TACTimat: Exploring the Design Factors of An Effective Touch Based Tool for Stimulation Therapy

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***Abstract*— TACTimat is a therapy tool developed for both hyper and hyposensitive children through a novel art and design focused approach. Our initial study explores how shape, texture, and density of elements on a tactile mat may influence the behaviour of young children with an Autistic Spectrum Disorder (ASD) or other cognitive disability during tactile exploration.**

I. Introduction

TACTimat is part art, part therapy tool for children with Autistic Spectrum Disorder (ASD), utilizing haptic stimuli to address the needs of hyper and hyposensitive children. TACTimat is a continuation of a previous artwork, "The Finger Rub Rug" [1], after a child physiotherapist indicated the potential of its material properties and shape for practice. In this WiP, we discuss the test of the first prototype at a child therapy centre in the Netherlands.

Children with ASD have difficulty processing stimuli [2] and quickly exhibit stress-responses to unfamiliar or complex stimuli. Few therapeutic tools help regulate sensory stimulation, other than "sensory rooms" -- controlled environments with curated stimuli. Yet, these often induce over-stimulation or anxiety in ASD children. Moreover, the rooms are not portable, reducing access to limited locations and times. Play, and the use of toys has been shown effective in treating tactile sensitivity dysfunctions [3], utilizing common toy shapes and materials. Less understood is the role of biomimetic materials and shapes, and of tactile stimuli during play and therapy -- the focus of TACTimat.

II. TACTimat

The TACTimat is a 36cm by 61cm sculpture from which 158 flexible, silicone shapes -- "buttons" -- rise. Their shape and grid composition are aesthetically chosen and invite to explore through touch. The buttons rely on biomimetic inspiration, each approximating the dimensions of human fingers. While the shape is mostly fixed, they differ in height, density and tip profile. Most of these tactile qualities are apparent by just looking, while to discover others, like density and texture, humans rely on exploratory procedures (EPs) [4].

III. Results and Discussion

The TACTimat prototype was tested during physiotherapy sessions of approx. 15 min. with 20 special needs children between 2 and 8 years old, of whom 5 have a cognitive impairment or ASD. From video footage, qualitative data was extracted.

During exploration, participants focused only on the mat. This focused state had a relaxing effect on children with a cognitive disability or ASD. All children displayed exploratory behaviour in line with EPs [4], such as caressing, squeezing, and pressing, validating that tactile exploration was occurring, and that such exploration was in line with abled-bodied users. Other behavioural patterns were: walking over the mat; stroking multiple buttons; pulling or tipping them; pressing with a foot; and picking up the whole mat. Taller buttons resulted more often in walking, grabbing and stroking behaviour, while shorter buttons were often pressed on with a thumb.

The clearest validation came from three children with a cognitive disability or ASD, who were first walking high on their toes – an ASD behaviour indicating insufficient stimulation. Once they engaged with the TACTimat, they began walking on the sole of their foot on the surface (see fig. 1). Additionally, balance-deficient children happily trained their balance and a girl with a clubfoot trained her proprioception. Taller buttons, sharper tips and a higher density of buttons, seem to provide more intense stimuli.

In conclusion, the TACTimat lays the foundation for the design of a flexible tool for stimulation therapy with the goal to induce activation without overstimulation. More piloting is needed to gather quantitative data to research relationships between the buttons' shape and the reaction of special needs children. With this data, conclusions can also be drawn on differences between children with and without ASD.

Figure 1. A child walking on toes uses the complete foot sole on the TACTimat.

References

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