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Reinforcement Learning-Based Persuasion by a Conversational Agent for Behavior Change

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Abstract

Motivation

Changing personal behavior is one of the most promising ways to improve health and reduce premature death. eHealth interventions are a good way to support such behavior change, but adherence to them remains low.

Aim

We aim to design and develop persuasive communication in form of a virtual coach that helps people to adhere to their behavior change intervention.

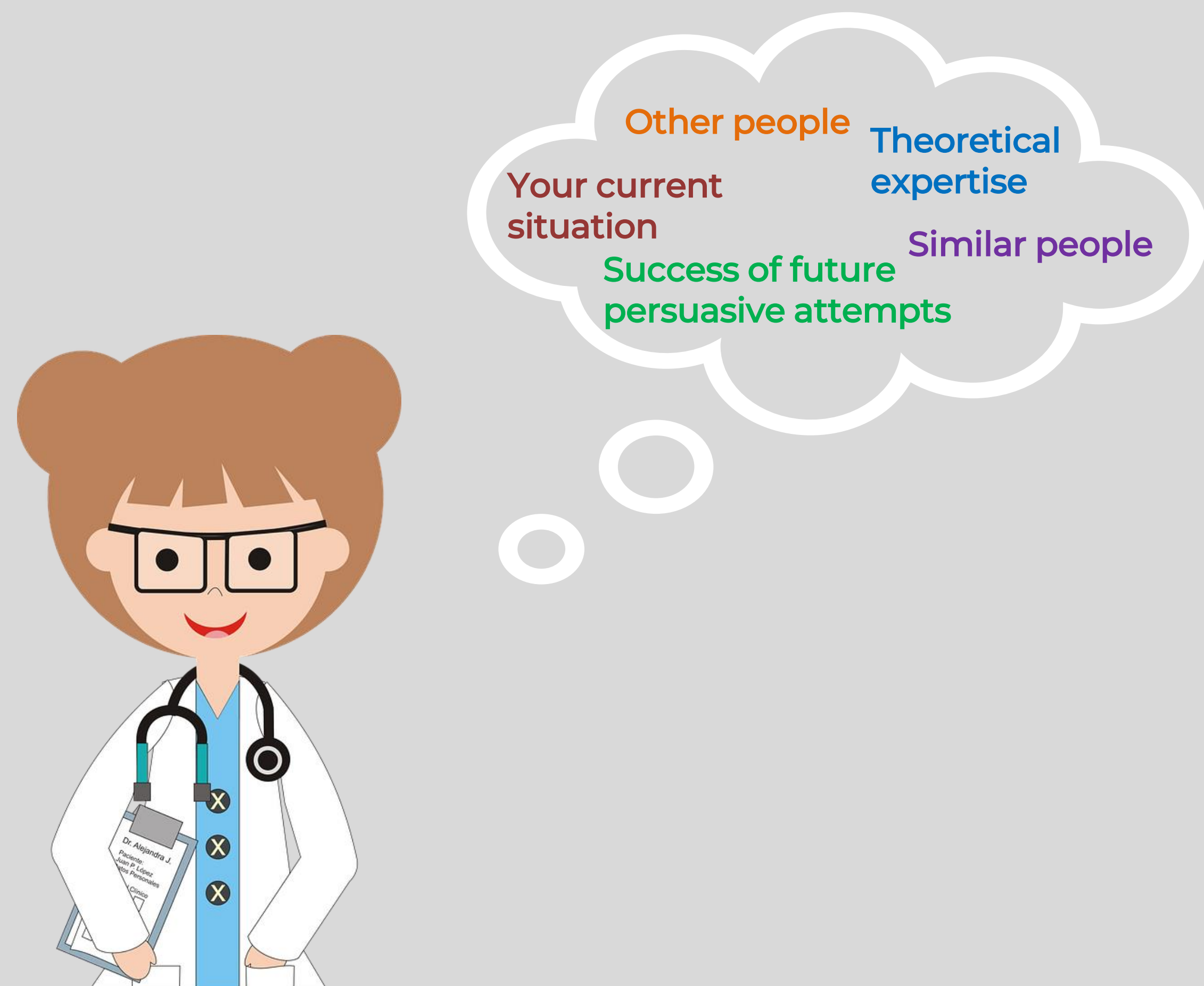
Approach

Our virtual coach persuades people based on a personalized reinforcement-learning algorithm that considers a person's current and future states as well as the similarity of people. This approach was tested in an experiment in which more than 500 participants interacted with the virtual coach in 5 conversational sessions. In each session, people were persuaded to do a small preparatory activity for smoking cessation or increasing physical activity. We currently analyze the gathered data to determine 1) the effectiveness of the approach, 2) the policy similarity for different types of activities, and 3) the acceptance of the virtual coach. The anonymized data will be shared.

This is Hannah

She's here to **help you**. Help with what you ask? With changing your behavior of course! Surely there is something you want to change. Maybe you want to finally go running twice a week or go to bed earlier. You are lucky, because Hannah is a **therapist** and here to motivate you.

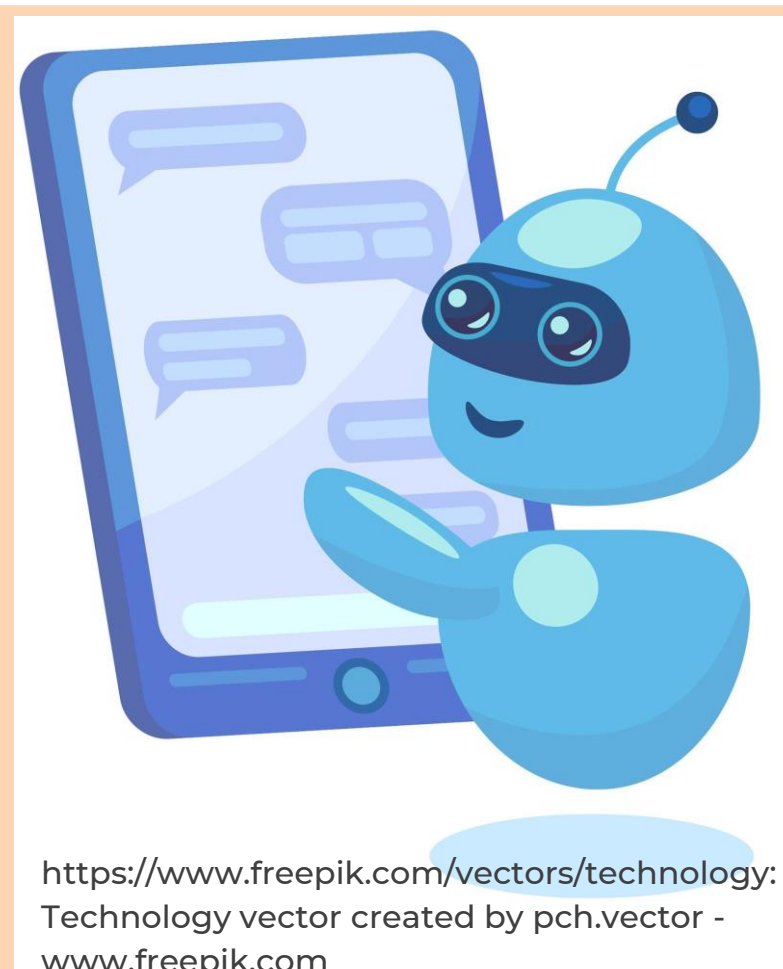
How does Hannah decide how to persuade you to stick to your behavior change intervention?



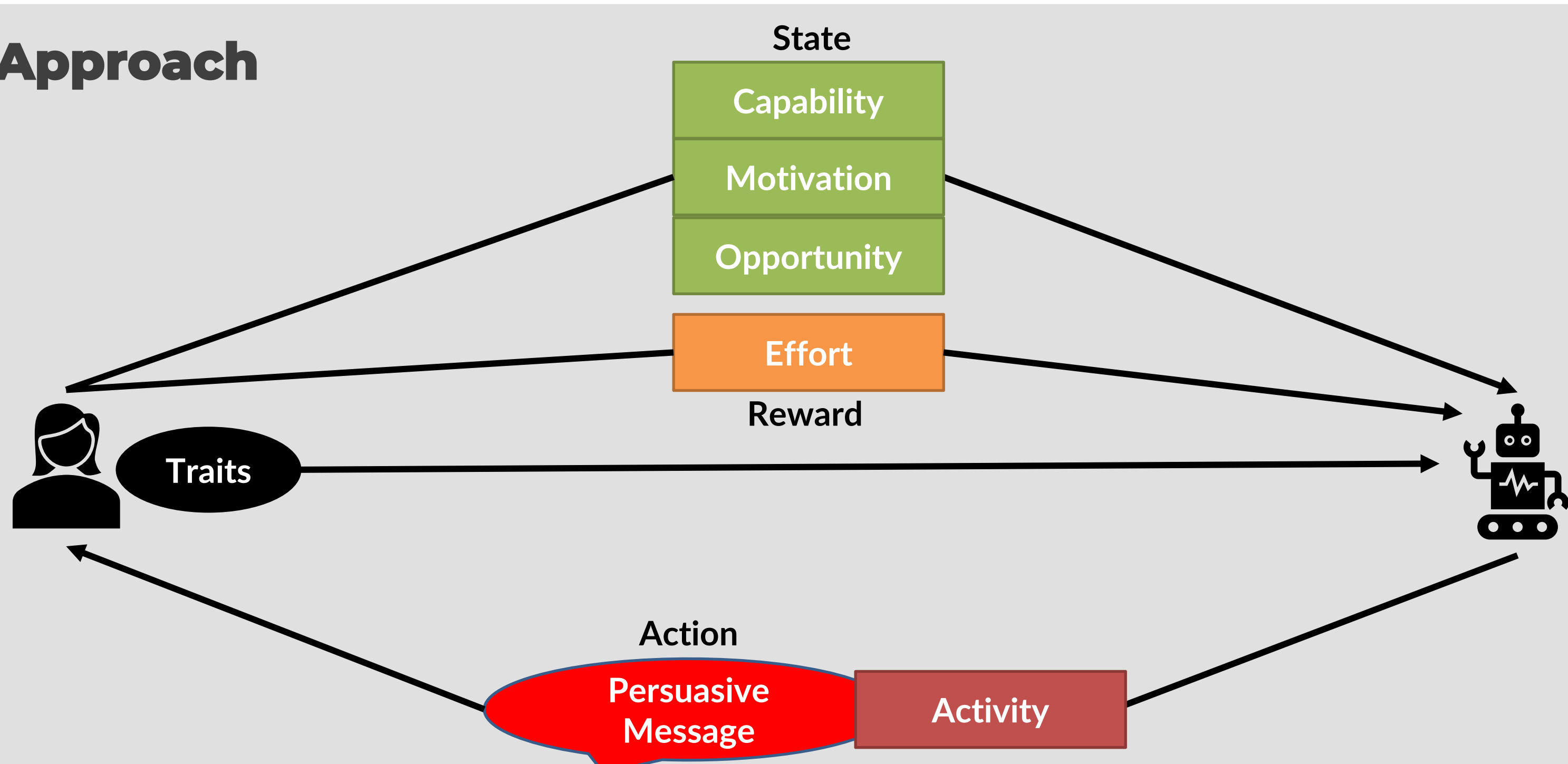
Now let's meet Sam!

In contrast to Hannah, he is your **virtual coach**. Sam is available at all times, scalable, cost-effective and can facilitate tailoring [2].

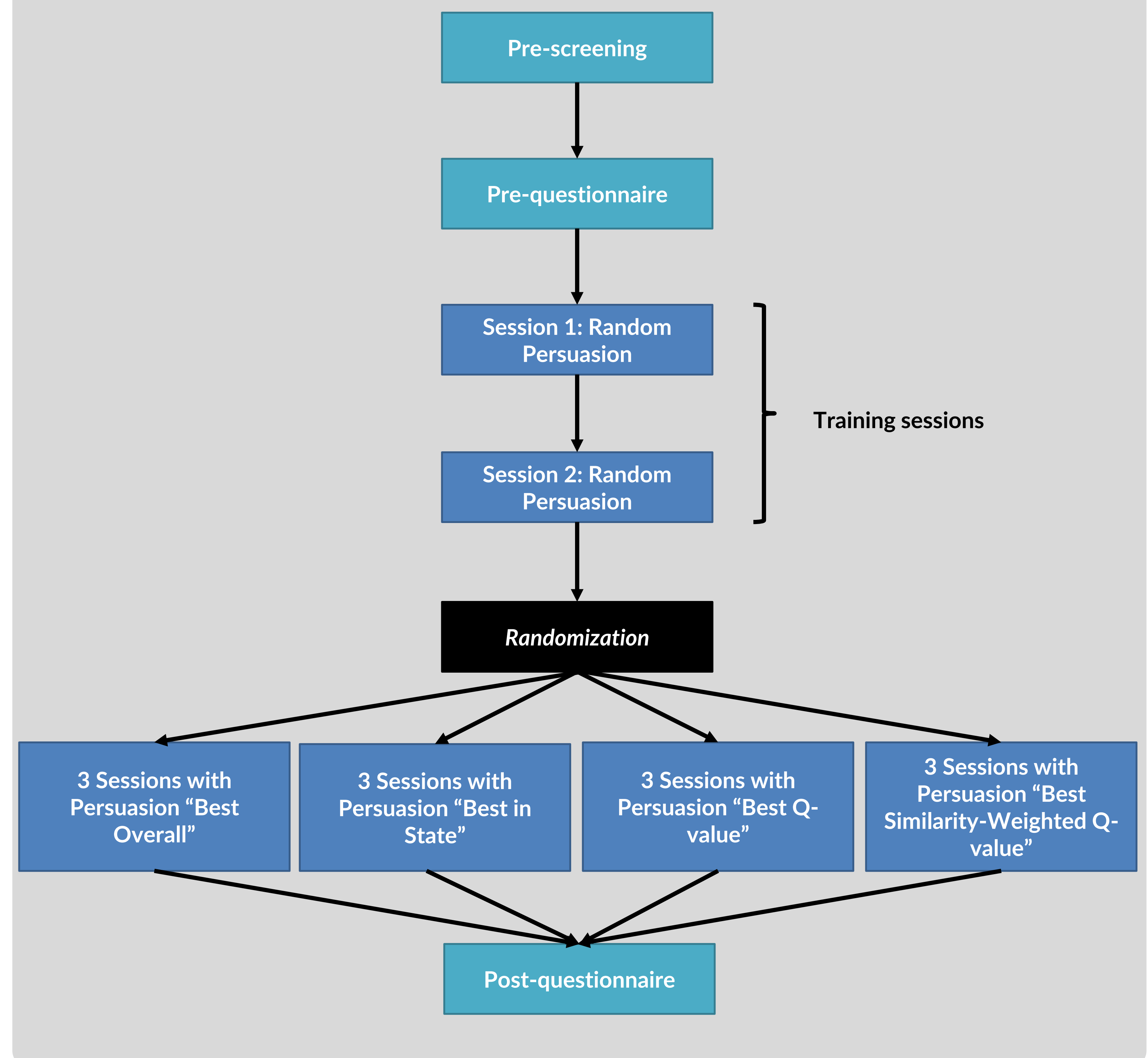
Can Sam do what Hannah can, or even more?



Approach



Experiment



Effectiveness of Approach

We will evaluate the effectiveness of the approach based on:

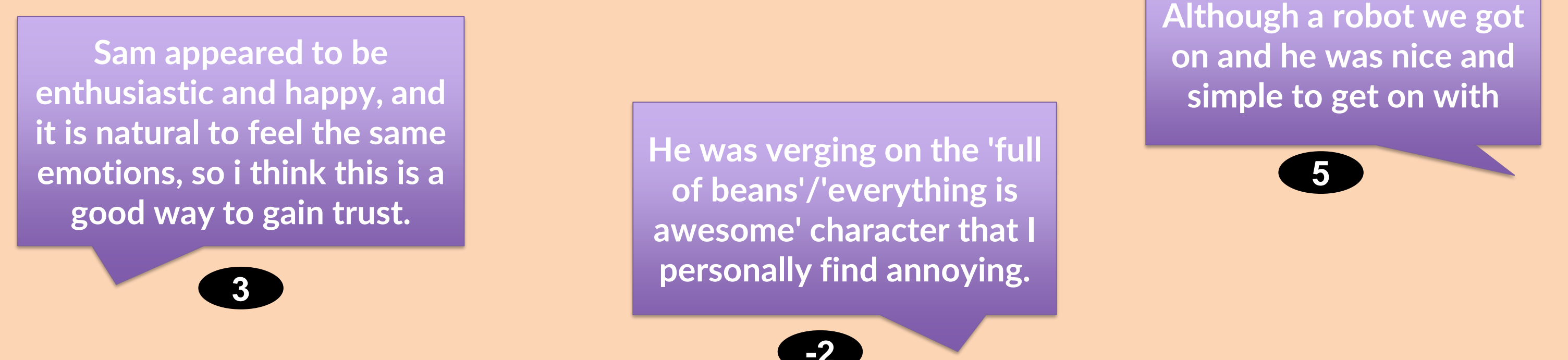
1. The change in **effort** between the training and the testing sessions,
2. The change in **effort** between the testing sessions, and
3. The change in **perceived motivational impact** of the virtual coach between the training and the testing sessions.

Policy Similarity

We will compare the optimal policies computed based on **all collected data** on the one hand, and data collected based on either **only smoking cessation activities** or **only physical activity increase activities** on the other hand.

Acceptance of the Virtual Coach

We asked people about their **acceptance** [1] of the virtual coach **Sam** via 6 questions. This data will also be analyzed.



References

- [1] Timothy W Bickmore, Suzanne E Mitchell, Brian W Jack, Michael K Paasche-Orlow, Laura M Pfeifer, and Julie O'Donnell. 2010. Response to a relational agent by hospital patients with depressive symptoms. *Interacting with computers* 22, 4(2010), 289–298.
- [2] Yanhui Liao, Qiuxia Wu, Jinsong Tang, Fengyu Zhang, Xuyi Wang, Chang Qi, Haoyu He, Jiang Long, Brian C Kelly, and Joanna Cohen. 2016. The efficacy of mobile phone-based text message interventions ('Happy Quit') for smoking cessation in China. *BMC Public Health* 16, 1 (2016), 1–11.

Acknowledgements

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