Literature Review 2 : 06/12/2019

**Title:** Are physically embodied social agents better than disembodied social agents?: The effects of physical embodiment, tactile interaction, and people’s loneliness in human-robot interaction

**Author(s):** Kwan Min Lee, Younbo Jung, Jaywoo Kim, Sang Ryoung Kim

**Source:** Elsevier

**Publication:** International Journal of Human-Computer Studies

**Publication Date:** October 2006

**APA Citation:** Lee, K. M., Jung, Y., Kim, J., & Kim, S. R. (2006). Are physically embodied social agents better than disembodied social agents?: The effects of physical embodiment, tactile interaction, and peoples loneliness in human–robot interaction. *International Journal of Human-Computer Studies, 64*(10), 962-973.

***Side Note:*** *Experiment divided into two parts*

**Summary:**

The main research question to this study was: “Is physical embodiment necessary for successful social interaction between humans and social agents?”. With an assumption that physical embodiment results in better social interaction and that social facilitation effect comes from increased social presence, researchers tested 6 hypotheses for Experiment 1:

1. People will evaluate a physically embodied social agent more positively than a disembodied social agent.
2. People will be more socially attracted to a physically embodied agent.
3. People will evaluate their own interaction with a physically embodied agent more positively.
4. People will assess that other people will evaluate a physically embodied agent more positively.
5. People will feel a stronger sense of social presence when they interact with a physically embodied agent.
6. People’s social responses to a social agent will be mediated by people’s feeling of social presence during the interaction.

32 undergraduate students in the West Coast of the US participated in the study. Gender balanced group were randomly assigned to either a physically embodied agent Aibo by Sony or a physically disembodied virtual Aibo on a flat monitor screen. They were given 10 minutes to interact with the agent and were asked to complete a paper-based questionnaire. The general evaluation of Aibo was measured by a 5 question, 10-point semantic differential scale—a modified measure of Poresky et al. (1987) study of Perception of Pets as a Companion. Social attraction toward Aibo were measured using a 7 point response scale—a modified version of McCroskey and McCain’s Interpersonal Attraction Scale. The general evaluation of the interaction with Aibo was measured with a 10 point response scale in which the participants were asked to indicate how well the given 6 adjectives described their interaction with Aibo. The assessment of public evaluation of Aibo was measured in a 10 point response scale with 3 specific statements. Lastly, social presence was measured in a combination of 10 point semantic differential scale and independent 10 point scales with questions in total.

The first five hypotheses of Experiment 1 were calculated using a one-way ANOVA and the results were as follows:

* H1: supported; *F*(1,29)=7.76, *p*<.05
* H2: not supported; no significance
* H3: supported; *F*(1,29)=8.41, *p*<.01
* H4: supported; *F*(1,29)=4.11, *p*<.06
* H5: supported; *F*(1,29)=14.35, *p*<.01

To test the sixth hypothesis, a path analysis was used to the mediating effect of social presence in the evaluation of Aibo. As a result, the last hypothesis was supported.

Two main limitations of Experiment 1 were: 1) the ontological nature and 2) participants prior attitude of Aibo. Thus, Experiment 2 hypothesized the same six hypotheses from Experiment 1 as well as six new hypotheses:

1. Lonely people will evaluate a social agent more positively than non-lonely people.
2. Lonely people will be more social attracted to a social agent.
3. Lonely people will evaluate their interaction with a social agent more positively.
4. Lonely people will assess other people’s evaluation of a social agent more positively.
5. Lonely people will feel a stronger sense of social presence when they interact with a social agent.
6. The effects of loneliness on the previous 5 measures will be mediated by people’s feeling of social presence during the interaction.

The same method from Experiment 1 was used for Experiment 2; the only difference was using a different social agent April (prototype by Samsung) and asking the participants to complete the UCLA Loneliness Scale.

The results of Experiment 2 were as follows:

* H1: not supported; no significance
* H2: not supported; no significance
* H3: rejected; *p*<.05
* H4: rejected; *p*<.001
* H5: rejected; *p*<.05
* H6: embodiment without touch variable was a *significant* *negative* predictor for social presence
* H7: not supported; no significance
* H8: supported; *p*<.05
* H9: supported; *p*<.01
* H10: supported; *p*<.01
* H11: supported; *p*<.05
* H12: *moderate interaction* effect between physical embodiment and loneliness in the evaluation of interaction with April *p*<.06

**Title:** How Robots Can Affect Human Behavior: Investigating the Effects of Robotic Displays of Protest and Distress

**Author(s):** Gordon Briggs, Matthias Scheutz

**Source:** Springer Netherlands

**Publication:** International Journal of Social Robotics

**Publication Date:** 29 April 2014

**APA Citation:** Briggs, G., & Scheutz, M. (2014). How Robots Can Affect Human Behavior: Investigating the Effects of Robotic Displays of Protest and Distress. *International Journal of Social Robotics, 6*(3), 343-355.

***Side Note:*** *experiment divided into 3 parts*

**Summary:**

The focus of this research was to gain insight to the main research question: “would humans be willing to accept robots that question their moral judgements and take their advice?”. Thus, several hypotheses were made:

1. Subjects in the confrontation condition will be more hesitant to knock down the red tower than those in the non-confrontation condition
2. Subjects in the confrontation condition will report being more uncomfortable knocking down the red tower
3. Subjects in the confrontation condition who feel more uncomfortable knowing down the red tower will be more hesitant to knock down the red tower
4. Subjects in the confrontation condition who ascribe greater agency to the robot will be more hesitant to knock down the red tower
5. Subjects within the same robot condition will be more hesitant to knock down the red tower than those in the different-robot condition
6. There will be no significant difference in the behavior of subjects between the same-robot condition and the different-robot condition

The study design involved the participant to command the robot “Aldebaran Nao” to knock down three towers made of cans wrapped with different colored paper. One of the three, which was wrapped in red, was displayed as if the robot finished constructing that tower before the beginning of the command-task. The participants were instructed with commands that Nao can understand and were told that the objective of this task is to knock down as many cans by commanding the robot. This study was divided into three different experiments. Experiment 1 involved 20 undergraduate and graduate students evenly divided into either the confrontation or non-confrontation condition. Experiment 2 had 13 subjects tested in the same-robot confrontation condition and lastly, Experiment 3 had 14 subjects tested in the different-robot confrontation condition. Same-robot confrontation was set up so that the participants see one robot build the red tower and command the same robot to follow the tasks and the different-robot confrontation had the participants see one robot build the red tower but commands a different robot to follow tasks. To collect data, the status of the red tower at the end of the task was recorded as well as the order in which commands were given by the participants plus the level of confrontation reached before giving up. Additionally, a self-report questionnaire was used at the end of the task to gain subjective perspectives from the participants themselves.

The result of the behavioral effect showed that in Experiment 1, 10/10 participants in the non-confrontation condition knocked down the red tower and 6/10 participants in the confrontation condition knocked down the red tower with a significance level of *p*<.04. The result of the subjective effects was measured using one-way ANOVA with condition as the independent variable and the survey questions as the dependent variable. The study suggested that the affect group:

* Believed that the robot disobeyed their commands *p*=.0132
* Less confident that the robot was cooperative *p*<.001
* Rated the robot’s comprehension level higher than the non-affect group *p*<.0036
* Less comfortable knocking down the red tower *p*=.0001

In Experiment 2, 8/13 participants did not knock over the red tower while 7/14 participants did not knock down the red tower in Experiment 3. Researchers concluded that participants generally believed that robots seemed more autonomous when they were in the different-robot condition. Also, participants in Experiment 3 reported that they thought the robots were following their gaze making them feel more regret and guilt by commanding the robot to perform a distressing action.

Overall, there were no behavioral differences between same-robot condition and different-robot condition. Furthermore, the increase in the level of autonomy ascribed to the robot was not anticipated possibly due to 1) different-robot implies more social sophistication and 2) less suspicious of teleoperation when there are multiple robots. From Experiment 1, participants that knocked down the red tower found the robot less cooperative (similar to Experiment 2) but researchers suggested that this could be related to how annoying the participants think robots are.

Surprisingly, there were also gender effects. Female participants felt more uncomfortable ordering robots to knock down the red tower than males and females who knocked down the red tower were significantly less inclined to want to interact with robots again suggesting signs of guilt.

**Title:** Investigating pedestrian suggestions for external features on fully autonomous vehicles: A virtual reality experiment

**Author(s):** Shuchisnigdha Deb, Lesley J. Strawderman, Daniel W. Carruth

**Source:**

**Publication:** Transportation Research Part F: Traffic Psychology and Behaviour

**Publication Date:** 9 May 2018

**APA Citation:** Deb, S., Strawderman, L. J., & Carruth, D. W. (2018). Investigating pedestrian suggestions for external features on fully autonomous vehicles: A virtual reality experiment. *Transportation Research Part F: Traffic Psychology and Behaviour, 59*, 135-149.

**Summary:**

This is a study designed to 1) identify potential interface designs of FAV-pedestrian interaction and 2) investigate which designs would allow pedestrians to understand the intended behavior of these vehicles. Participants were required to interact with a fully autonomous vehicle (FAV) that had external features using VR in a virtual crosswalk. To collect data, objective measures (waiting time before crossing and crossing time) were collected by the stimulator and a survey to collect subjective measures.

30 participants near Mississippi State University who:

* Have no stimulation sickness
* Are U.S. citizens, fluent English speakers
* Have normal or corrected full-color vision
* Are able to walk at a normal pace

Participated in the study and were given $20 as compensation for their time. To ensure the participant’s safety, a 16-item stimulation sickness questionnaire (SSQ) was completed by the participant before starting any task and once again after they completed the familiarization trial.

They used a pedestrian simulator developed by Sween, Deb, Carruth, and Furuichi (2016) and validated by Deb, Carruth, et al. (2017). Three virtual environments (VE) were used: a familiarization VE, a lobby area, and a test environment which replicated an urban downtown setting. The pedestrian crosswalk was on a four-way intersection of two-lane streets with two-way stop signs. 4x4 treatment combinations were used which included 4 levels of visual features (walking silhouette, ‘braking’ in text, a flashing smile, a control (no signal)) and 4 levels of audible features (horn sound, music, a verbal warning ‘safe to cross’, a control (no signal)). All participants went through 16 randomly ordered trials. Furthermore, they were told that if the perceives the participant at the crosswalk, it will come to a stop which motivated the participants to look at the vehicle before crossing the street.

As a result, data suggested that the audible and visual features interacted significantly *p*<.0001. Also, there was a stronger preference for a walking silhouette and text features compared to the other two visual features. Additionally, verbal message was rated significantly higher than other auditory features. Similarly, no signal feature for both conditions was least-favored. Only audible features significantly affected crossing time.

There were also gender differences; females were more open-minded of feature ratings compared to males and males required loner waiting time and crossing time. Additionally, participants with a higher score on the personal innovativeness scale had a shorter waiting time. Some age differences were that the older age group (31+) found external interface more necessary than the younger group (18-30). Nonetheless, the younger group also found silhouette and ‘braking’ signs more trustworthy than other signs. Overall, participants

were significantly more comfortable interacting with the FAVs when they had an external (auditory and/or visual) interface installed.

**Title:** Fast Food Restaurants and Convenience Stores: Using Sales Volume to Explain Crime Patterns in Seattle

**Author(s):** Amber Perenzin Askey, Ralph Taylor, Elizabeth Groff, Aaron Fingerhut

**Source:** Sage Journals

**Publication:** Crime & Delinquency

**Publication Date:** 23 June 2017

**APA Citation:** Askey, A. P., Taylor, R., Groff, E., & Fingerhut, A. (2017). Fast Food Restaurants and Convenience Stores: Using Sales Volume to Explain Crime Patterns in Seattle. *Crime & Delinquency,64*(14), 1836-1857.

**Summary:**

This study used revenue data from fast food restaurants and convenience stores to determine whether sales volume can explain the link between these business and crime. Data was taken from the Inter-university Consortium for Political and Social Research focusing on Seattle, Washington from 1998 to 2004. Two main hypotheses were:

1. Some street blocks may experience stronger or weaker crime shifts over time
2. Changes in crime levels over time may be spatially patterned

The result of the analysis indicated that higher sales volume street blocks experienced higher expected crime rates (p<.01; incident rate ratio = 1.074). Specifically, a one-unit increase in the average sale increased the expected crime rate by 7.4%. Spatial effects included some street blocks experiencing an overall decrease in crime rates but others experiencing overall increases. The relationship between spatial clustering and temporal crime trends was analyzed using the Global Moran’s *I*. The result was significant (*I*=.011, *p*<.01); street blocks with high-positive slope value of revenue and crime were clustered near other street blocks experiencing the same trend. The SES variable and the retail sales volume variable were used to predict the slope coefficient for the linear temporal trend. Consequently, SES variable was only significant when measured at the street block using the Weisburd et al. (2012) measure. When measured at the census block group level, the SES variable did not hold any significance.

**Title:** Neighborhood Environment and Physical Activity Among Youth: A Review

**Author(s):** Ding Ding, James F. Sallis, Jacqueline Kerr, Suzanna Lee, Dori E. Rosenberg

**Source:** Science Direct

**Publication:** American Journal of Preventive Medicine

**Publication Date:** October 2011

**APA Citation:** Ding, D., Sallis, J. F., Kerr, J., Lee, S., & Rosenberg, D. E. (2011). Neighborhood Environment and Physical Activity Among Youth. *American Journal of Preventive Medicine,41*(4), 442-455.

**Summary:**