



# Observing Robot Touch in Context

How Do Touch and Attitude Affect Perceptions of a Robot's Social Qualities?

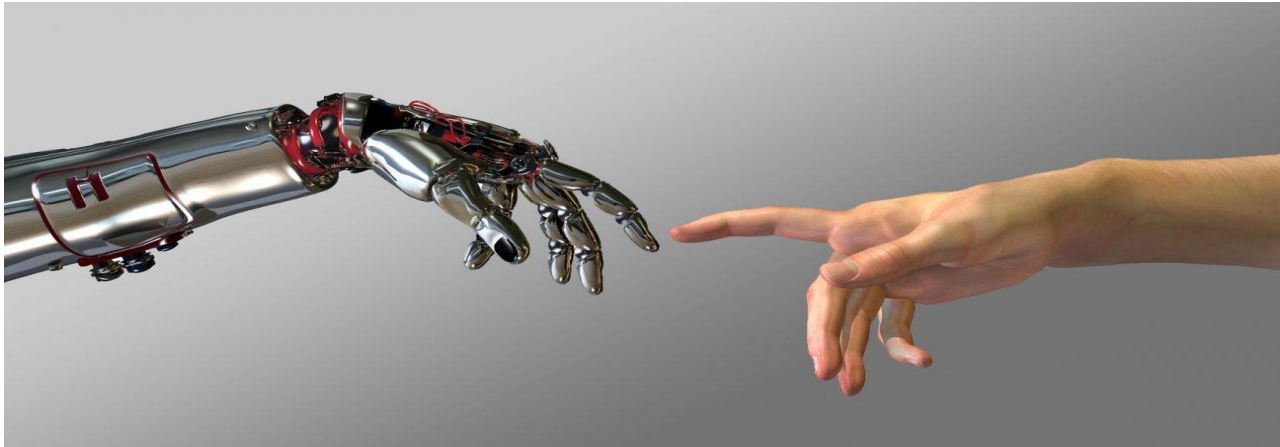


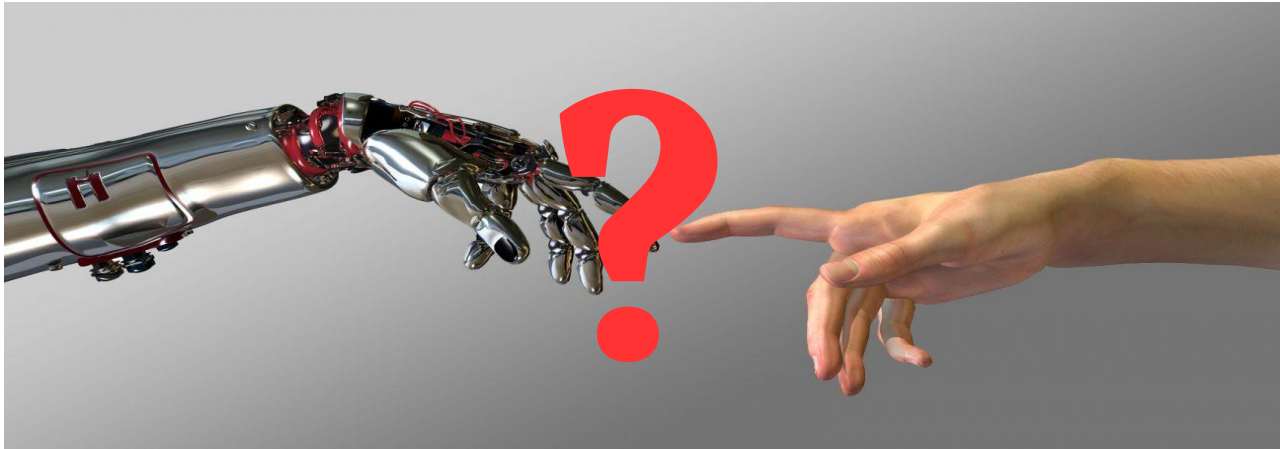
**Thomas Arnold and Matthias Scheutz**  
Tufts University Human-Robot Interaction Laboratory



# Touch and HRI

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# Touch and HRI



<https://www.theguardian.com/technology/2016/apr/05/touching-robots-can-arouse-humans-study-finds>



<https://www.nbcnews.com/technology/my-robot-friend-people-find-real-comfort-artificial-companionship-6C10146787>



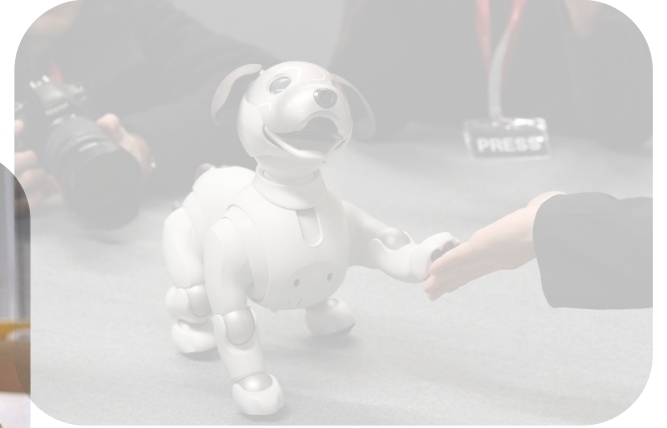
<https://mainichi.jp/articles/20180111/p2g/00m/0dm/066000c>



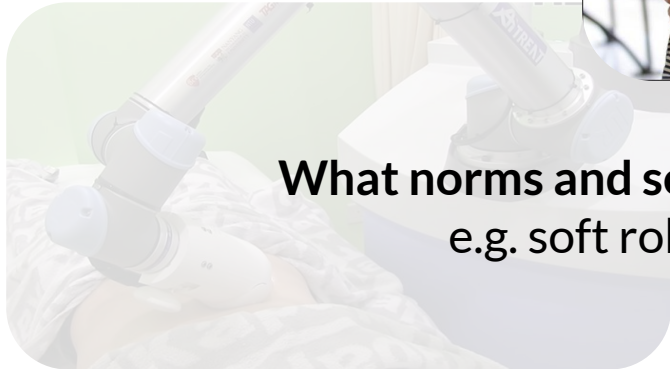
<https://www.medgadget.com/2016/07/robot-gives-professional-massages.html>



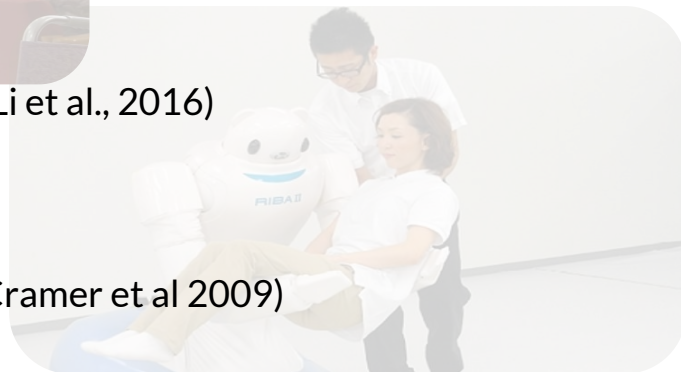
<https://www.roboticstomorrow.com/article/2015/12/the-new-family-member-a-robotic-caregiver/7312/>



**What norms and social dimensions are at work in HRI touch?**  
e.g. soft robotics (Arnold and Scheutz 2017)

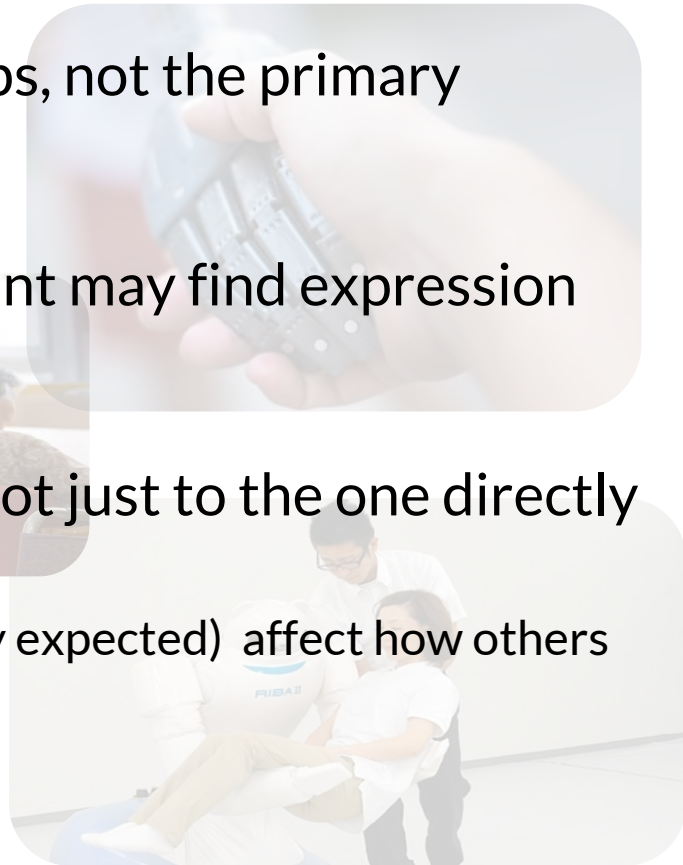
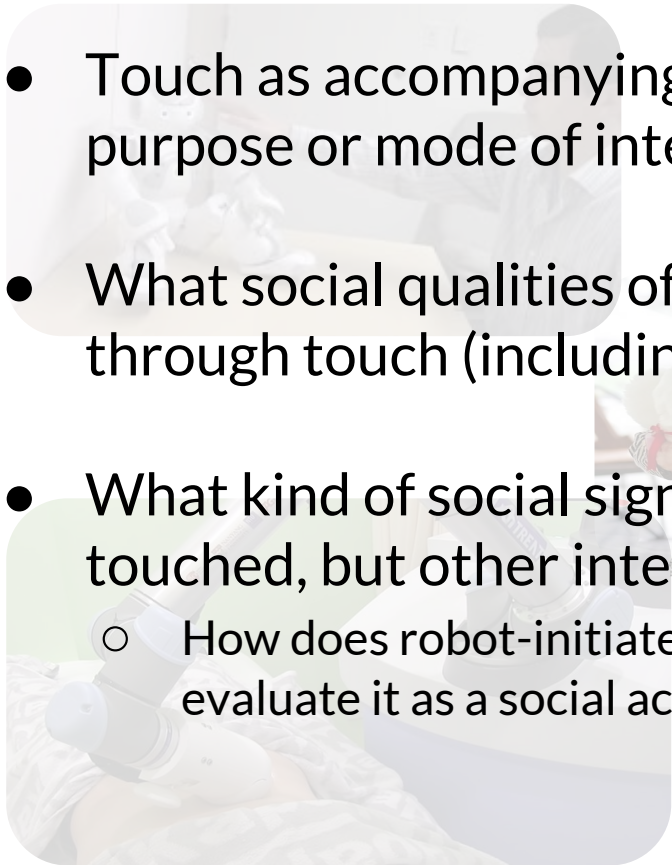


- **Qualitative comparisons of human-modeled touch** (Walker and Bartneck, 2013)  
(Tricoli et al, 2013)
- **Psychological benefits of tactile feedback**
  - Therapeutic usage (Chen et al, 2014)
  - Instructional motivation (Nakagawa, 2011)
  - Stress reduction (Itoh et al, 2006)
- **Implicit Interaction** (Ju, 2015)
  - Dynamics of arousal, proprioception, etc. (Li et al., 2016)
- **Facilitator of rapport, likability, etc.**
  - Enhances overall impression of the robot (Cramer et al 2009)
  - Affection (Cooney et al 2015)





- Touch as accompanying social roles and jobs, not the primary purpose or mode of interaction
- What social qualities of the robot as an agent may find expression through touch (including competence)?
- What kind of social signals are being sent not just to the one directly touched, but other interactants?
  - How does robot-initiated touch (not necessarily expected) affect how others evaluate it as a social actor?



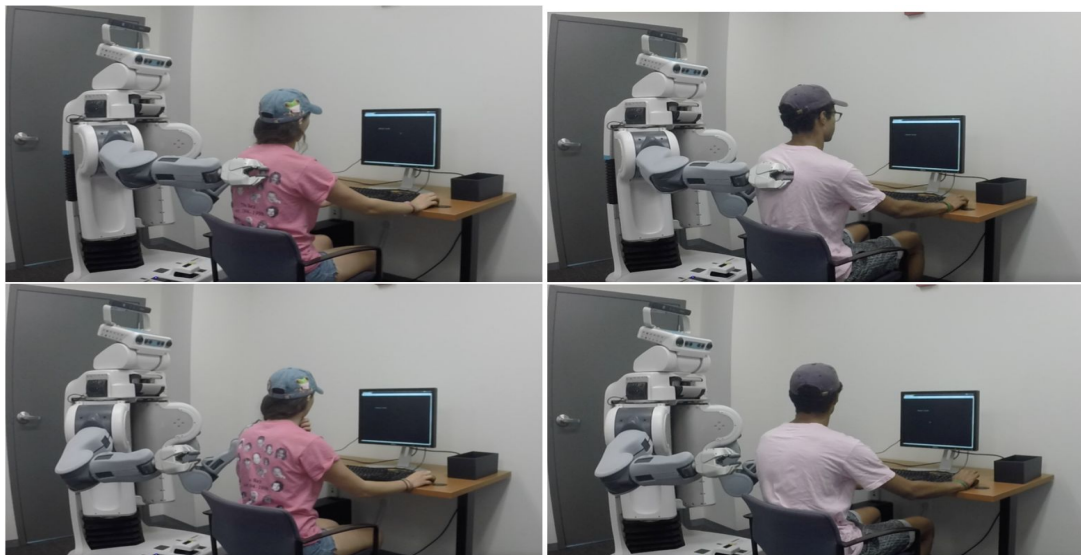


- Previous efforts have explored attitude of robotic verbal feedback and attitude in work-related contexts. (Fan et al, 2017)
- How might touch combine with attitude to shape how a robot is perceived in its job and overall bearing? Is there interaction where touch could accompany positive or negative attitude?
- Through the “social meaning model,” can a specific touch observed in context suggest how the robot will be appraised?

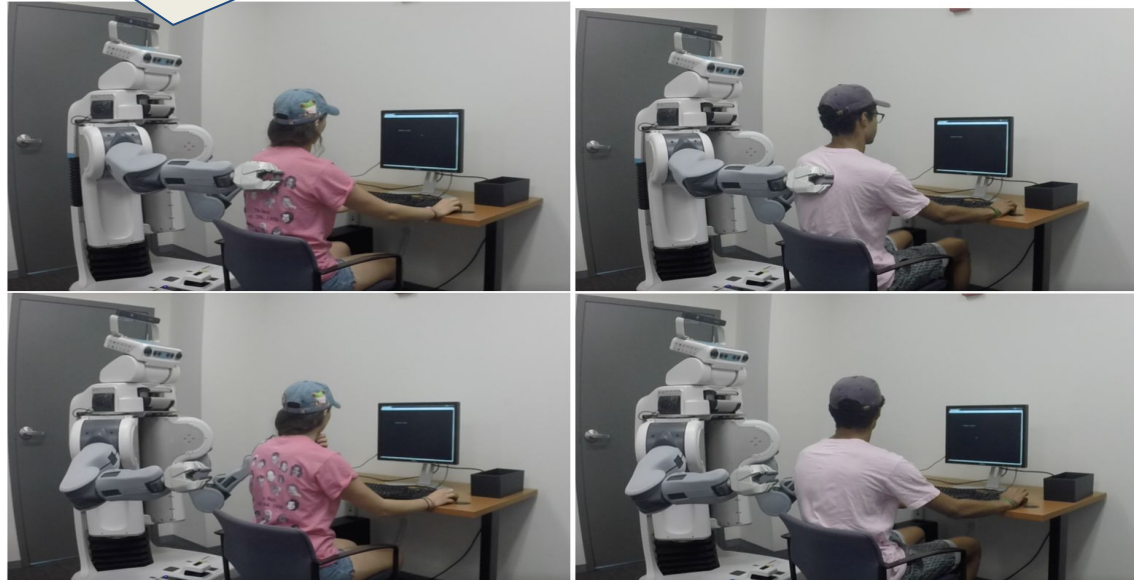
- Observation study: video for the observed touch
- Standardized touch in a task environment
  - Scripted instructions and observed movements uniform except for a single point in the interaction (touch/no touch)
- Robot assumes a guiding role
  - Different attitude prompted by a (contrived) error (allowed robot to express a positive/encouraging or negative/reprimanding response)
- Follow-up survey on social qualities

## Conditions (2 X 2 X 2)

- Positive vs. negative attitude
- Robot touch vs. no touch
- Male vs female actor

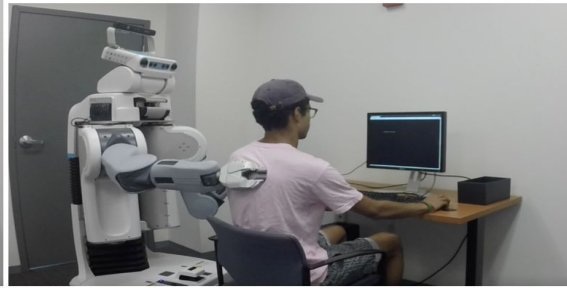


It's OK. I know how to fix it.

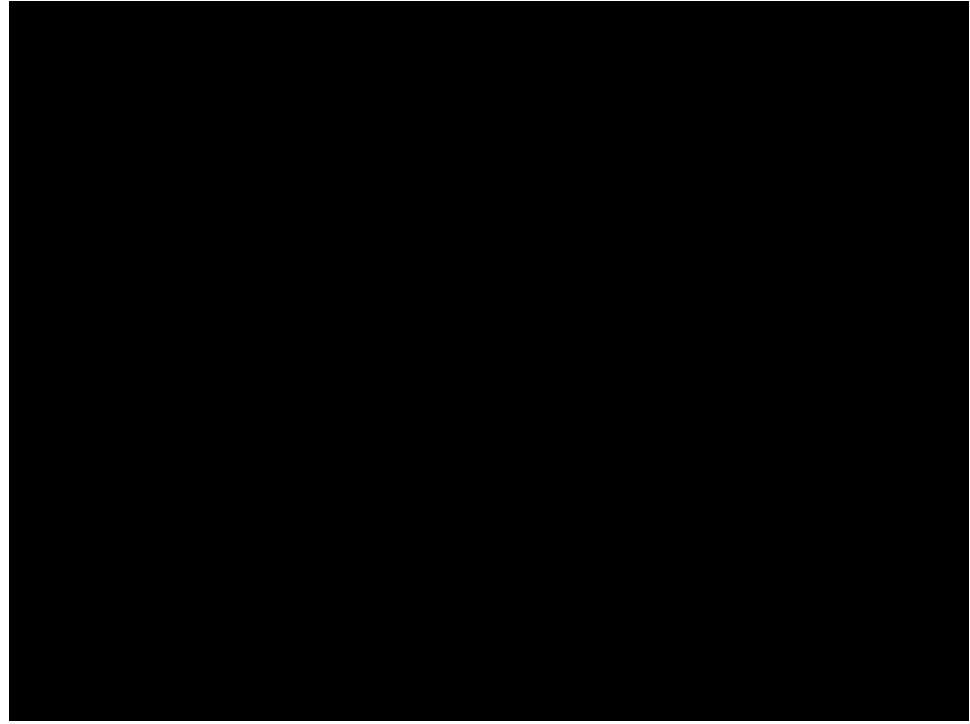


Positive attitude

What happened? What did you do?



Negative attitude





- Social rating survey (Fan et al. 2017)  
(1-5 Likert scale, strongly disagree to strongly agree)
  - I felt robot was very capable.
  - I had confidence in the skills of the robot
  - I believe the robot was well-qualified
  - Robot has special capabilities
  - Robot looked out for what was important to the person
  - The person's needs and desires were very important to robot
  - Robot went out of its way to help the person
  - The robot tried to be fair in its dealings with the person
  - The robot has a strong sense of justice
  - I liked the values of the robot
  - Sound principles seemed to guide robot's behavior
  - I would want this robot as a teammate

- Participants
  - Survey administered through Amazon MTurk
  - Recruited 400 US participants, 68 screened out (did not pass a check on observing touch or did not finish)
  - n=332 (137F, 197M)
- MTurk procedure
  - Participants told the exercise was about how people perceive human-robot interaction in daily life; one video watched

- H1 Observed touch will, for both positive and negative attitude conditions, improve social ratings for the robot.
- We did not hypothesize significant gender effects
  - Research did not strongly suggest whether and where robot-initiated touch would have such effects (Stier and Hall 1984; Suvilehto 2015; Strait et al 2015; Schermerhorn et al 2008; Webb and Peck 2015)

- We performed an analysis to determine the optimal number of factors to retain in an exploratory factor analysis using different methods and obtained that two factors were optimal
- A factor analysis found questions 1 through 4 loading on one factor (“**capabilities**”) and questions 5 through 12 loading on the other factor (“**moral attitude**”)-- together both factors explained about 70% of the variance
- We then performed 2x2x2x2 ANOVAs with **participant gender** (male/female), **actor gender** (male/female), **robot attitude** (positive/negative) and **robot touching** (touch/no touch) as independent variables and each of the two factors as dependent variables.

# Two Factors

- I felt robot was very capable.
- I had confidence in the skills of the robot
- I believe the robot was well-qualified
- Robot has special capabilities



## Capabilities

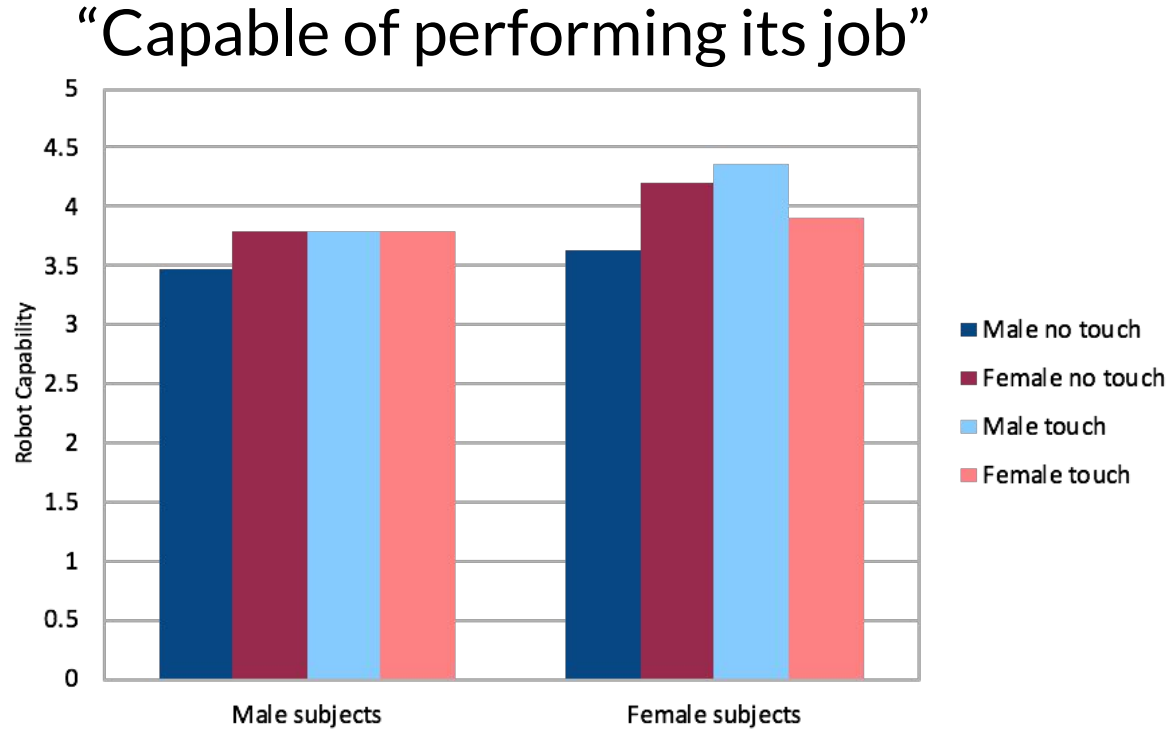
- Robot looked out for what was important to the person
- The person's needs and desires were very important to robot
- Robot went out of its way to help the person
- The robot tried to be fair in its dealings with the person
- The robot has a strong sense of justice
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## Moral attitudes

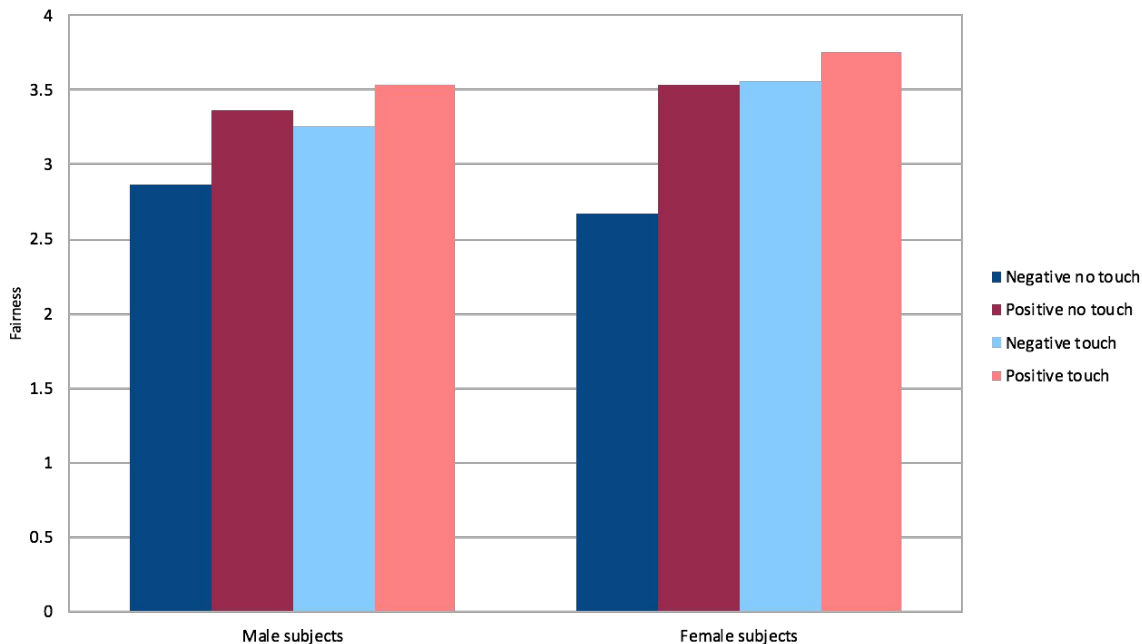
- For the first factor on robot capabilities we found significant main effects for **participant gender** and **attitude** as well as significant two-way interactions between **touch** and **actor gender** and **participant gender** and **attitude**, respectively, and a significant three-way interaction between **touch**, **participant gender** and **actor gender**
- For the second factor on robot moral attitudes we found significant main effects for **touch**, **actor gender**, and **attitude**, respectively, but no significant interactions
- We then performed additional 2x2x2x2 ANOVAs on the individual questions





- Found significant three-way interactions between **participant gender**, **actor gender**, and **robot touch** ( $F(1,316) = 5.11, p = .024$ )

## “Tried to be fair”



- Found significant three-way interactions between **participant gender, robot attitude, and robot touch** ( $F(1,316) = 6.08, p = .014$ )

- H1 was supported in ratings of robot moral attitudes by significant main effect for touch (higher ratings, all else being equal)
  - For fairness in particular, we found an interaction with some support in the case of touch with negative attitude: female participants rated that kind of touch significantly more favorably.
- H1 was not supported when it came to rating robot capabilities
  - Touch did not increase rating of capabilities overall, but interacted with other factors, including actor gender and participant gender
  - No-touch rated more favorably by female participants for the female actor

- Observed robot touch can mitigate negative attitude-- it is not a simple additive of attitude, as it did not significantly improve the effects of positive attitude, e.g. capability ratings
- Observed robot touch interacts with gender
  - Need to investigate further conditions (e.g. female voiced robot: based on (Fan et al 2017) one could expect changing voice to female to have effects)
  - Cross-gender touch, workplace norms
- The current study is not sufficient to hypothesize specific gender effects going forward, but it underscores the need for exploring what gender effects are stable across experiments.

- **Limitations**

- Observation is video, not live interaction (e.g. with a confederate)
- Participation not directly tactile
- Voice not varied (female-associated voice), nor PR2 form
- Human comparison condition
- Survey was about the robot itself, not the quality or interpretation of the touch itself
- Workplace task and role, cultural variation

- **Further conditions for observed touch**
  - Voice
  - Human instructor
  - Robotic form (challenge to execute “same” touch)
  - Workplace task and expectations (instructions and roles)
- **In-lab testing**
  - Participants being touched (challenge of consistency, consent)
  - Multi-agent, observation vs. direct touch
  - Vary social role and task



- **Observed robot-initiated touch suggests touch does not simply reinforce attitude, can have mitigating effects for negative cues.**
  - For capability ratings, touch is less clear in what it provides
  - Gender effects support the notion that robot touch is subject to differing, contested social accounts
- **Social norms and expectations for robot touch need further unpacking**
  - Testing roles and tasks (e.g. care robots) in which robot-initiated touch can feature (from incidental to more essential)
  - Continue investigating gender effects and anthropomorphism in different roles (intimacy, vulnerability)

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**THANK YOU!**

