Emulating Sociality:
A Comparison Study of Physiological Signals from Human and Virtual Social Interactions.

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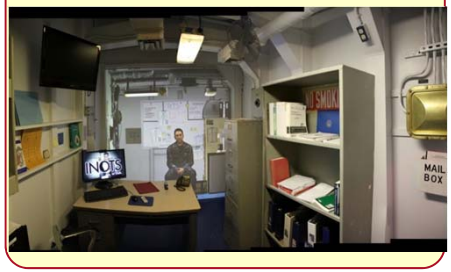
Introduction

Research Question: Do people respond differently to virtual humans compared to real humans within similar interactions?

- Dramatic advances in the capabilities of simulation platforms and video games have lead to an increase in demand for automated training platforms to supplement operational training in a variety of contexts with new demands for social-skills training platforms (i.e., negotiation, mediation, etc.).
- However, whether people organically and naturally react to virtual humans in the same way that they might other humans in social situations is directly relevant to future efforts.
- We present preliminary data comparing behavioral and physiological responses of participants as they engaged in *identical* social interactions with both human and virtual human interaction partners in a within-subjects design.

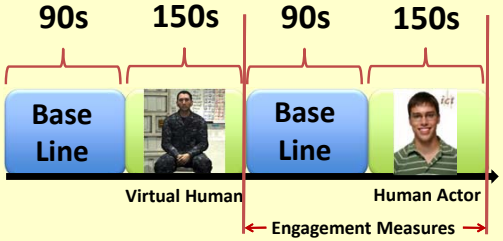


Methods

Participants

- N = 20 NAVY ROTC students, recruited from UCLA
- 81%m, 19%f; Mean age: 19.8 yrs, SD = 1.57

Experiment Design



- Participants engaged in two, semi-structured conflict mediation interactions: one with a virtual human ('Cabrillo'), one with a human (voice actor of 'Cabrillo'). Order was counterbalanced between subjects.
- Completed BIG 5 personality questionnaires prior to interactions, and engagement measures after each.
- Interaction partner dialogue was driven by participants' choices for constructive or critical responses.
- Each point in the conversation tree was tagged for affect expressed by the virtual human (exasperation, irritation, shame), which was matched by human actor.

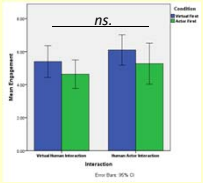
Physiological Measurements

- Participants were instrumented with BioPac Sensors:
  - Electrocardiogram (ECG)
  - Electrodermal Activity (EDA/GSR)

Results

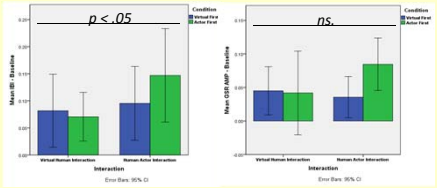
Self-Report Data

Paired samples t-tests found no differences in participants' ratings of their engagement between interactions, or between interaction order.

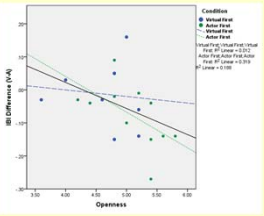


Physiological Analysis

Factorial Analysis. Inter-beat interval and waveform amplitude were extracted from raw signals (ECG, EDA/GSR). Features were aggregated within conditions and subjected to repeated measures ANOVA models with Engagement scores, with presentation order as a between-subjects factor.



- **IBIs were shorter, on average, when interacting with the virtual human interactions compared to the human actor ($F(1, 17) = 8.19$, $p < .05$).**
- **Null effects for Engagement ($F(1, 17) = .81$, $p = .38$).**
- **No interactions between factors were observed.**
- **Null effects for factorial models for EDA/GSR.**

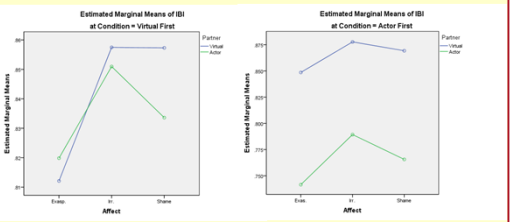


Openness to experience was strongly related to IBI, but only when participants interacted with virtual human first. ($b = 2.18$, $p < .05$)

Results Con't.

Event-Related Analyses

IBI estimates were aggregated across epochs in which interaction partners expressed different affect (exasperation, irritation). Repeated measures ANOVA models were used to compare across affect, partners, and presentation order.



- **IBI showed differences between epochs where interaction partners displayed different affect ($F(2, 28) = 4.98$, $p < .05$)**
- **Again, IBI showed differences between Actor and Virtual Human interaction partners ($F(1,14) = 5.72$, $p < .05$)**
- **Main effect for partner effect attenuated by Partner X Condition Interaction ($F(1, 14) = 4.23$, $p = .06$)**

Discussion

- Differences in physiological responses to actors and virtual humans were minimal. Where they did appear, they were accompanied by complex interactions with presentation order and individual variability (Big 5).
- Participants' pattern of SNS arousal relative to virtual human expression showed components of an complimentary, sympathetic response—they showed more arousal (shorter IBI) when interaction partners evidenced distressed affect (i.e., exasperation and shame), but less arousal (longer IBI) when partner evidenced defensive expression (i.e., upset).
- Future endeavors will seek to improve the efficacy of these training platforms with Brain-Computer-Interface techniques and leverage neurophysiological signals to drive behavior of virtual humans interacting with users.

Self-report and physiological measures indicate that interactions with social virtual humans can rival those of real humans.