Social Acceptance of Humanoid Robots

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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)
- Oestreicherer & 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

UK (N = 100)

- No Positive: 27%
- Expectation of specific benefits, future possibilities: 46%
- Other, including general positive sentiment: 27%

Japan (N = 201)

- No Positive: 12%
- Expectation of specific benefits, future possibilities: 47%
- Other, including general positive sentiment: 41%

$\chi^2(2) = 19.54$  
$P < .001$
On Negative Sentiments toward Humanoid Robots

No negative sentiment

Laziness, unemployment, meaning of humanity

Others, including physical risks and maintenance costs

\[ \chi^2(2) = 27.55, \quad P < .001 \]

UK (\(N = 100\))

Japan (\(N = 201\))
On Types of Tasks Humanoid Robots Should not Perform

- Caring, emotional support, decision making, education, medicine.
- Other, including anti-social behavior and military robotics

\[ \chi^2(2) = 18.56, \quad P < .001 \]

UK (\( N = 106 \))

Japan (\( N = 98 \))
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)

General anxiety toward humanoids

- **Exp**: respondents who had seen real humanoid robots, or seen humanoid robots via media
- **Nexp**: respondents who had never seen humanoid robots

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


