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A Robot's Experience of Another Robot: Simulation

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Abstract

To develop a robot that is able to recognize and show affective behavior, it should be able to regulate simultaneously occurring tendencies of positive and negative emotions. To achieve this, the current paper introduces a computational model for involvement-distance trade-offs, based on an existing theoretical model (see other poster). A number of simulation experiments were performed, which confirmed the empirical finding that positive features do not exclusively increase involvement.

Implementation

Aesthetics, Epistemics, and Robot's Own features

$Perceived_{(<Feature>, A1, A2)} = Bias_{(A1, A2, <Feature>)} * Designed_{(<Feature>, A2)}$

Ethics

$Perceived_{(Good, A1, A2)} = Satisfaction_{(A2, Club)}$
$Perceived_{(Bad, A1, A2)} = 1 - Satisfaction_{(A2, Club)}$

Affordances

$Perc_{(Aid, A1, A2)} = \Sigma(ExpectedSkill_{(A1, A2, language)} * Skill_{(A1, language)})$
$Perc_{(Obstace\ A1, A2)} = 1 - \Sigma(ExpectedSkill_{(A1, A2, language)} * Skill_{(A1, language)})$

Similarity

$Similarity_{(A1, A2)} =$
$1 - (\Sigma(\beta_{sim \leftarrow feature} * abs(Perceived_{(Feature, A1, A2)} - Perceived_{(Feature, A1, A1)}))$
$Dissimilarity_{(A1, A2)} =$
$\Sigma(\beta_{dis \leftarrow feature} * abs(Perceived_{(Feature, A1, A2)} - Perceived_{(Feature, A1, A1)}))$

Relevance, Valence, Involvement, and Distance

Formulas have the form of:
$A = \beta_B*B + \beta_C*C + \beta_D*D + \beta_{CD}*C*D$
β_B = (regression) weight main effect B on A
β_{CD} = weight interaction effect C and D on A

Effects on:	Main effects	Interaction effects
Relevance Valence	Ethics Epistemics Aesthetics Affordances	Ethics x Affordances Ethics x Aesthetics x Epistemics
Involvement Distance	Similarity Relevance Valence	Relevance x Valence

Satisfaction

Satisfaction(A1, A2) =
$\gamma_{inv\text{-}dist} * max(Involvement_{(A1, A2)}, Distance_{(A1, A2)}) +$
$(1 - \gamma_{inv\text{-}dist}) * ((Involvement_{(A1, A2)}, Distance_{(A1, A2)}) / n)$

(after Werners, 1988)

Results

- **Beautiful** agents raised more involvement, *and* more distance in other agents.
- **Ugly** agents also raised more involvement, *and* more distance in other agents.
- **Beautiful** adds relatively more to involvement, and **Ugly** adds relatively more to distance
- **Realistic** agents raised more involvement, *and* more distance in other agents.
- **Unrealistic** agents also raised more involvement, *and* more distance in other agents.
- **Realistic** adds relatively more to involvement, and **Unrealistic** adds relatively more to distance, although this difference is smaller than the difference between Beautiful and Ugly.

Application Domain

Equip virtual agents and robots with models to make them behave emotionally more human-like

- Virtual therapists (see picture)
- Health coaches
- Conversational agents
- Tutors and instructors
- Game characters

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Next Steps

- Connect model to emotion regulation model Gross
- Validate against empirical data human trade-off processes
- Incorporate combined model into virtual characters

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