The BuddyDouble: An Ambient Productivity Companion for Adults with ADHD

Emma Kathrine Derby Hansen
School of Arts & Communication
Malmö University
Malmö, Sweden
emmaderbyhansen@gmail.com

Adults living with ADHD experiences unique challenges in the daily functions of life, with limited options for assistive technology that considers the nuanced stresses of adulthood and their implications for managing the disorder. Many are forced to adopt tools for organization, task management, productivity and scheduling which are designed for the functions of a neurotypical experience. Forcing yourself to approach productivity and motivation a way that isn't natural for you, even if it is the 'proper way', will often lead to unreliable results, worse self-worth and overstimulation. The BuddyDouble is designed to offer and alternative option for assistive technology, meant for the adult experience of living with ADHD. This design uses the strategy of 'body doubling' to facilitate productivity and self-driven motivation in ways people with ADHD is responsive to, with the goal of providing support and companionship users.

I. Introduction

In 2024, as a part of my master's studies, I worked on the design of assistive technology aimed at adults with ADHD to facilitate productivity and motivation in their daily life. This work laid the foundations for the design of the BuddyDouble, a portable robotic companion that uses body doubling to support the quality of life of neurodivergent adults.

Attention-Deficit Hyperactivity Disorder (ADHD) have historically been falsely considered solely as a childhood disorder, resulting not only in a large part of adults with the disorder going undiagnosed or misdiagnosed (Wender et al., 2001), but also in a majority of research regarding support and accommodations for the disorder being made solely with the contextual considerations of child's life and needs in mind (Spiel et al., 2022).

A specific focus on adults with the disability, provides a completely different set of contextual considerations. Independent adults generally have many more responsibilities and co-dependent relations than children, with much less assistance provided. And with it being an invisible disability, there's also a generally lesser tolerance for adults visibly facing struggles because of ADHD, than in the case of children. As a result, adults living with undiagnosed or late-diagnosed ADHD have often created or adopted functioning methods on their own, either consciously or subconsciously. These methods, often referred to as 'mastering strategies', are a means of addressing or 'masking' the characteristics of the disorder [1].

But while being an adult with the disorder often means having adopted certain mastering strategies for dealing with one's ADHD, it does not eliminate the need for assistance in daily life. This prototype is designed to support neurodivergent users in maintaining self-driven motivation and productivity in the broader context of adult life, especially typically with household chores, home management, self-care or repetitive tasks in mind.

II. Related Work

The prototype designed to facilitate *body doubling*, a well-established mastering strategy for productivity and focus, often found discussed and shared within neurodivergent communities but also utilized by neurotypical individuals (Eagle et al., 2023). The strategy of body doubling does not involve a specific methodology, but rather gives conscious thought to a social effect on motivation which can then be actively initiated by the user. An explanation have been defined as:

"Having someone in the room or on a call/chat in order to accomplish a task or be productive. The second person may be doing a different task or a similar one, and it is a form of accountability and helps you stay on task." - (Eagle et al., 2023, p. 2).

In essence, body doubling is to consciously use the presence of others to motivate oneself, in order to stay productive or accomplish a task. The *BuddyDouble* is meant to allow for facilitating body doubling for one or more individuals, by providing an ambient presence of an '*other*'.

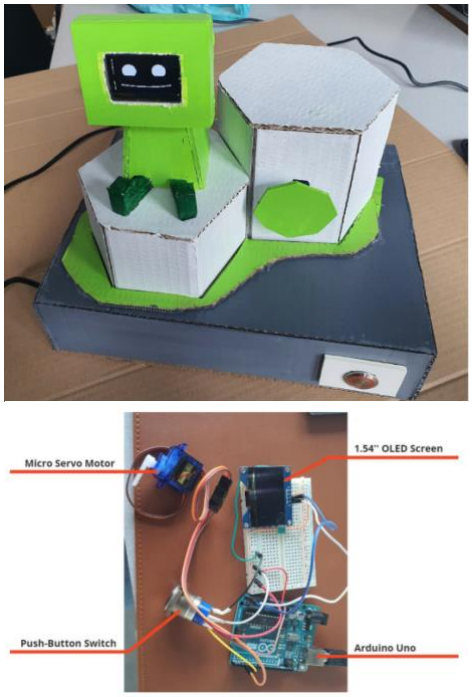
The nuances for how to best achieve this facilitation have also been designed with and influence from adults with ADHD, through a series of interviews, collaborative sketching sessions and reflective feedback from the participants. This invitation to include neurodivergent adults in the design of assistive technology has been crucial in the formation of the *BuddyDouble*'s potential for unique support, as this has inclusion have often not been prioritized in development of other assistive technologies (Spiel et al., 2022).

III. Prototyping the BuddyDouble

The BuddyDouble was initially rapidly prototyped as a part of my initial studies on the design of assistive technologies for ADHD adults and was subsequently relatively unrefined and unsuitable for common use. The first prototype concept was restricted to use in a specific location, due to size and power source limitations, and only had the functional capacity to serve as a proof-of-concept for the participants in the research, meant to be further improved in later iterations.

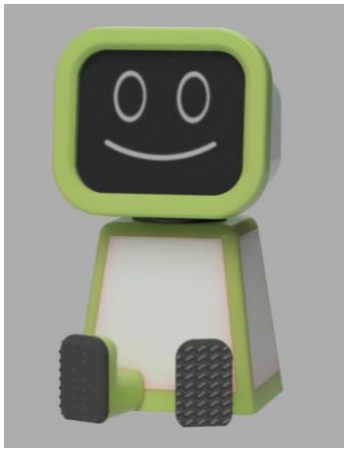
The concept had a lot of potential for providing an innovative and accessible experience of an assistive technology catered to the unique challenges of living with ADHD as an adult.

Therefore, I further worked on a design that which prioritized useability and portability, as an accessible modal for companionship and motivation in body doubling.



1 First prototype iteration. A rapidly made construction with simple electronic components.

The new iteration is meant to provide same desired assistance to users, but with a greater focus on portability, usability and considerations of hardware choices to allow for full functionality, support firmware capacities and allow for the adaptation into the use of custom PCBs to minimalize resource use in production.

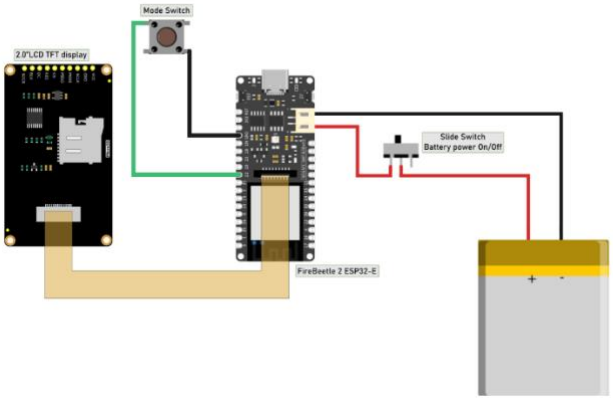


2 - Re-imagined prototype figure. The casing is intended to be 3D-printed in multiple parts and assembled by hand.

The BuddyDouble consists of a portable figurine with a LCD TFT display for a 'face' to allow the prototype to; display 'idle' animations when not in use, display 'working' animations when used for body doubling, display the 'results' of the figurines 'work' to the user as a reward at the end of a body doubling session, and allow the user to interact with the firmware for controlling preferential settings.

The user can initiate body doubling by pressing a button in the figurine's chest, effectively switching it from 'idle mode' to 'co-working mode'. The user is also able to turn off the prototype completely to save battery charge when stored away or being transported, which is done through the use of a slide switch in the back of the figurine.

When the prototype is in 'co-working mode' the use of animations on the 'face' of the figurine establishes an eye-catching, distinctive and non-invasive presence in the shared space acting as an 'other' for emulation, mirroring and companionship while being productive. This presence also creates an 'anchor' for the users actions to the intended task, as while the user might be distracted or take a break the prototype visibly 'working' functions as a reminder of the task the user originally intended to accomplish, without the need for the prototype to prompt productivity through notifications or reminders. Furthermore, the tangible presence of the prototype when not in active use allows the user to more easily establish a habit of use, as many people with ADHD struggles with object permanence.



3 Re-iterated component diagram, using commercially available electronic components.

The prototype is at this stage designed to make use of commercially available electronic components including:

- A 2.0" LCD TFT display w. SD card slot
- A push-button switch
- A slide switch
- A rechargeable Li-ion battery
- A microcontroller board capable of supporting:
    - Battery charging control, with USB-C compatibility.
    - GDI Cable connection for control of display screen.
    - IoT-capabilities to allow for wireless updates to firmware or communication.

The chosen microcontroller board for this iteration is the ***FireBeetle 2 ESP32-E*** from DFRobot, which is more than capable of allowing for full intended functionality. However, a more optimized choice would be to design a custom microcontroller PCB, to both save on unnecessary resource use and to better fit the intended circuitry and components within the prototype casing.

IV. Responsible innovation

This prototype is designed to offer an assistive technology for neurodivergent adult with conscious thought to the unique challenges and cognitive stresses a disorder such as ADHD brings. Not simply in the context of a 'measurable' productivity benefit, such as in one's work or education, but in the context of daily life and societal expectations. The ability to maintain a self-driven intrinsic motivation is vital for anyone to execute the tasks of maintaining a home, financial responsibility, time management and work-life balance. ADHD makes this ability unreliable and difficult to manage, often negatively impacting the mental health and self-perception of the person.

I believe that an importance side of responsible innovation is the ability to create solutions that work *with* the factors at play and allowing for people to adapt the innovation to their own needs, rather than for the innovation to only be beneficial if people are able to change and adapt for it. This is the case in many technologies aimed towards people with ADHD, such as digital products for organization, task management and gamification of productivity, which is designed to optimize the stereotypical neurotypical process of 'being productive'.

However, it is also relevant to consider the sustainability in making the assistive technology a physical solution, rather than the aforementioned digital products which are often freely available to users through existing devices. This prototype would be more costly to produce, both financially and in resource costs for manufacturing, and would also be requiring more effort for the users to access. The effort to reduce the impact of these factors would need to be further considered in detail, when a more complete picture of the final prototype development is established.

V. Author bio(s) / experiences

Emma Kathrine Derby Hansen

I've long been fascinated in exploring the relationships between humans and the technology around us, how we humanise it and grows along with it. In my education I've previously studied Computer Science and Communication Studies, which have eventually led me to my current field of Interaction Design, where I have found a great affinity for designing for unconventional experiences and playful interaction.

During the research preceding the design of the BuddyDouble, I was living with undiagnosed ADHD myself and had a fair amount of people in my personal network who also had the diagnosis. In these social circles I've had many discussions at length about the unique challenges it imposes to not only one's ability to 'function normally' but also to one's self-perception when we couldn't do so. The BuddyDouble is not only a result of the design research into the topic and the empirical insights from participants, but also a manifestation of my own efforts to navigate life with the disorder.

I've worked with electronic prototyping and digital fabrication a fair amount in relation to both my studies and as a personal hobby where is am in large parts self-taught. I enjoy working with electronic hardware and tangible interactive technology, as a way of incorporating my technical skillset in my creative work. The skillset I've developed has also resulted in me having extensive experience as a teaching assistant, where I've largely been teaching physical and electronic prototyping to students at both Roskilde University in Denmark and Malmö University in Sweden, along with an extended position staffing the IOIO Mechatronics Lab at Malmö University.

I've still a great deal to learn in regards to design and manufacturing of customized PCBs and electronic projects, but hope to develop my skillset in this area at every opportunity I can.

VI. Acknowledgements

I wish to acknowledge to the invaluable insights from participants in my original dissertation research, which laid the foundation for the current iteration of the BuddyDouble. They served as an irreplaceable source of empirical knowledge on the nuances of living with ADHD as an adult, and where innovative design could be better suited to providing support in their lives.

VII. References

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