

2023

# Are human-like robots trusted like humans? An investigation into the effect of anthropomorphism on trust in robots measured by expected value as reflected by feedback related negativity and P300

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The Plymouth Student Scientist  
University of Plymouth

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## Appendices

### Appendix A – Consent Form

**UNIVERSITY OF PLYMOUTH**  
**FACULTY OF HEALTH AND HUMAN SCIENCES**  
**CONSENT TO PARTICIPATE IN RESEARCH PROJECT**

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Name of Principal Investigator  
Jeremy Goslin

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Title of Research  
An investigation of trust in human, machine, and robot interaction

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**What is the research about?**

This study investigates trust in interactions with humans, computers and robots in an economic investment game.

**What should I expect?**

You will play an investment game with a human, robot, and computer partner. The goal of each game is to try and make as much (virtual) money as possible by the end of the game. In each round of the game you are provided two credits of (virtual) money, and you have to decide how much of that money you are willing to risk in an investment with the partner (0, 1, or 2). The partner will each receive three times the money invested and will have to decide how much they will return to you in return. It is possible that they will return more, or less, than you originally invested.

After the games you will also be asked to complete short questionnaires to elicit your views of the game and the three partners you played with.

During this experiment we will also be measuring brain activity using electroencephalography (EEG).

This EEG procedure is both non-invasive and passive and involves the placement of small electrodes on various locations on your scalp and face. The procedure used in this experiment is as follows:

1 – After swabbing the skin with alcohol two electrodes will be attached to your skin using an easily removable surgical adhesive, one to the right of your right eye, and one below your right eye. In addition you will be fitted with an elastic cap, containing additional electrodes, which will cover your hair. This elastic cap will be held in place by elastic straps attached to an elastic belt fitted across your chest.

2 – Each of the electrodes will then be filled with a conductive water-based gel using a flat, wide aperture, syringe (this type of syringe does not penetrate the skin), whilst rotating the syringe to move hair away from the location of the electrode. The clear gel is non-abrasive and hypoallergenic, but let the experimenter know if you feel any discomfort during the procedure.

In addition to the collection of EEG information you will also be asked to fill in a questionnaire used to ascertain information on faculties related to health and handedness. Full reporting is essential, especially for matters of health, and you will not be penalised if safety concerns preclude your participation in this study.

After the experimental procedure is complete, we will wash your hair to remove the conductive water-based gel and towel dry your hair.

The whole study will take 1.5 hours:

- EEG set up: 30 Minutes
- Experiment procedure: 45 Minutes
- Clean up: 15 Minutes

You will be granted 3 participation points for this study.

If you have questions related to any of these procedures the experimenter will be happy to give you further information. If you subsequently have questions concerning this study or would like to be withdrawn please contact either:

Lucy Wilson  
Jeremy Goslin

**Is there any harm that may arise from my involvement?**

There is no potential for harm involved in this study.

**Do I have to take part?**

Your participation in the task is entirely voluntary and is based on informed consent.

**Can I change my mind and withdraw from this study?**

You may withdraw at any time without penalty, or prejudice to your relationship with the University or any staff, and without prejudice to your assessment of academic performance. If you no longer wish to take part in the experiment, any data collected up to that point will be removed from the study and deleted.

**Will information be kept confidential?**

All data collected within the study will be entirely confidential. Data stored electronically will be password protected, and your data will be referenced only by a participant number.

**Will I be identifiable in any way?**

A hard copy of your name and participant number will be kept in a locked filing cabinet for a year after the study is completed. Your name will not be associated in any other way with the data collected.

**What if I have any questions/ would like further information?**

Please feel free to ask any questions you have now. If you would like further information regarding the study at a later date, or would like to know the outcome of the study, please feel free to contact the experimenter. If you have any problems then please contact the director of studies (Jeremy Goslin) in the first instance. If you feel the problem has not been resolved please contact the secretary to the Faculty of Health and Human Sciences Ethics Committee:

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PLEASE TICK AS APPROPRIATE, AND SIGN & DATE THE FORM

- ☐ The objectives of this research have been explained to me.
- ☐ I understand that I am free to withdraw from the research at any stage, and ask for my data to be destroyed if I wish.
- ☐ I understand that my anonymity is guaranteed, unless I expressly state otherwise.
- ☐ I understand that the Principal Investigator of this work will have attempted, as far as possible, to avoid any risks, and that safety and health risks will have been separately assessed by appropriate authorities (e.g. under COSHH regulations)

Under these circumstances, I agree to participate in the research.

Name: .....

Signature: .....

Date: .....

## Appendix B:

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Name of Principal Investigator

Jeremy Goslin

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Title of Research

An investigation of trust in human-machine interaction

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Robots have been used in industry and exploration for some years, but are now beginning used to fulfil more social roles, from domestic (e.g. Roomba vacuum cleaners) to social-based work (e.g. elderly caregivers). For their integration into society to be successful, human-machine relationships must be established, and an integral part of that formation concerns our trust in those relationships. The present study aims to understand our trust in robots, as they can be highly effective solicitors of anthropomorphic projection (Zlotowski, Proudfoot, Yogeeswaran, & Bartneck, 2015), especially when they have a human-like face or body (Burgoon, Bonito, Bengtsson, Cederberg, et al. 2000). This leads us to project our own social schemas onto them (Fussell, Kiesler, Setlock & Yew, 2008), with the further expectation that they will behave appropriately (Salem, Rohlfing, Kopp & Joubin, 2011) and follow our social norms (Syrdal, Dautenhahn, Walters, & Koay, 2008). In this study we examine the differences in expected value when playing an investment game with a human, computer, or a robot. Previous research has suggested that behaviour and anthropomorphism of an agent are the most significant factors in predicting trust in the robot (Natarajan & Gombolay, 2020).

Traditionally, trust has been measured using the Trust in Automation Scale (Jian, Bisantz & Drury, 2000) and the Trust Perception Scale-HRI (Schaefer, 2013). However, using questionnaires can lead to disparate findings (Kessler, Larios, Walker, Yerdon & Hancock, 2017). Due to these concerns, this study uses event related potentials to examine expected value in a trust game (Berg, Dickhaut & McCabe, 1995) with humans, computers and robots. This will allow us to compare the expected value, as measured by Feedback Related Negativity (FRN, Holroyd & Coles, 2002) and P300 (Yeung & Sanfey, 2004; Hajack, Holroyd, Moser, & Simons, 2005), between the different partners. The key question of this study was to examine the relationship between anthropomorphism and trust. Therefore in this experiment we compare expected value, as measured by FRN and P300, in humans, computers and robots.

Please be assured all data will be anonymous. If you wish to withdraw your data from this study please contact

the study was run please contact

please contact the secretary to the Faculty of Health and Human Sciences Ethics Committee:

If you have any complaints about how  
If you feel the problem has not been resolved

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