Increasing Psychological Well-being Through Human-Robot Interaction

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Prosocial Machines

As interest increases in developing technologies which **enhance the lives of users**, a class of machines which **users may attribute** their own **increases in psychological and physical well-being toward** has emerged.

Users of electronic fitness bands may be influenced to alter their behaviors as a result of the band's notification of an exercise goal accomplishment. Likewise, patients receiving verbal encouragement from a social physical therapy robot may attribute their success to the motivational nature of the system.

As many of these machines focus on providing primary prevention rather than treating a specific impairment, human-machine interactions in this arena may benefit from findings and techniques pioneered in the field of positive psychology.

Approach

This work examines the question:

How can prosocial machines best leverage their capabilities to increase psychological well-being?

As a first exploration of this question, we designed a **single session human-robot or human-computer positive intervention interaction** modeled after a successful hope-inducing study from the field of positive psychology.

Though prior interventions have been administered by humans, research in the area of self-guided interventions via web interfaces has also demonstrated positive outcomes. This provokes the question of **how the delivery medium affects an intervention.**

Robot

During interactions in the Robot condition, participants listen to a Nao robot, named Ben, guide them through the exercise. The participant uses the web interface to enter responses to exercise prompts.

Speech: The robot plays pre-generated speech utterances that correspond with each step of the exercise. The CereProc William (English, England) voice is used throughout the study.

Head Gaze: The robot engages in loosely synchronized head gaze, alternating between fixations and aversions depending upon sentence structure. The participant's head pose is identified using an Intel® RealSense ™ F200 RGBD sensor.

While using the web interface, the robot avoids fixating for long durations on the participant or display.

Eye Blinks: The robot mimics eye blinks using the LEDs in its eyes, with a frequency of three to five seconds.

Computer

Interactions in the Computer condition do not involve the Nao robot. Instead, participants are guided through the exercise by the web interface alone. Participants also respond to exercise prompts using the web interface.

Speech: The computer interface uses the same pre-generated speech utterances as the Nao robot and the same CereProc William synthetic voice.

Captioned Speech: In the computer condition, the web interface displays the text transcript of the spoken guidelines.

The text autoscrolls and the currently spoken word is highlighted in blue with the surrounding words highlighted in a blue to black gradient, creating a spotlight effect on the active word.

Study Design

Comparison Groups
Participants either interact with a robot and computer, only a computer, or only complete surveys.

Pre-interaction Questionnaires
Upon arrival participants complete measures which index emotional intelligence, self-esteem, and state-hope. Additionally participants complete the Beck Depression Inventory, as intervention efficacy may be reduced for those with depressive symptoms.

Interactive Session
Participants interact with either a Nao robot and computer or only a computer for an average of 25 minutes. Depending on the condition, either the robot or computer guides participants through a hope-building exercise. In both conditions participants use the computer interface to input their responses to questions posed by the exercise.

Post-interaction Questionnaires
Immediately after the interaction, participants complete the state-hope scale, evaluate the robot and/or computer interface, and provide feedback about the usefulness of the content presented.

Two Week Follow Up
Within two to four weeks, participants receive and respond to an online survey which measures

Interaction Content

Hope Theory
The interaction was modeled using C.R. Snyder's Hope Theory. Succinctly, hope is defined as a positive motivational state, which is rooted in achieving goals through a sense of agency and planning (pathways). A hope-increasing intervention hinges on education about hope theory, developing a moderately difficult goal, enumerating concrete sub-goals, and identifying potential barriers and alternative routes to the end goal.

Content Sources
Studies which successfully increased participant hope levels using a human to guide the intervention were examined and adapted to fit the conditions within this study. Additionally, a workbook authored by McDermott and Snyder for self-guided guided increase of hope, *Making Hope Happen*, was used for source material.

Exercise Steps
The hope-building exercise begins with an explanation of Hope Theory, followed by a guided application of the theory to one of the participant's past goal setting experience, and progressing to a guided application of the technique to one of the participant's future goals. Information regarding maintaining physical and psychological well-being is also provided.

Pilot Results

Eight participants from the university psychology study recruitment program recently completed a pilot version of the study. Participants ranged in age from 18 to 34 and had a variety of academic majors.

The qualitative responses from participants during the exercise have been positive in both conditions, with diverse and thoughtful responses given to each prompt. Those in the robot condition provided more optional comments at the end of the study, mostly praising the robot's delivery of the content.

One participant in the computer condition commented that they would have preferred more feedback from the system.

Sample Goal Responses:

"To become financially stable "

"I would like to have my .. son, who was diagnosed with ASD .. better able to communicate with others by age 5."

"My future goal is understanding people better and becoming a better friend."
Barrier: "Not knowing how to handle certain circumstances."
Pathway: "Realizing that no one is perfect and doing the best I can."

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