Harnessing the power of social engagement for human-robotics interaction

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What do these robots have in common?

... they have limited awareness of what people do, think and want

... they are limited in showing what they are doing and will do

... they do not engage on social level

... they don’t have a face
Ever talked to your computer or your car?

- We attribute human motivation, characteristics or behaviour to non-human organisms or inanimate objects
- We anthropomorphise consciously and unconsciously
  - E.g. pareidolia: Seeing animal or human features in objects and random patterns.
Beyond just looking cute

• What function would facial features have on a robot?

• A face amplifies anthropomorphisation, but why would you want to make a robot human-like?
Making robot faces

• Display an avatar on a screen
  • But lacks 3D features, which hampers gaze reading

• Build a mechatronic face
  • Costly, mechanically complex, low mean time between failure, less flexible
Retro-projected face technology

Eye gaze reading

• Can we read a robot’s eye gaze?
  • Not as well as human’s, eyes need to be 3D.
  • Display type has a significant influence, $F(3, 88) = 8.121, p < .01$. Looking angle has a significant influence, $F(1, 88) = 14.438, p < .01$
Social word-meaning learning

• Young children benefit from the investment of parents and carers.
• Can we transfer this onto robots?
  • The machine learning no longer passively absorbs but actively influences the learning experience
Experimental setup

• Participant sitting across robot.
• We shortcut speech recognition and vision by interacting through touch screen.
Two conditions

• **Condition 1: Non-social robot**
  • Will observe examples using a statistical learning mechanism

• **Condition 2: Social robot**
  • Does the same, but will try to elicit better learning data through social interaction
  • “What’s this?” or “Is that a mammal?”, resulting in active learning
  • Socially guided machine learning

• **Research questions**
  • Will people treat the robot as a social agent?
  • Will the social robot result in better machine learning?
Results (1)

- Social robot learns better and faster than non-social robot.

(Joachim de Greeff)
Results (2)

- People will tailor the learning experience for the robot, even if the robot doesn’t solicit this. More notable for the social robot.

* p < 0.05
Results (3)

- Female participants are better teachers than males ($p < 0.05$).
  - The robot learns better from them.
  - Trends towards female participants being better tutors.
So...

- Robots are not only anthropomorphised, but this effect can also be used to make **machine learning more effective**.

- But why use real robots, and not on-screen avatars?
  - Robots are expensive
  - Difficult to develop and mass produce
  - Technology is not as mature as alternatives
  - Difficult to customise appearance
  - Tend to be fragile
Physical versus on-screen robot

• Study in which children play a quiz.
  • Two conditions: physical robot or on-screen robot.
  • Attention and number of fixations significantly higher.

Looking duration in 10 min. session

F(1,8)=57.30

(Belpaeme et al., 2013, Journal of HRI)
Robot results in increased learning gain

• n=100 participants, mostly undergraduates
• Solve 4 puzzles, maximum of 15 minutes per puzzle
• 3 lessons per game, during pause or at 25%/50%/75% completion

Robot results in more **compliance**

- Keeping a diabetes diary is important for diabetes self-management
  - Learn about diabetes.
  - Recognize patterns, (day, weekend, season).
  - Link own behavior with glucose levels (apply knowledge).
- Personal robot stimulates use of diary and medical adherence
- Children meet robot in person **at hospital or at home**
  - They keep a diary **for two weeks**
  - Robot helps filling in the diary through a **video conferencing**
Het dagboekje: Mijn Zorgpagina

Gezondheidsdagboek

Klik op de categorie en het tijdstip om uw gegevens in te voeren. De optie 'Koolhydraten' bevat een speciale rekenmachine waarmee u de juiste hoeveelheid koolhydraten van diverse voedingsmiddelen kunt berekenen.

Uw gezondheidsdagboek is persoonlijk, u bent de enige die uw gegevens kunt lezen. Wil u uw gegevens naar uw zorgverlener malen? Klik dan op downloaden en volg de instructies.

donderdag 1 november 2012

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Eetlust (cijfer)

Energie (cijfer)

Huidaard (cijfer)

Notitie:

**Notitie bewerken**
Method

• 6 children with diabetes (9-12 yrs old)
• Within subject design
  • Survey of how do children experience filling in a diary with the robot
  • Log of how do the children use the diary
  • Observations of how do the children behave with the robot
Results

- We measure time spent on filling in diary and amount of feedback (number of characters) used in open comments.
- Time not different, but amount of feedback doubles.

![Graph showing mean time for filling in diary and characters in activity log with and without a robot, indicating a significant p-value of 0.09.](image)
The effect of social robots

• Children are more accepting of the robot’s “flaws”, when the robot personalizes its responses.
  • Trend towards more learning by the child.
• Young users will align with the robot (use same language, same posture).
• Young users quickly settle in a turn taking pattern with the robot.
• Social robot can increase motivation and compliance.
  • Making a (semi) autonomous robot, even with restricted interaction scenarios, is very hard.
    • Technically challenging.
    • The nature of interactions: dynamic and open.
Stroke rehabilitation

• Case study: 8 y. old, cerebral stroke
• Lost mobility in right leg, arm and partial mobility in face
• Patient at the Neurology Department
  • No specific paediatric facilities
  • Rehabilitation long and frustrating process for patient
• Medical staff suggested use of robot
  • Robot used for motivation and rehabilitation exercises.
  • Used for 6 days, several times per day, with bespoke activities running on the robot
Collaborators

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