Title: Longitudinal electrodermal recordings of mentally disabled individuals and their caretakers

Matthijs L. Noordzij\textsuperscript{1} & Marleen E. Laroy-Noordzij\textsuperscript{2}

\begin{itemize}
\item \textsuperscript{1}University of Twente, Department of Cognitive Psychology & Ergonomics, The Netherlands
\item \textsuperscript{2}De Twentse Zorgcentra, The Netherlands
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Background

Almost no scientific observations exist concerning the physiological changes and events that arise before and during human aggressive behavior. Yet, there are many instances where it might be of great benefit to have insight in these changes, for example when an individual has limited communicative capabilities to express their emotions and rising frustrations. In our project we focused on such a situation by measuring physiological changes of people with severe mental disabilities, who also consistently showed challenging behavior (CB) such as aggressive acts and self-injurious behavior. Caretakers often report being surprised by these outbursts and explicitly express a need for additional tools to gain insight in the arousal levels of their clients. The aim of our project was to investigate the potential value of ambulatory physiological measurements in bringing this insight to the caretakers. An additional goal was to also examine the relation between the physiological changes of the caretakers themselves and the CB of the clients. We did this because actions of direct care staff have been found to be antecedents of the aggressive behavior of clients, and therefore we wanted to investigate the possibility that heightened levels of arousal in caretakers might be associated with a higher likelihood of future aggressive behavior.

Method

We followed 9 individuals with severe mental disabilities and their regular caretakers during sessions of two to three hours on a fixed timeslot and day of the week over a period of months. During all those sessions (typically a total of 24 per client-caretaker couple), we measured electrodermal activity (EDA) with a wrist sensor, and we recorded the clients behavior on video. EDA, and the parameters that can be extracted from it, such as the number of skin conductance responses per minute, have been found to be a good estimate of the activity of the sympathetic part of the autonomic nervous systems. As such, it can be taken as a further operationalization of the arousal level of the client and caretaker, which was the dependent variable of interest for our project. The measurement device was the Q sensor “Curve” from Affectiva, which allows for wireless, non-intrusive measurements of EDA with a sample rate of 32Hz (which is more than sufficient for state of the art analysis methods). A protocol was developed to realize these measurements, while minimizing distress for the clients (see Noordzij, Scholten, Laroy-Noordzij, 2012, Measuring Behavior). After each session caretakers noted whether any CB had occurred. Subsequently, trained professionals examined the videos and determined the nature, severity and onset of the CB. EDA parameters were extracted automatically both with computationally simple trough-to-peak analyses, and with more sophisticated decomposition analyses of the signal into its phasic and tonic components.
**Results and Discussion**

As expected the participants displayed CB during many of the sessions. These events were typically associated with medium to highest amplitudes and frequencies of the electrodermal responses. Our data analysis also brought to light some of the complexities surrounding the determination of arousal levels of these clients. Even detailed viewing of the videos by trained professionals resulted in only moderate levels of inter-rater reliability concerning the severity CB and especially the precise onset of CB. This reflects the observation of experienced caretakers that the buildup phase towards CB is hard to detect. On the other hand, we also found low correlation between EDA fluctuations of caretakers and clients. This, and further video analysis, showed that caretakers did not continuously interact and track the arousal level of the clients on a behavioral level. This fact alone opens up a set of possibilities to create a monitoring system based on the EDA levels of client, which informs the caretaker when EDA levels are in a medium to high range (i.e. the only moments when CB occur). Currently, we are developing such a monitoring prototype, which, together with findings from our ongoing analysis of this rich data set will be further discussed during the presentation.