PAPER: Clasp: Digital Tactile ASD Anxiety Management

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ABSTRACT

In this paper, we describe the technical features of *Clasp*, a system designed and prototyped by adults on the Autism spectrum and their support network, along with an interdisciplinary team of academics. The system consists of three components: 1) A *tactile digital stress* device which communicates usage data over Bluetooth to a Smartphone 2) *Support network communication* via SMS and online social network status updates with stress device usage 3) *Usage data aggregator and visualization* for self and community feedback. The system has been prototyped, and a number of anxiety coping devices (stress-balls, pull cords, bracelets) are being digitized to communicate usage data to a connected Smartphone, which then relays usage data at defined trigger points to a user's selected online social support network.

Categories and Subject Descriptors

H.5.2 [**User Interfaces**]: Haptic I/O; Prototyping.

General Terms

Design, Human Factors.

Keywords

Anxiety, Tactile, Communication, Social networks

1. INTRODUCTION

Autism Spectrum Disorder (ASD) affects an individual's ability to communicate and interact socially with others, and can thus result in profound isolation and anxiety in everyday situations. Although half a million people in the UK have ASD [1], services to support adults living in the community are scarce. Two of the biggest challenges for people with ASD are communicating with others for social engagement, and accessing appropriate support, which often requires direct social contact. The anxiety associated with these seemingly simple acts can be devastating [2].

In this paper we describe the prototype which emerged from the Access ASD project where 3x multi-disciplinary academic researchers worked in partnership with people on the spectrum and their support networks. A 4 month period of engagement, negotiation, trust building and self selection led to the formation a core user group (CUG) of 10 people, who worked with the researchers in a 3 month iterative process to design and develop a technology prototype to address their social engagement needs and aspirations

The Access ASD project is a sub-project or "Sprint" of the larger Catalyst project [7]. The process of Sprint selection in Catalyst is that community groups and academics come together to bid for project funding – here a community takes a leading role in defining the content and direction of the research project. In Access ASD local council adult social care commissioning managers came together with health service and charity professionals and academics, to propose a brief to investigate social anxiety issues and digital support networks with adults on the spectrum. The research team engaged with the community who shaped the prototype into the *Clasp* system presented here.

An emerging management process, now called "SpeedPlay" [3] has been applied to similar community-university partnership projects [6], and was used here in Access ASD to fully engage the academic team with the community in an iterative cycle of prototype development.

This paper will not discuss in depth the development process of Clasp; rather it will concentrate on the technical aspects of the prototype.

2. SYSTEM DESIGN

The system that emerged from the collaborative process of engagement consists of three components: 1) *tactile digital stress* device which communicates usage data over bluetooth to a smartphone 2) *Support network communication* via SMS and online social network status updates with stress device usage 3) *Usage data aggregator and visualization* for self and community feedback. These three components are described here.

2.1 Digital Stress Device

Many of the CUGs use coping strategies designed to help distract (in the case of carrying favorite photos or images) or release energy through movement or tension of some part of the body (For example, scrunching of the toes). Devices are often squeezed or passed through the hands and are highly personal; they vary from bracelets and jewelry to stress balls and bunches of keys. Many CUGs carry a device as part of their anxiety coping strategy and will use them when they become anxious. It was proposed here to digitize these devices, so usage can be characterized and anxiety levels tracked.

Hoggan et al [4] investigated the effect of augmenting phone calls with non-verbal messages, using a system of tactile input. Their findings indicate that users express greetings, presence and emotions through what they call *pressages*. Similar technology is used here - the CUGs indicated non-verbal communication would be useful in expressing emotion when anxious. Often when CUGs become anxious, the anxiety takes over – and processes required in communicating this to their support network break down. The CUGs can find it incredibly difficult to take their mobile phone from their bag, unlock it and type out an SMS –choosing what to type is incredibly difficult. An automatic system linked to a digital stress device could send alerts to their support network quickly and without requiring user intervention. The members of the

social support network could then decide the most suitable intervention.

2.2 Support Network Communication

Many CUGs use online social networking sites such as Facebook and Twitter, however because their wide social networks may not be fully understanding of ASD, they choose not to communicate ASD related information to the whole network. Instead they rely on more traditional, direct forms of communication such as phone calls and SMS with their support network, and tend to use these only in emergency situations. There were concerns over the ownership and security of the data collected on social networks. In one workshop we mapped the scope of the CUGs ASD support network, and found an average of 17 people per CUG member that they could trust with helping them with ASD. If they had an online platform they could use to safely engage with their support network, then the network may become more engaged in supporting the individual and sharing the care-giving beyond a primary carer.

Hong et al [5] conducted a study to determine if use of an online social network could reduce the barriers to independence experienced by individuals with autism. Their findings showed that circles of communication helped individuals widen their support network, therefore reducing over-reliance on primary care-givers. They laid out a number of design features of online social networks, including contextual circle formation, and precise communication and privacy controls. These features aligned with the user requirements captured from the CUG and were considered when evaluating suitable online social networking platforms.

2.3 Self feedback & Network Representation

Some of the CUGs said that they found it difficult to remember when and where they are anxious. If this information was logged through the use of a digital stress device linked to their Smartphone, then an anxiety history could be seen, showing dates and times they used the device and what triggers were reached. This information would be augmented by sensor data such as GPS location from the Smartphone and even calendar entries and call logs. This data aggregate could be used for self-feedback - understanding what situations trigger anxiety which may eventually lead to crisis. In addition, this information could be shared with their social support network and fed into how they wish to be represented on the network.

This self feedback would have the effect of empowering the user, perhaps giving some sense of control and help them avoid future anxious situations and places. If anonymised data was available, anxiety could be "crowd sourced" and stressful places, as well as and most importantly safe havens, could be mapped out and users could collaborate and share their own tips and on coping strategies. Likewise, local government and funding bodies could use this anonymous information to better direct funding and support.

3. IMPLEMENTATION

The Speedplay process involves repurposing and adapting existing technologies and devices to rapidly and iteratively build prototypes of systems for review and refinement by the CUG. As such, the Clasp system has been prototyped iteratively in paper, using a laptop and Smartphone as the platform, and Play-Doh, bracelets and mocked-up materials for tactile input devices. V2.0 of the prototype uses an off the shelf game controller, the squeezable Blobo[1] which communicates measurements from a host of sensors via Bluetooth to a paired device. Here, a laptop records data from the Blobo's pressure sensor making a digital stress ball. In V3.0 of the prototype a Smartphone replaces the laptop and we investigate prototyping other digital stress devices, using battery powered small form factor Bluetooth enabled Arduino prototyping boards and elastic cord sensors which have varying electrical resistance. These are arranged to make digitized pull cords and bracelets, to characterize different kinds of tactile anxiety responses. An anxiety coping mechanism is highly personal; hence working with CUGs to build digital versions of devices they use is key to ensure future usage.

The Clasp Android platform Smartphone app is described by Figure 1. The app logs usage of the digital stress device, and the user can characterize usage to build in personal triggers (e.g. a long hard squeeze of stress ball or 3x short hard pulls of a cord). Once a trigger is reached the user can define a desired automatic response, In the prototype there are 3: 1) SMS an individual with their defined message and location data, 2) a post detailing the usage to the online social support network or 3) a user-set distraction URL which could bring up a favorite online video search, web image search or perhaps a favorite page from an online encyclopedia. It is intended that the app will be modular, and user can contribute more customized response modules.

The social support network was built around a Diaspora "pod." Diaspora[2] has the functionality of other social networks – it allows text and photo status updates and has built in circles of visibility called "aspects" which allow the user to define which subset of their contacts will see their post. Rather than the traditional social networking site model where the site holds and often owns the data its users post, Diaspora is a distributed network of "pods". A community can set up its own pod on its own server, and that communities data is stored only on its pod. Users can be friends with people based on other pods, and at the time of render in browser the users data is fetched from their pod. This has the effect of the community controlling and owning the data themselves, and the user has fine-grained control over who see their posts.

4. FEEDBACK AND NEXT

This prototype is in the early stages of infancy, so rigorous user trials "in the wild" have not been conducted yet. However feedback from the CUGs, their support networks and professionals working with ASD has been overwhelmingly positive so far. The Clasp system addresses and links together a number of "needs" from non-verbal communication with a support network, providing a "safe" and secure network to share condition-related data to self feedback and reflection for future coping strategies. Clearly the Clasp system could have impact far beyond ASD and be useful to the wider population.

With this in mind future work will involve further trials with the CUGs and the development and support of a collective formed from the community to take the concept beyond prototype. In future it may evolve into a system which can be used to help people with ASD and beyond manage anxiety and in turn enable better social integration.

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[1] http://www.ball-it.com/

[2] http://www.diasporaproject.org

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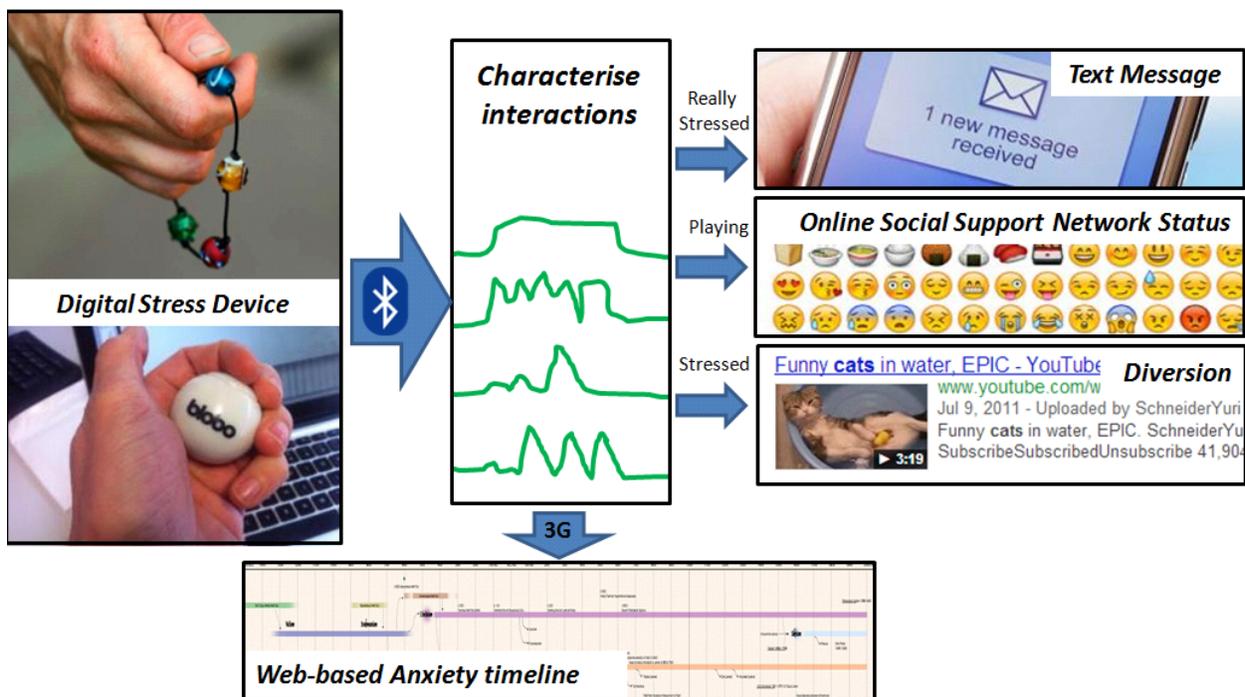
Figure 1: Clasp: Digital Anxiety Management and Communication