nomura et al., 2007)
  - 40's: more positive than 20's
- Survey for visitors of an event about robots held in a shopping facility (Nomura et al., 2009)
  - Adults (26～50):
    - Prediction: communication robots
    - Expectation: non-communication robots
  - Elderly (more than 51)
    - Both communication and non-communication robots in both prediction and expectation

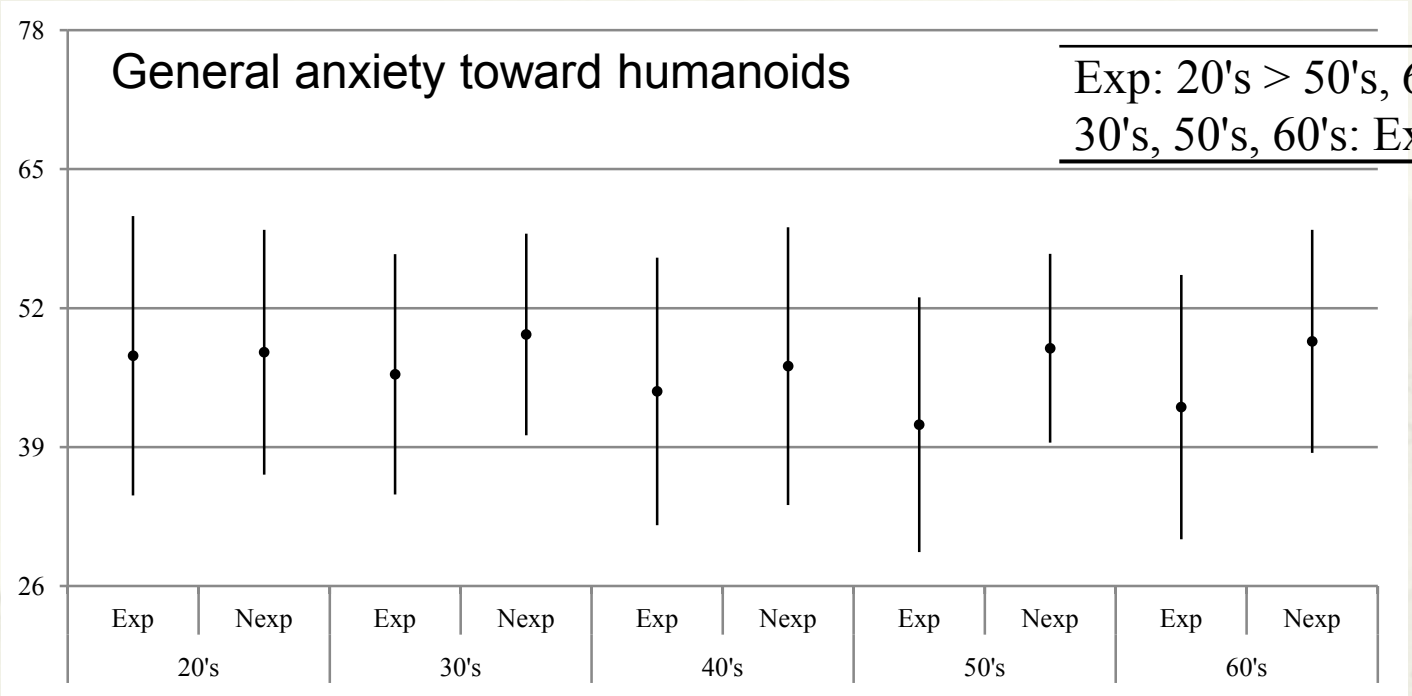
Development of Frankenstein Syndrome Questionnaire

- A measurement tool to investigate social acceptance of humanoid robots (Nomura, et al., 2012)
  - General anxiety, anxiety toward social risks, trustworthiness for developers, and expectation in daily life
  - Exploration of effects of age, culture, experiences
- Current stage:
  - A pilot test in Japan (*N* = 1000)

Influences of age and experience

- Experience of humanoid robots in real situations or through media information:
  - Positive influences on trustworthiness for developers and expectation in daily life
- Age:
  - Elder population -> increased trustworthiness for developers and expectation in daily life

Interaction between Age and Experience (1)



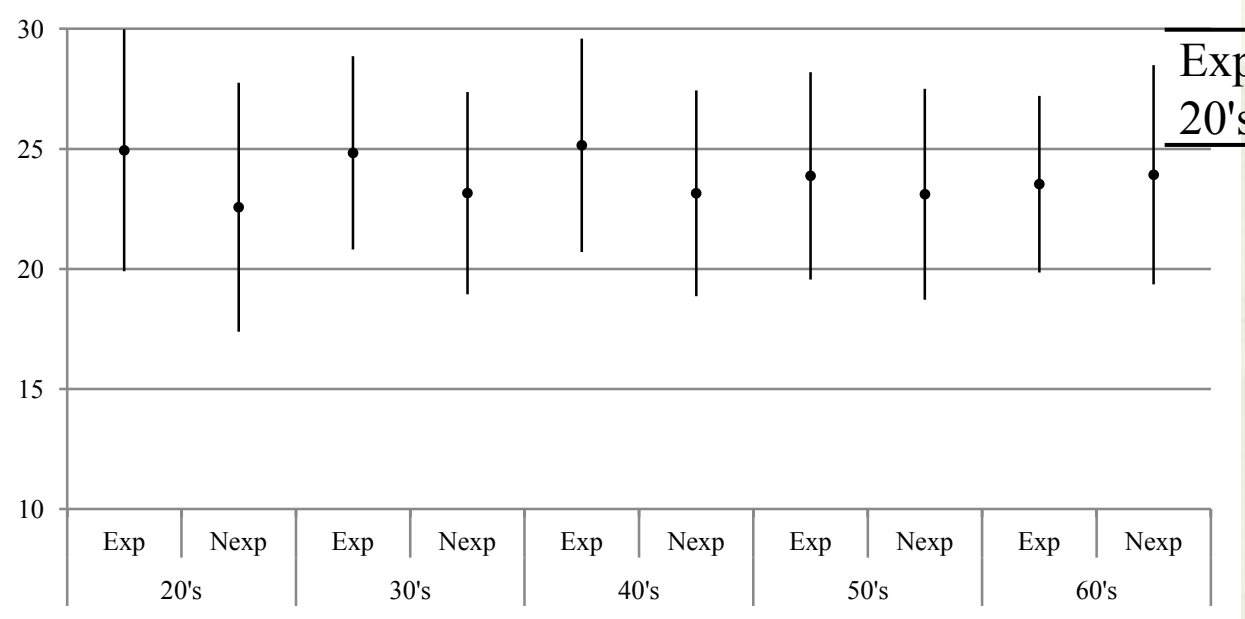
Exp: 20's > 50's, 60's; 30's > 50's
30's, 50's, 60's: Exp < Nexp

Exp: respondents who had seen real humanoid robots, or seen humanoid robots via media

Nexp: respondents who had never seen humanoid robots

Interaction between Age and Experience (2)

Anxiety toward social risks of humanoids



Exp: 40's > 60's
20's, 30's, 40's: Exp > Nexp

A trend opposite to general anxiety

Future Direction of the Research

- Investigation of interaction effects between age, experience, and culture
  - Another pilot, and main tests of Frankenstein Syndrome Questionnaire
- Exploration of essential factors in age and cultural differences
  - Educational systems, religious beliefs, mass-media
- Unification of TAM

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References

- Bartneck, C., Suzuki, T., Kanda, T., and Nomura, T. (2007). The Influence of People's Culture and Prior Experiences with Aibo on their Attitude towards Robots. AI & Society, 21(1-2), 217-230.
- Davis, F.D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. MIS Quarterly, 13(3), 319-339.
- Heerink, M., Krose, B., Evers, V., and Wielinga, B. (2008). The Influence of Social Presence on Acceptance of a Companion Robot by Older People. Journal of Physical Agents, 2(2), 33-40.
- Kamide, H., Mae, Y., Kawabe, K., Shigemi, S., Hirose, M., and Arai, T. (2012). New measurement of psychological safety for humanoid. In Proc. ACM/IEEE International Conference on Human-Robot Interaction, pp.49-56.
- Kamide, H., Mae, Y., Kawabe, K., Shigemi, S., and Arai, T. (2012). Effect of human attributes and type of robots on psychological evaluation of humanoids. In Proc. International Workshop on Advanced Robotics and its Social Impacts, pp.40-45.
- Kaplan, F. (2004). Who is afraid of the humanoid?: Investigating cultural differences in the acceptance of robots. International Journal of Humanoid Robotics, 1(3), 465–480.

- MacDorman, K. F., Vasudevan, S. K., and Ho, C-C. (2009). Does Japan really have robot mania? Comparing attitudes by implicit and explicit measures. AI & Society, 23(4), 485-510.
- Nomura, T., Tasaki, T., Kanda, T., Shiomi, M., Ishiguro, H., and Hagita, N. (2007). Questionnaire-Based Social Research on Opinions of Japanese Visitors for Communication Robots at an Exhibition. AI and Society, 21(1-2), 167-183.
- Nomura, T., Suzuki, T., Kanda, T., Han, J., Shin, N., Burke, J., and Kato, K. (2008). What People Assume about Humanoid and Animal-Type Robots: Cross-Cultural Analysis between Japan, Korea, and the USA. International Journal of Humanoid Robotics, 5(1), 25-46.
- Nomura, T., Kanda, T., Suzuki, T., and Kato, K. (2009). Age Differences in Images of Robots: Social Survey in Japan. Interaction Studies, 10(3), 374-391.
- Nomura, T., Sugimoto, K., Syrdal, D. S., and Dautenhahn, K. (2012). Social Acceptance of Humanoid Robots in Japan: A Survey for Development of the Frankenstein Syndorome Questionnaire. In Proc. International Conference on Humanoid Robots (to appear).
- Rollin, B. E. (1995). The Frankenstein Syndrome: Ethical and Social Issues in the Genetic Engineering of Animals. Cambridge University Press.
- Oestreicher, L., and Eklundh, K. S. (2006). User expectations on human–robot co–operation. In Proc. IEEE International Symposium on Robots and Human Interactive Communication, pp. 91–96.

- Salvini, P., Laschi, C., and Dario, P. (2010). Design for Acceptability: Improving Robots' Coexistence in Human Society. International Journal of Social Robotics, 2(4), 451-460.
- Scopelliti, M., Giuliani, M. V., and Fornara, F. (2005). Robots in a domestic setting: A psychological approach. Universal Access in Information Society, 4, 146-155,
- Shin, D-H., and Choo, H. (2010). Modeling the acceptance of socially interactive robotics: Social presence in human–robot interaction. Interaction Studies, 12(3), 430-460.
- Syrdal, D. S., Dautenhahn, K., Nomura, T., and Hirai, H. (2011). Examining the Frankenstein Syndrome : An open-ended cross-cultural survey. In Proc. International Conference on Social Robotics, pp.125-134.
- Yamamoto, S. (1983). Why the Japanese have no allergy to robots. L'esprit d'aujourd'hui (Gendai no Esupuri), 187: 136–143 (in Japanese).