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Designing technology for spatial needs: Routines, control and social competences of people with autism

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ABSTRACT

Over the years, the relationship between technology and people with autism has been framed mainly in a medical model, where technology is primarily aimed at mitigating deficits and providing helps to overcome limitations. This has yielded a variety of Human-Computer Interaction designs addressed to improve the autistic individuals' daily tasks and behavior. In this article, we want to explore a different approach, by proposing a phenomenological take on the autistic lived experience, which could integrate the results achieved by the medical model, and offer a "first person perspective" on autism. More precisely, by adopting a cognitive approach to urbanism we want to explore how autistic individuals conceptualize and experience the spaces they inhabit. To this aim, we interviewed 12 adults with a diagnosis of autism asking them to recount their everyday movements and city living activities. Building on the study findings, we identified three kinds of spaces that characterize their life and outlined a series of design considerations to support technology interventions for satisfying their spatial needs. Then, during a design session, we developed our conceptualization as well as our design suggestions, yielding a more nuanced picture of how space is subjectively constructed by autistic people.

1. Introduction

Autism is characterized by peculiarities in domains as diverse as social interaction, communication, attention, and practical skills (Hobson, 1993), as well as emotional features like a propensity to become anxious. All of these may occur in different forms, ranging from severe intellectual and language impairments to high-functioning autistic/Asperger syndrome, sometimes with an IQ above the average. The latter may often remain invisible to society (Hobson, 1993; Luciano et al., 2014; Keller et al., 2016). Since autism is marked by a tendency to withdrawal from social relationships as well as oftentimes a preference for the mechanical and formal over the biological and psychological, technology-based interventions appear to be successful when used by affected individuals: interactive technologies typically are more predictable than humans, do not require direct social interaction, and can provide routines as explicit, present, and clear expectations, as well as feedback consistent rewards or consequences for responses (Kientz et al., 2013).

Designing technology for people with autism, however, implies the willingness to understand their "neurodiversity",[1] if we want to go beyond the idea that a unique mode of existence and experience is legitimate in our society. For a long time, neurodiverse conditions have been framed within a medical model, "defining being disabled by people's physical or cognitive differences and the resulting functional limitations" (Frauenberger, 2015, 58). Likewise, the relationship between technology and people with disabilities has been framed within the medical model, because it has proven to be pragmatically useful in providing requirements for design (Frauenberger, 2015). This surely has to be applauded, as Mankoff et al. (2010) noted: however, they also pointed out that a different take, coming, for instance, from disability studies, could integrate the medical approach helping us produce a nuanced understanding of these people's needs. In the 1980s, the disability rights movement proposed a reconceptualization of disability (the so-called social model), being seen as a social construct resulting in

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[1] Neurodiversity is a movement advocating different cognitive and perceptual capabilities than what is normative, in other words, neurotypical (Çorlu et al., 2017). The term was coined in 1999 (Singer, 1999), and has been used to advocate autistic people's rights, whereas neurotypical started indicating all those individuals not belonging to the autism spectrum. Over time, populations with other neurological conditions, such as ADHD (Attention Deficit Hyperactivity Disorder) (Dalton, 2013), joined the movement by using the term to refer to their community as well.

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impaired people being disadvantaged (Barnes, 2012). Recently, Frauenberger et al. (2016) claimed that we need to capture the complexities of the disabled experience, suggesting that we should explore novel theoretical approaches. If we want to be able to respond to needs and desires that go beyond mitigating deficit, this requires us to understand what is meaningful in the autistic people's lives and develop solutions that are situated in their lifeworlds (Frauenberger, 2015).

Building on top of these insights, in this article we aim at exploring how people with autism experience the spaces they live, since their spatial needs, i.e., what they seek when they inhabit a place, or move across different environments, seem to be still underexplored in both the autism and Human-Computer Interaction (HCI) literature. We further propose to adopt a phenomenological perspective, in order to account for the lived experience of this neurodiverse population. This could integrate the medical perspective, by offering an alternate take on the autistic lived experience.

The philosophical and psychological paradigm of phenomenology has its roots in the works of Husserl (1962, 1976), Merleau-Ponty (1962), and Heidegger (1982). This theoretical approach sees reality as the product of a "view from within" (in contrast with the "view from nowhere" criticized by Nagel, 1986) and conceives the mind as subjectivity, which actively "constructs" the world by ascribing subjective meanings to it (Clancey, 1997; Brizio & Tirassa, 2016). Within HCI, phenomenology has been used to promote a tool-based approach to design (Ehn, 1988), ground a theory of embodied interaction (Svanæs, 2013), and inform the design of Personal Informatics systems (Rapp & Tirassa, 2017). Phenomenology offers a rich and diverse range of orientations providing a useful framework for understanding how people make sense of existence in and toward the world (Frauenberger et al., 2010). Therefore, it may be useful to understand the autistic people's experience, looking at their world from a first person point of view.

To explore autistic spatiality, we moved from studies on cognitive urbanism (Lynch, 1960), which investigates how the features of human cognition and the characteristics of urban environments interact to produce a subjective spatial representation of city places, paths, and landmarks. This approach focuses on how people experience and subjectively construct urban environments, thus encompassing the phenomenological perspective we want to follow.

In sum, our work aims to explore how adults with autism live their cities, what kind of spatial needs they have, and how they can be supported in their daily routines by technology. We look for an answer to the following questions: How do individuals with autism perceive and represent the urban spaces in which they live? What do they mean for them? What kinds of barriers do they encounter when moving across urban environments? How might HCI technologies support people with autism living their city and during their transfers?

We interviewed 12 adults with autism asking them to recount their everyday movements and city living activities. Our contribution to HCI is twofold: (i) we investigate autistic persons focusing on their lived spatial experience, and (ii) we provide implications for the design of interactive systems capable of supporting their situated needs in urban environments.

The article is structured as follows. Section 2 outlines the relevant related literature and our theoretical background. Section 3 describes the method used in this research. Section 4 exposes its results. Section 5 discusses the main features of the "autistic space" and presents a few considerations for design. Section 6 reports the outcome of a design session with high-functioning/Asperger individuals, developing our conceptualization of the autistic space, along with the proposed design suggestions. Section 7 describes the limitations of our study and Section 8 concludes the article.

2. Background

In this section, we will first introduce relevant literature with reference to autism and technology. In doing so, we will try to highlight current literature trends. Then, we will briefly outline the theoretical background that informed our study.

2.1. Autism and adult individuals

The clinical investigation of adolescents and adults with autism has not been developed as extensively as that of children (Kientz et al., 2013). This may be a function of the medical model that promotes early intervention in the home and school targeting school-aged individuals, because that is where the service provisions have been focused. The clinical focus on the autistic children's first years of life has also been translated into a privileged attention of the HCI community to designing technologies suitable for them (Boucenna et al., 2014). Frauenberger et al. (2016), for example, involved four autistic children in participatory design sessions to develop smart objects designed from and for their idiosyncratic perspective. Hirano et al. (2010) developed vSked, an interactive and collaborative visual scheduling system aimed at supporting primary school classroom activities for children with autism. Suzuki et al. (2016) created EnhancedTouch, a bracelet-type wearable device that can measure human-human touch events and provide visual feedback to augment touch interaction, in order to facilitate physical contact between children with autism. Spiel et al. (2017) developed an approach for participatory evaluation called PEACE (Participatory Evaluation with Autistic ChildrEn) to include autistic children in dedicated evaluation phases through the co-definition of goals and methods, joint processes of data gathering and co-interpretation of findings. Boucenna et al. (2014) provided a detailed picture of how technology has been used for supporting autistic children.

More recently, HCI has begun to explore design for adults with autism as well. For example, Hong et al. (2012) implemented SocialMirror, a device connected to an online social network that allows autistic adults to seek advice from a trusted network of family, friends and professionals. Simm et al. (2014) prototyped Clasp, a tactile anxiety management, communication and peer support tool developed with, by and for adults diagnosed with high functioning autism. Boyd et al. (2016) designed SayWAT, a wearable assistive technology that provides feedback to adults with autism about their prosody during face-to-face conversations. Simm et al. (2016) created Snap, a digital stretch wristband that collects interaction for later reflection and the self-management of anxiety, through a three-month co-development process with and for adults diagnosed with high-functioning autism.

Most of these interventions have been addressed to social communication skills like language production, emotion management, and social interaction, as these are the core features of autism in clinical terms. Exceptions are Hara and Bigham's work (2017), who developed the Assistive Task Queue, a crowd labor platform to facilitate image transcription tasks. They suggested that people with autism are likely to be able to accomplish this kind of assignment, and that a platform of that kind might help them find appropriate tasks to work on. HygieneHelper (Hayes & Hosaflook, 2013) supports teens and young adults in developing skills for independent living by tracking and monitoring progress on hygiene routines, and prompting feedback through a virtual coach.

We aim at exploring technology opportunities for autistic adults, focusing on the domain of spatiality: daily movements in the urban environment, as well as modes of living city spaces, represent an important aspect of the everyday life, which appears to be still underexplored in autistic people.

2.2. Autism and spatial needs

Autism is marked by an atypical social functioning, with a need of withdrawal from social interaction, which can grow into the preference for non-socially intensive activities and environments. Moreover,