Research Traineeships proposal

1. Title of the Project

RAINMAN: **R**esearching **A**utistic traits via **IN**ovative tools to **M**easure and **A**meliorate **N**onverbal skills

2. Coordinators

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3. Project Summary

Relevance

Autism is a developmental disability that affects how a person communicates with and relates to other people. Whereas it was traditionally considered as a clinical condition to categorize people with a pathological disorder in social interaction, recent evidence suggests autistic traits are continuously distributed across the general population. Figure 1 visualizes how the Autism-Spectrum Quotient (AQ), a score for autistic traits based on self-report, is distributed in a non-clinical population [29].

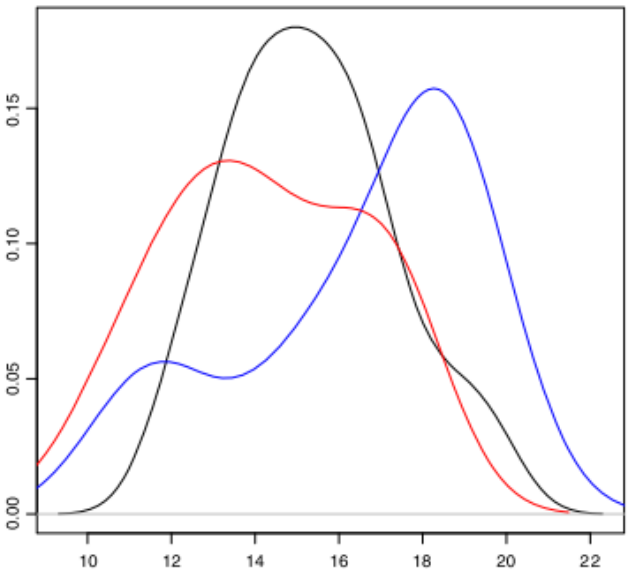

Figure 1: AQ distributions for non-clinical populations (female scores in red, male scores in blue, combined scores in black)

Autism has been linked to a dysfunction of the 'mirror neuron system' early in development [5,6,8,13]. This is reflected in deficient nonverbal behaviours, as people with autism do not **spontaneously adapt** their expressions to others [11,22,27,28,31]. Gaze aversion is a typical characteristic of autistic children [1,34], as well as proportionally less smiling and gesturing [21]. Accordingly, people with autism behave markedly different from people with a typical development who use such nonverbal features to build and support social rapport with others [7,14,23], whereas non-clinical people with high AQ scores have somewhat dismissively been described as "human robots" as they behave socially awkward because of limited or inappropriate nonverbal behavior. This in turn tends to lead to a serious degradation of their quality of life, with a risk for social exclusion, lower relationship satisfaction, and increased anxiety and depression [26].

Challenges

Whereas prior work has almost exclusively focussed on comparisons between individuals with a clinical condition and healthy controls, we lack information on the extent to which gradient differences in AQ are reflected in nonverbal skills, and where the turning point lies between acceptable and problematic behaviour. Also, the labeling of nonverbal features has generally been manual, subjective and very broad [9,16,17,20,25], in that sense not doing justice to potentially subtle differences between people differing in AQ. Furthermore, previous work often used data with limited ecological validity, for instance being based on acted emotions; these methods do not yield data that are representative of the way people express themselves in more spontaneous settings. Likewise, receptive skills have been tested by letting participants view and rate decontextualized stimuli (like still images) [18,19,32,35], which again does not reflect how people behave in real interactions where they are supposed to instantaneously react to input from conversation partners [2,33]. Finally, there is a lack of tools that allow people to train and improve nonverbal skills in ways that represent natural interactions.

The goals of the project are therefore:

1. To elicit natural but controlled interactions of people with varying AQ scores
2. To relate participants' nonverbal features to AQ and other cognitive scores
3. To explore whether nonverbal skills of participants with higher AQ scores can be improved via specific training methods.

Our approach

O-cam paradigm In order to obtain data that are both controlled and ecologically valid, this project will make use of the o-cam paradigm [12], i.e., a simulated Web cam conference that has the appearance of real computer-mediated interaction. In reality, though, participants are communicating with actors whose contributions have been prerecorded. In order to create the illusion that the recorded person is live, the paradigm makes use of a scripted procedure whereby an experimenter and the other person greet each other, and work

together to set the microphone levels and move closer to the camera. Figure 1 gives an example from one of our own studies using the paradigm showing a still of the actor (on the left) whose smiling and wave gestures are spontaneously mimicked by our participants (on the right). We have already used the paradigm in pilot studies about social and communicative skills which revealed that it is ideal to explore nonverbal features to social rapport (e.g. nodding behaviors, facial mimicry, positive and negative feedback) [3,4,15].

Figure 2: (a) Still of a recorded actor's greetings and (b) participants waving back and smiling at the partner.

Measures Recordings of participants obtained via the o-cam paradigm will be measured automatically using a tool (CERT) for fully automatic real-time facial expression recognition [10,24]. Figure 3 gives the output of this tool for one of our previously recorded materials, showing the actual movie, as well as the various estimates for different facial features (like eyebrow raise or smiling), and more general measures (like nodding or eye gaze patterns). In our project, we will record these responses and link them to the behavior of the video-recorded actor to compute nonverbal cues to '**social rapport**', and correlate these with AQ scores and various other cognitive measures like IQ, and social wellbeing.

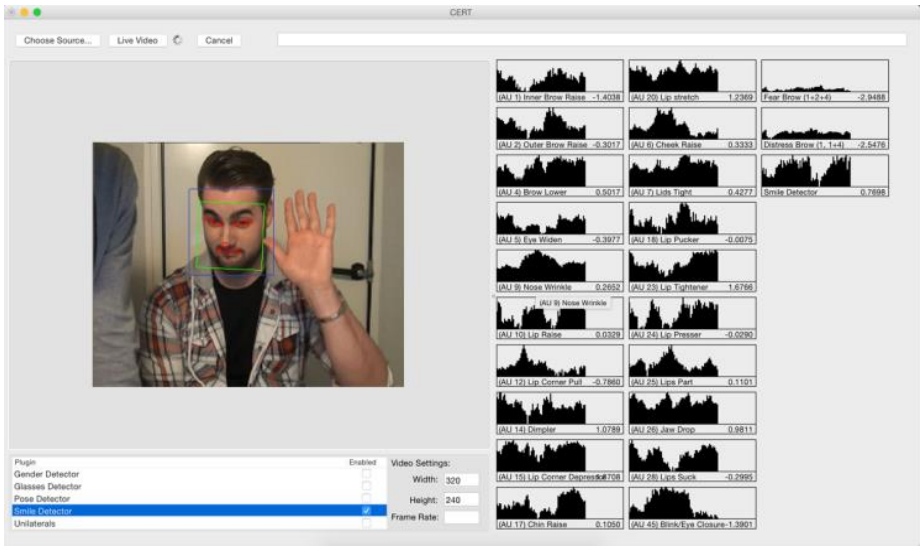

Figure 3. Screenshot of CERT processing a recorded participant.

Experimental details: AQ-scores of 335 first-year psychology students have already been collected. These scores were normally distributed. From this population, a high-AQ (upper 10%), middle-AQ (45%-55%), and low-AQ (0%-10%) group (N=35 per group) will be selected and tested on the O-cam paradigm to measure nonverbal cues to social rapport, where we will focus primarily on the amount of mimicry (e.g. smiling behavior primed by the smiles of the recorded actor). We expect that people who score high on the AQ-subscales 'social interaction' and 'communication' will display fewer correlates of rapport, but expect that training (in follow-up projects, see below) will improve nonverbal skills [30], particularly in the high-AQ group, and possibly this transfers in 'real life' to contribute to social wellbeing.

Outlook

If our approach with the o-cam paradigm turns out to be useful to elicit and record natural interactions, we plan to exploit it as a basis for future collaborative work to train and **improve nonverbal skills of (non-clinical) participants**. In a first round, participants may then be exposed with the recordings of their own interactions, that will be compared with recordings of socially skilled participants, whose data are used as "teacher" models. Participants would be given explicit feedback on how they can exploit features like nodding, smiling, and eye gaze to support social interactions with partners in various settings (like starting a conversation with a stranger, or sharing a secret with a friend), and trained in subsequent sessions with the paradigm. The advantage of interacting with videos is that, besides scientific rigor, the various social settings can be trained until a satisfactory level is reached.

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4. Project timeline

Sept.-Dec. 2018:	Setting up the o-cam paradigm, collecting behavioral data
Jan.-March 2019:	Analysing participants' facial expressions with CERT software
April-June 2019:	Performing statistical, correlational analyses, writing report

5. Research Trainee Profile

We welcome prospective candidates who have an interest in nonverbal communication and/or issues related to autistic traits. Experience with experimental research during their bachelor, master or research master is recommended. Applicants should send a short cv as well as a motivation letter to Marc Swerts (m.g.j.swerts@uvt.nl) and/or Jean Vroomen (j.vroomen@tilburguniversity.edu), who can also be approached to request further information.