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Forensic Psychiatric Patients with Autism Spectrum Disorder

Levine D*

Deakin University, School of Life and Environmental Sciences, Waurn Ponds, VIC, 3216, Spain

Abstract

Autism spectrum disorder (ASD) and intellectual disability (ID) are prevalent in forensic psychiatric samples. People with ASD and/or ID often experience difficulties in emotion processing which can lead to aggressive or self-harming behavior. The use of biocueing (using wearable technology to constantly monitor and provide feedback on bodily changes) shows promise for improving emotion processing and, thus, potentially reducing aggressive behavior in this population. Both qualitative and quantitative methods were used to examine the feasibility and acceptance of Sense-IT, a biocueing application, in a sample of forensic psychiatric patients with ASD and/or ID and their forensic psychiatric nurses. To our knowledge, the current study is the first to examine first-person experiences with biocueing in forensic psychiatric patients with ASD and/or ID. Results show that, in general, participants experienced the biocueing application as positive and are willing to use biocueing. This is an important finding since forensic patients are often unmotivated to engage with therapeutic techniques. An exploration of trends in aggression and self-harm prior to and during the use of biocueing showed no significant changes. Future research should focus on the way biocueing can be implemented in clinical practice.

Keywords: Autism disorder; Intellectual disability; Emotion regulation; Aggression; Biosensing techniques

Introduction

Autism spectrum disorder (ASD) and intellectual disability (ID) are prevalent in forensic psychiatric populations. ASD is characterized by persistent deficits in social communication and restricted, repetitive patterns of behavior, interests, or activities. ID includes both intellectual and adaptive functioning deficits in conceptual, social, and practical domains. Both individuals with ASD and ID demonstrate impairments in processing their own emotional responses. Emotion processing includes both the recognition of emotions and the regulation of emotions. These difficulties in emotion processing are associated with various forms of challenging behavior, including self-harm and aggressive behaviors. Currently, there is a lack of evidence-based tools to improve emotion processing in people with ASD and/or ID this is a major unmet clinical need. The use of technology that measures physiological parameters (e.g. heart rate) has shown promise for improving emotion processing and, thus, potentially reducing aggressive behavior and self-harm Ambulatory, constant monitoring and feedback on bodily changes through wearable biocueing could provide individuals with an objective tool to signal deviating arousal levels, real-time in everyday life, allowing for just-in-time behavioral support. Studies in laboratory setting showed that wearable devices can be used to discriminate physiological states associated with rest from those associated with emotional stress in individuals with ASD. Results furthermore suggested that aggression to others can be predicted by heart rate measured by biosensors in naturalistic observation studies of youth with autism and adult inpatients. Also, a pilot study showed that real-time biofeedback may improve emotional self-regulation in children with ASD. Altogether, the use of wearable technology shows promise to timely recognize aggressive outbursts and to improve emotion processing of patients with ASD and ID. Yet, however promising, biocueing can only be effective when people are willing to use it. Many mental health applications are developed with little regard to the specific characteristics and needs of its target users. Many users stopped using a mental health application after only two weeks, especially when their preferences were not met. It is therefore important to include the input of clinicians and patients while designing a new mental health application, especially when designing an intervention for forensic patients who are regarded as a complex and highly unmotivated population. Furthermore, studies showed that patients with ASD find it important that wearable technology is invisible and does not attract unwanted attention from others. However, scientific records of first-person experiences related to biocueing technology is scarce. To our knowledge this was the first study examining first-person experiences with biocueing of forensic psychiatric inpatients with ASD [1-6].

Materials and Methods

A convergent mixed-method design was applied to examine the research questions. A convergent mixed-method design involves the collection of both qualitative and quantitative data in order to examine a research question. Qualitative data, collected via semi-structured interviews, were the main source of data to examine the acceptance and feasibility of Sense-IT as it provided insight in the participants' experience of the intervention. Additionally, quantitative data were collected using System Usability Scale (SUS) and Client Satisfaction Questionnaire (CSQ-8) in order to confirm findings from the qualitative data. For the second research question, quantitative Social Dysfunction and Aggression Scale-11 (SDAS) data were collected in order to explore trends in aggressive and self-harming behavior over time. A mixed-method was chosen in order to obtain a stronger understanding of the topic. Quantitative and qualitative data were integrated using a side-by-side comparison. The Sense-IT application was designed through an extensive study using a 'Users Experience Design' approach in which patients with borderline personality disorder and their therapists were involved. Sense-IT is a bio cueing application with two sides. The smart watch side of the intervention

***Corresponding author:** Levine D, Deakin University, School of Life and Environmental Sciences, Waurn Ponds, VIC, 3216, Spain, E-mail: Lev.d@ull.es

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displays heart rate as measured by the smart watch internal sensors, and then transformed to a simplified scale with levels from −3 to +5. At first use, an individual mean baseline heart rate and standard deviation were determined based on a measurement of approximately 30 min while the participant does his daily activities. Then a threshold criterion can be established for informing users of rising and falling heart rates (i.e. a change of 0.5, 1 or 2 times the standard deviation).

Data Analysis

The user was visually and (optionally) tactilely informed of this change via the smart watch. The smart watch application served as an additional monitor (and possible post hoc reflection on trends over time) to become aware of the change in heart rate. An on-board accelerometer together with Google Android built in algorithms classified the current activity of the wearer into six categories: in vehicle, on bicycle, on foot, running, still, walking. Subsequently, the user can be notified of substantial heart range changes during little or mild activity only (e.g. in vehicle, on foot, still and walking). The smartphone side of the app provided insight in previous measures and served as a diary that can be used to make notes about the change in physiological arousal. A semi-structured interview was used to qualitatively examine participants' experiences with the Sense-IT application during the study period, including experienced obstacles and suggestions for improving Sense-IT. Sample questions were: 'How was your overall experience with Sense-IT?', 'Can you come up with situations (which did not take place during the study) in which you would like to use Sense-IT? ', 'What thoughts did you have when Sense-IT (did not) correspond to your feelings?' and 'What is your opinion on the visual feedback provided by Sense-IT?' The same interview was used for both patients and nurses. With regard to the nurses some questions were slightly rephrased. For instance, we asked the nurses "In your opinion, in which situations did Sense-IT help the patient" instead of "In which situations did Sense-IT help you For the selection of participants, all inpatients from four different wards from a forensic inpatient hospital were approached as potential participants; they were informed on the aim and purpose of the study and received a demonstration of Sense-IT. Eligible patients signed the informed consent. In- and exclusion criteria were checked with the responsible clinician after the patient signed informed consent and gave permission to do so. SDAS was scored daily as a part of routine clinical assessment by rhetorical psych iatrical nurses. For the aim of the study, SDAS-data collected throughout the study amount with Sense-IT were analyzed, in addition as information collected within the thirty days before the beginning of the study amount as an intensive baseline level of aggression and self-harm. At the beginning of the study amount with Sense-IT, participants were tutored on the employment of Sense-IT. The study amount started with a 'set-up day' during which the baseline measuring occurred. the subsequent day, participants had a 'test-day' to expertise totally different the various sorts (visual or tactile) of feedback from the smart watch and also the different levels of thresholds (standard deviations from the baseline). Once the foremost comfy feedback and threshold were determined, and baseline pulse rate measurements were performed, participants wore the Sense-IT smart watch throughout period. Participants were tutored to wear Sense-IT all day long: from obtaining up within the morning to aiming to bed within the evening. Participants were contacted repeatedly by the primary author to ascertain whether or not there was a necessity for added support.

Result and Discussion

The first theme involved the expertise of participants with Sense-IT. The bulk of participants (17/21) reported positive experiences with Sense-IT. Some participants (7/21) cited that Sense-IT had no additional price for them, largely as a result of they reported that that they had no drawback control and recognizing their emotions. 2 alternative participants cited that they intimate with Sense-IT as strict moreover, participants (7/21) mentioned the importance of having the ability to alter settings to the individual patient, for example: "At initial, the watch vibrated usually, that I found annoying [7-10]. Later, the watch solely vibrated with high levels of tension that was fine. It's nice that this setting might be modified. Participants were asked what limitations of Sense-IT they intimate with throughout the study amount. Participants (7/21) mentioned technical problems with Sense-IT as associate degree obstacle. They chiefly mentioned that generally the Bluetooth association between sensible watch and smartphone was interrupted, inflicting Sense-IT to not work properly. Also, participants (9/21) mentioned that the present battery lifetime of the sensible watch was poor. This was thought-about a significant obstacle since participants had to charge the sensible watch double daily so as to be able to use Sense-IT. Another obstacle mentioned throughout the interviews was that participants (12/21) doubted the accuracy of the feedback provided by Sense-IT. This follows the expertise of participants that every now and then Sense-IT mentioned an increase in pulse rate once they failed to expertise stress themselves, and vice versa: "I suppose tension in my head goes unremarked. Sometimes I had stress or delicate irritation and that i got one dot at the most." Participants explained this as associate degree obstacle of Sense-IT as they understood the absence of a high pulse rate measured by Sense-IT as a press release that they might not expertise psychological stress. Moreover, 2 participants cited that they found the moving signal of Sense-IT distressful whereas they were resting: While resting, I found the vibration terribly irritating. I might rather have the watch to light once one thing modified. Throughout activities I did just like the vibration perform, it created ME tuned in to what's happening. Alternative obstacles within the use of Sense-IT that were mentioned by individual participants were: the very fact that feedback provided by Sense-IT was visible for others caused.

Discomfort, physical activities weren't perpetually recognized properly by Sense-IT and also the size and weight of the sensible watch. The main goal of this study was to examine the feasibility and acceptance of a biocueing application in sample forensic patients with ASD and/or ID and their nurses. Qualitative results cautiously indicate that, overall, both patients and staff experienced the biocueing application as positive and were willing to use a biocueing application in clinical practice. Quantitative results showed adequate usability scores and fair satisfaction scores. The results are is in line with a previous study indicating a positive attitude and similar usability outcomes for forensic outpatients towards the use of biocueing. In addition, the majority of the sample stated that of the biocueing application may help them recognizing changes in arousal (both stress and calmness). These findings are promising because of the complex and highly unmotivated nature of forensic psychiatric patients with respect to many existing therapeutic techniques especially given the fact that in the current study a prototype of Sense-IT was used. The current findings provide insight in the specific needs of patients with ASD and/or ID in using a biocueing application. For example, some patients with ASD experienced the tactile (vibrating) signal provided by the smart watch as disturbing. This is in line with the fact that people with ASD often experience sensory hypersensitivity. For these patients it was necessary to reduce the vibrating signals. However, other participants mentioned that they prefer a clear tactile notification of change in heart rate. This example shows the importance of being able to personalize feedback settings in order to suit the specific needs of an individual. Furthermore, participants mentioned that the biocueing

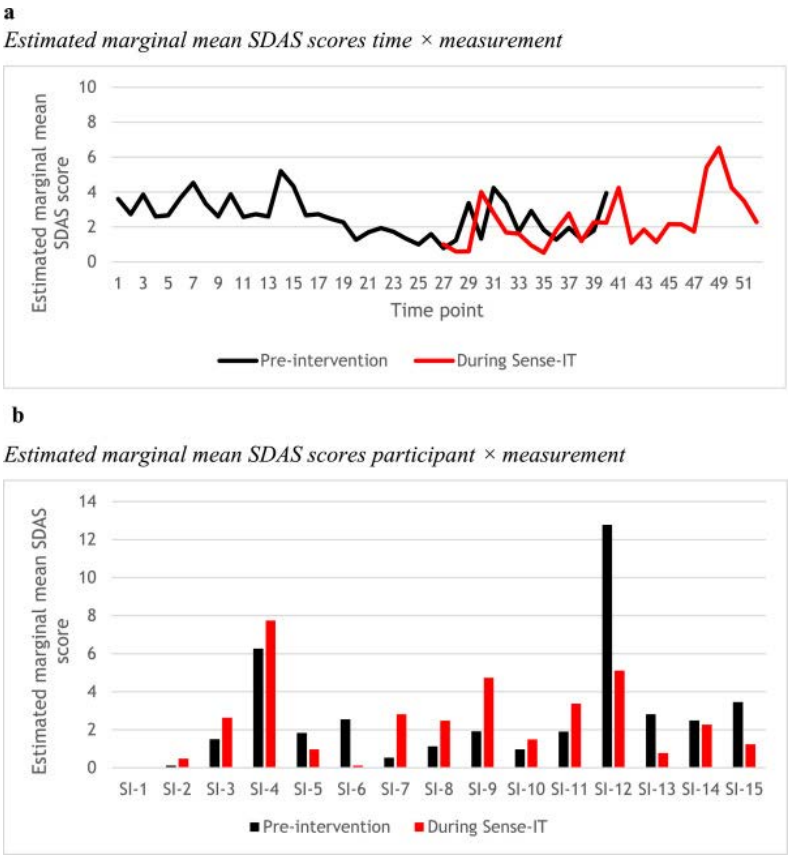

Figure 1: Graphical distribution.

application did not always respond to their subjective experiences. This can be explained as a need for a more detailed explanation of biocueing. The biocueing application uses heart rate to provide feedback, while also measuring activity, which allows it to cue substantial heart rate increases in low physical activity situations. However, heart rate is limited in recognizing psychological stress. The added value of the current implementation of biocueing is that it can point out any large changes in heart rate without an increase in physical activity.

Those moments are of interest, because they can indicate psychological stress. Biocueing can however not provide a perfect recognition of subjectively experienced stress nor can it uniquely identify emotional states. During the current study it appeared that some participants did expect this and were not feeling validated when the biocueing application did not give a signal when they subjectively experienced stress. It is thus important to provide a more detailed explanation that is in line with characteristics of patients with ASD and/or ID in order to manage the user's expectations. (Figure 1)

Alternative participants cited that they intimate with Sense-IT as strict moreover, participants (7/21) mentioned the importance of having the ability to alter settings to the individual patient.

Conclusion

The plot's boundary was digitized using ArcGIS software from the RGB image. The plot shows the actual representation of the study plot area. The eight SPAD points from each subplot were also pinpointed on the map. Shows the result of the RGB map with the SPAD points in vector format the NDVI map was\m generated using the algorithm (Equation (1)) in ArcGIS software from the multispectral image obtained. Shows the NDVI map from this NDVI map, the pixels values of the SPAD point were taken and recorded. The green color represents the healthy plant zone, while the yellow represents the less healthy plant zone. The healthy vegetation tends to absorb light within the visible band and reflect most NIR light.

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