

CHI 2026 DISSERTATION AWARD

Wearable, Discreet AAC

Co-design of Augmentative & Alternative Communication with People with Aphasia

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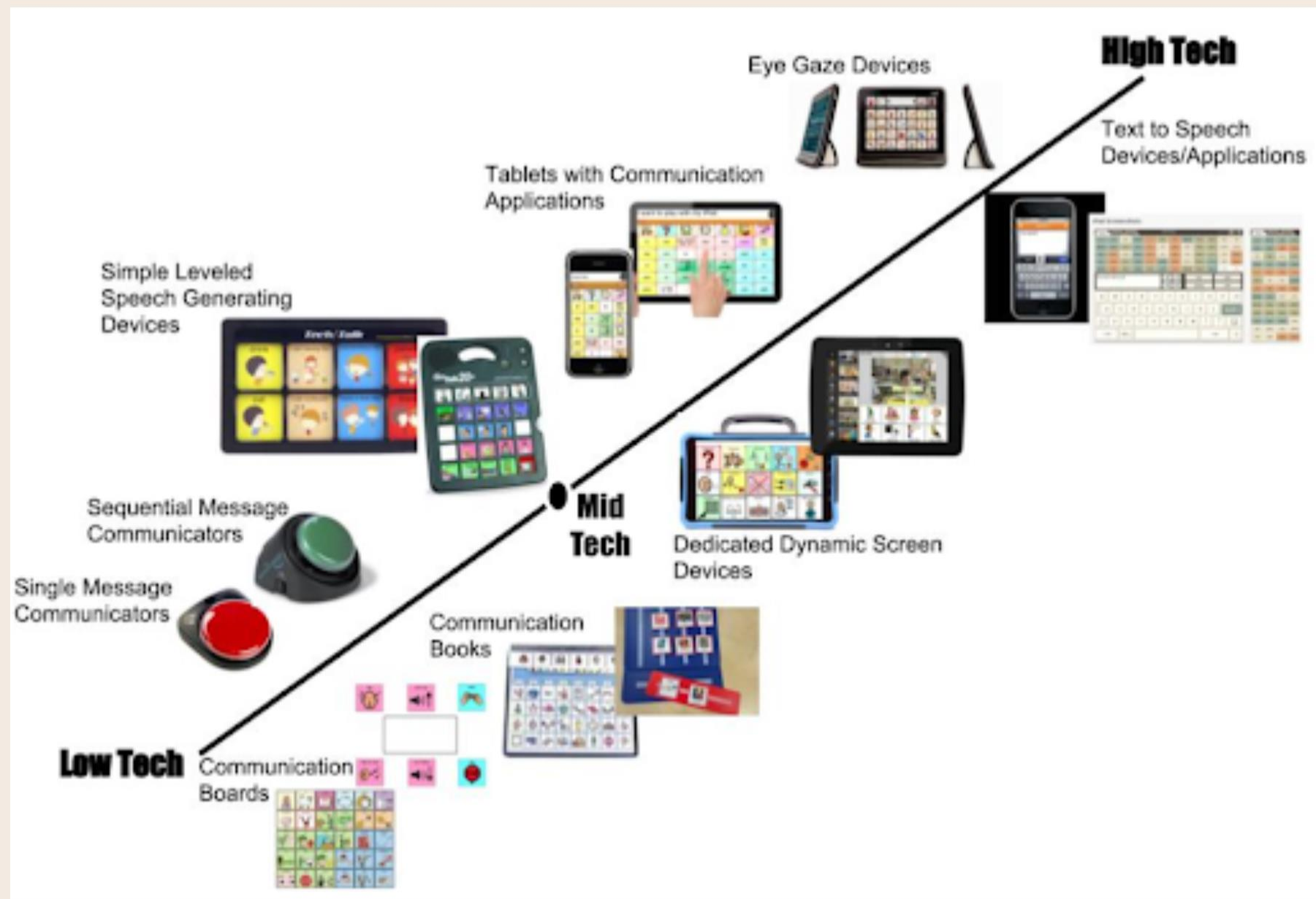
Supervised by Dr Timothy Neate & Dr Rita Borgo

Barcelona, Spain · April 13-17



Opening thoughts













Adoption challenges

- **Expensive**
- **Hard to learn**
- **Stigmatising**
- **Restricts agency & gestures**
- **Not portable**



- **Older adults**
- **Low computer literacy**
- **Long-term condition**
- **Poor access to services and healthcare**
- **Cost matters**



State of the Art in AAC

A Systematic Review and Taxonomy

In Proceedings of the 24th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '22), October 23-26, 2022, Athens, Greece. ACM, New York, NY, USA.

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Art in AAC: A Systematic Review and

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Communication needs (CCNs) can use high-tech alternative communication (AAC) devices to overcome communication difficulties. While much research has highlighted challenges of abandonment and solutions for their end-users. Presently, we lack the ability to comprehend these shortcomings for the accessibility community might direct its efforts towards AAC. In response to this, we conducted a taxonomy of high-tech AAC devices based on results from 562 articles identified in various databases. We provide a taxonomical classification of AAC devices – e.g. their interaction characteristics. We describe the communities and methodological approaches used. We explore accessibility and HCI literature to inform the exploration in light of the current taxonomical framework of the norms and incumbent research discourse on the communities of focus

ing → Empirical studies in accessibility.

Critically, challenges in human social interaction subject individuals to many risks such as isolation [122], employment challenges [123], mental health disorders [76] and a loss of autonomy. Equally, communication and freedom of expression under UN legislature [120] and reverence for "the right to a full and meaningful life" [105]. Aided and unaided AAC devices serve to remediate communication difficulties for individuals and communities with communication needs (CCNs) [126]. In particular, high-tech AAC devices emulate the most advanced electronic communication devices such as speech generating devices (SGDs) or voice output communication aids (VOCAs) [42]. Data on the prevalence of AAC is limited, however there will be a growing number of individuals requiring AAC interventions. There has been sustained academic research on AAC and interventions since the formation of the International Society for AAC (ISAAC) in 1983 and the AAC Research Institute. Since then, high-tech AAC has been developed in a wide range of devices [106] and serve many communities. High-tech AAC devices and interventions have led to positive and successful outcomes for individuals. With advances in computer technology, machine learning and artificial intelligence (AI) hold much promise for AAC [140, 185].

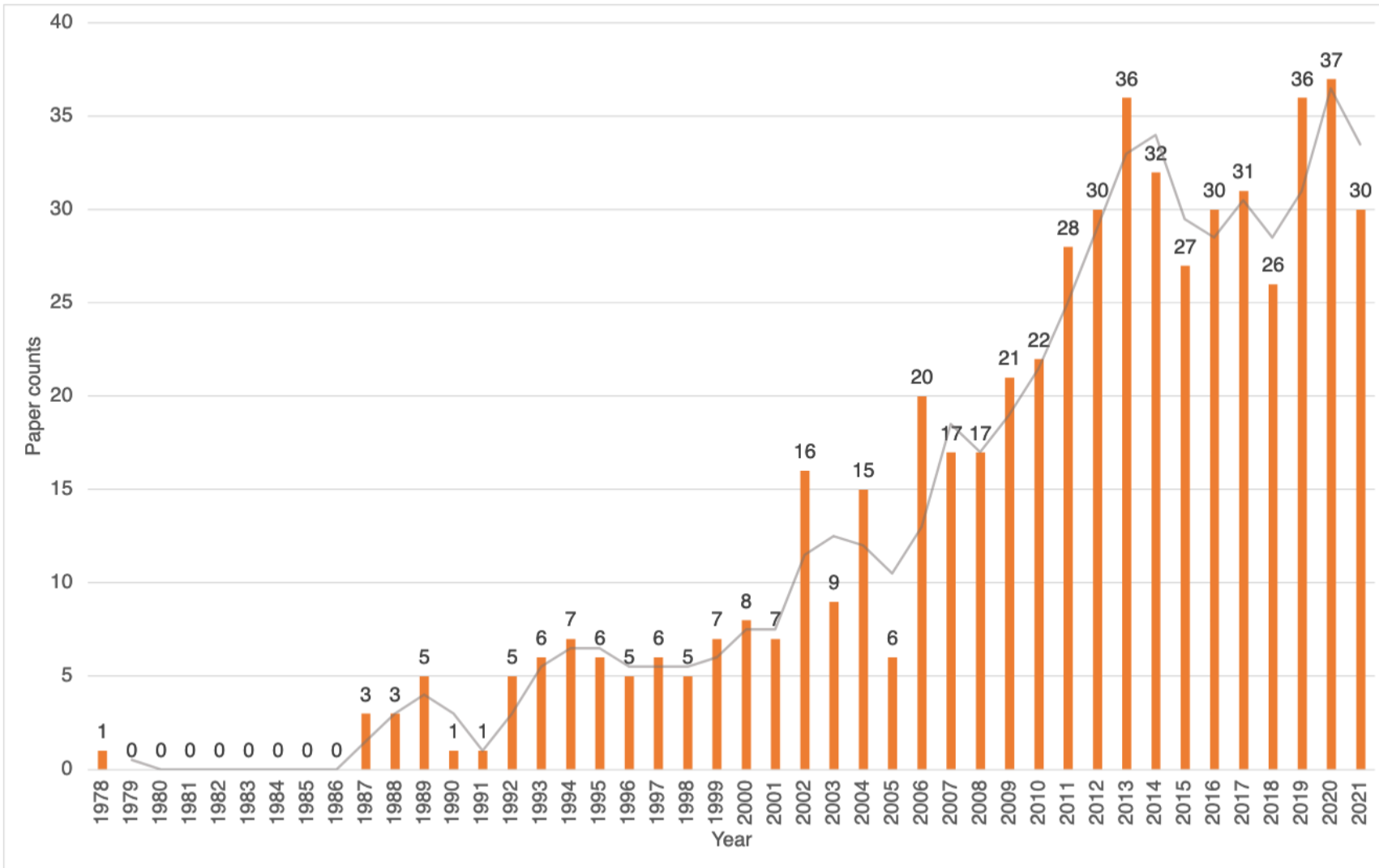


Figure 5: Frequency of 562 paper counts by year for high-tech AAC within dataset from 1978-2021.

Inputs

Mechanical - 216 (38.4%) - 140 (24.9%)

Tactile - 184 (32.7%) - 111 (19.8%)

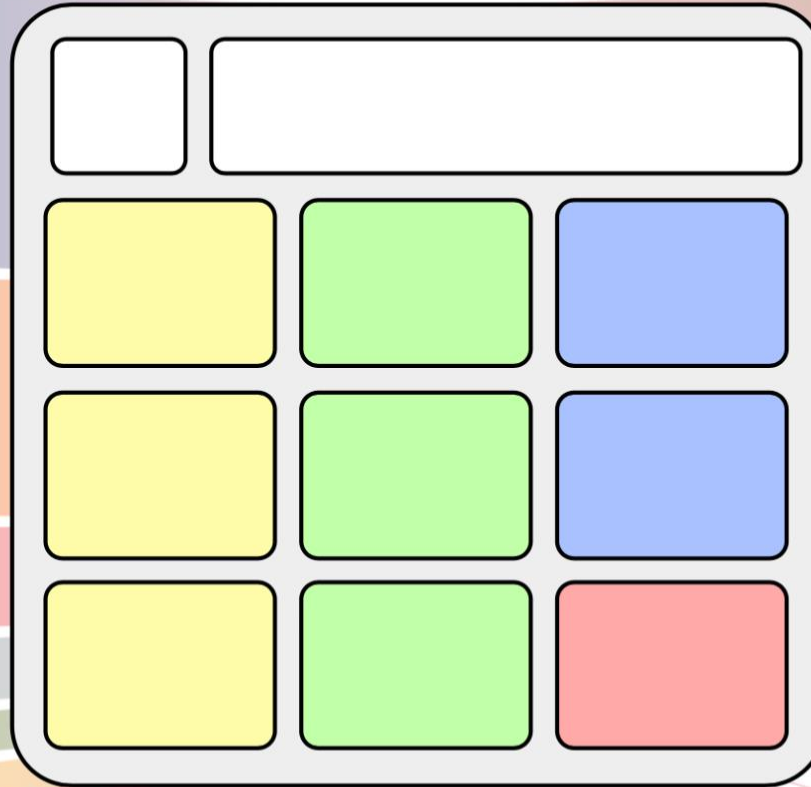
Camera - 77 (13.7%) - 34 (6%)

Gestural - 48 (8.5%) - 28 (5%)

Contextual - 31 (5.5%) - 5 (0.9%)

Verbal - 29 (5.2%) - 8 (1.4%)

Orientalional - 7 (1.2%) - 3 (0.5%)



Outputs

Audio - 353 (62.8%) - 280 (49.8%)

Visual - 157 (27.9%) - 87 (15.5%)

Motion - 11 (2%) - 4 (0.7%)

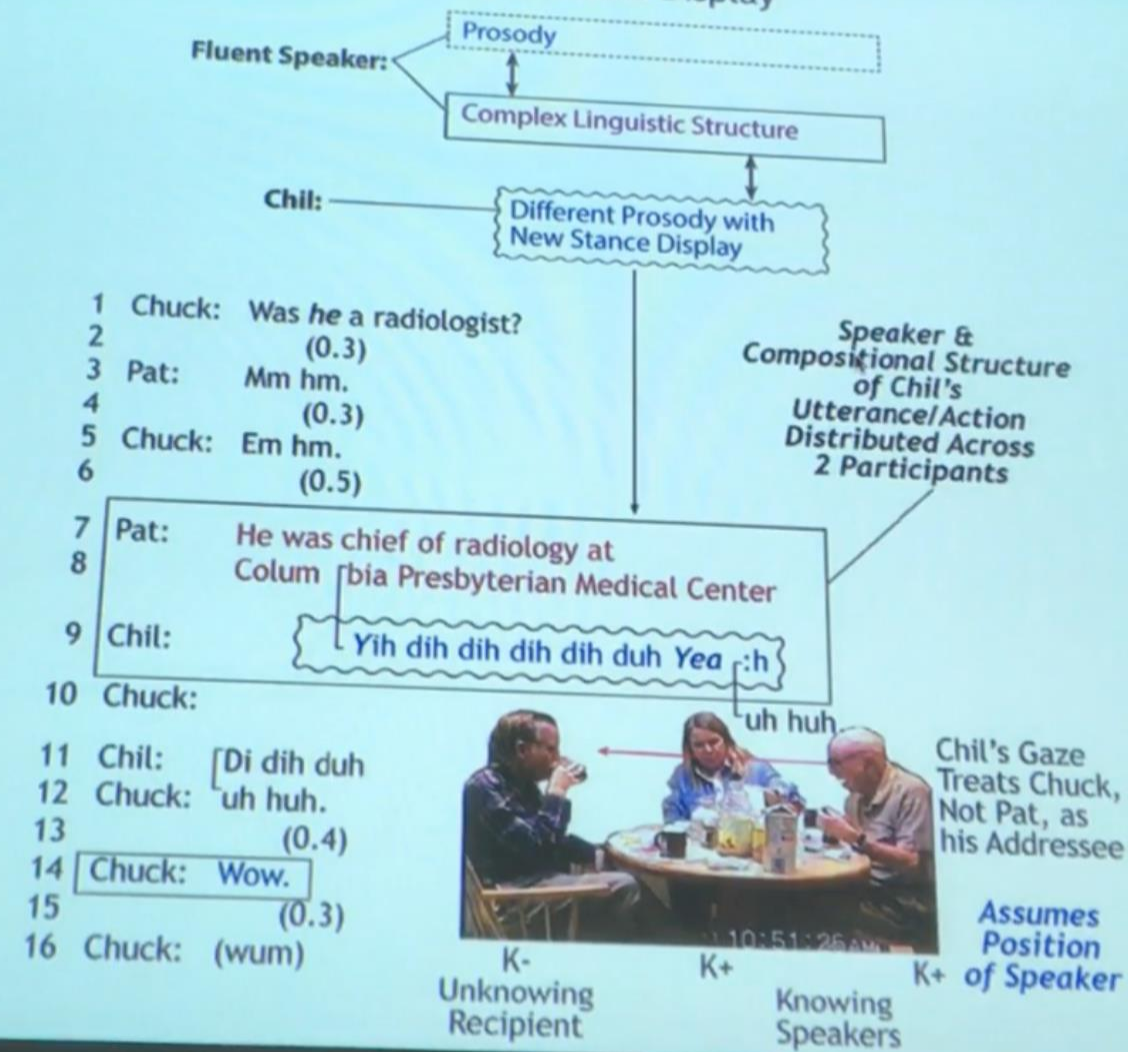
Thermoception - 0 (0%) - 0 (0%)

Gustation - 0 (0%) - 0 (0%)



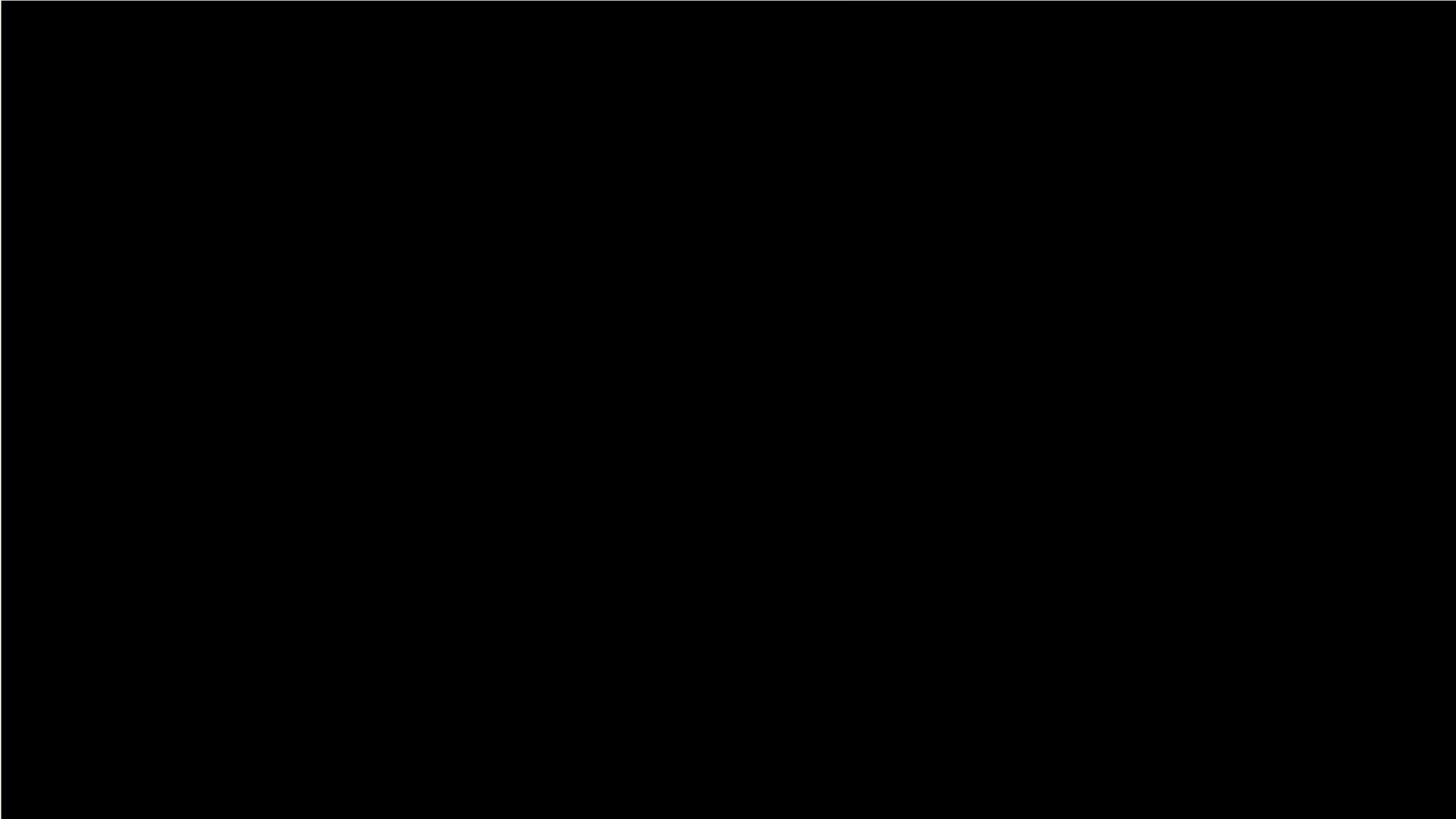


Piggybacking a Stance Display



Charles Goodwin

Simultaneous Action With Different Parts 9



Beyond Repairing with Electronic Speech

Towards Embodied Communication and Assistive Technology

In Proceedings of the CHI Conference on Human Factors in Computing Systems (CHI '24), May 11-16, 2024, Honolulu, HI, USA. ACM, New York, NY, USA, 12 pages.

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Beyond Repairing with Electronic Speech: Embodied Communication and Assistive Technology

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Philosophies have strongly favoured a dual-consciousness – emphasising the importance of the 'mind' over the 'body'. However, we argue that adopted as- some embodied and extend intentionality this paper, we restore an embodied view of enhance: understandings of assistive tech- nian communication. Initially, we explore logical theories of human experience, post- ments of technology, embodied accounts of l participatory design. We then present a g the generative and disruptive effects of c for co-designing AAC with people living ngs show that the embodied framework mensional account of experience and sug- levices that seek to 'repair' users' speech. idy, we then outline concerns with nascent disembody and limit accessibility.

Computing → Accessibility technologies.

Phenomenology; participatory design; em-

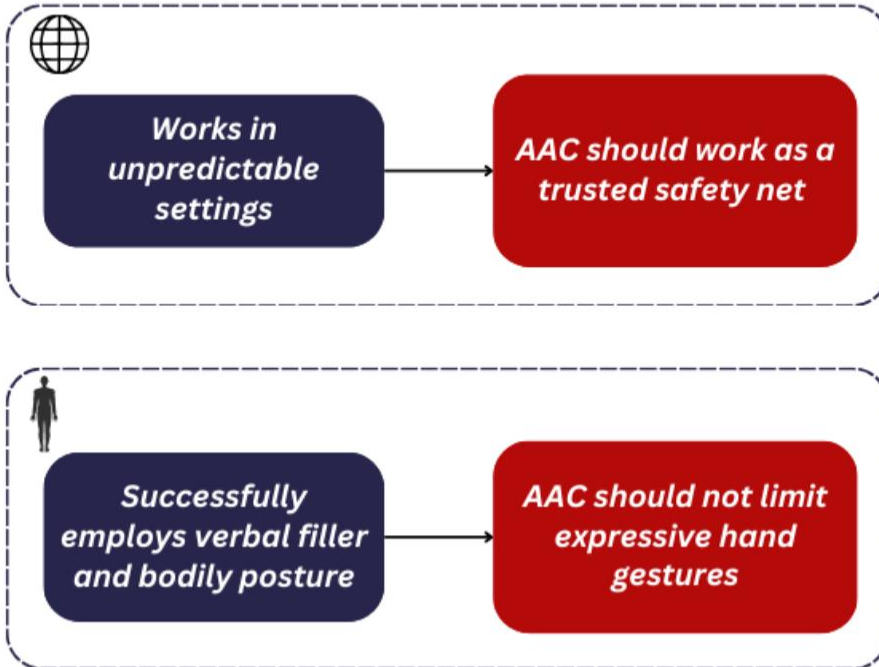
mind and *body* were separate – meaning co- ducible to processes occurring *only* within recent years, the Cartesian dualist position, w the body has been significantly weakened by and biological findings [22, 67, 88].

Equally, there has been a significant growth ness of bodily techniques for ensuring gener- such as meditation [76], yoga [47], fitness/ sleep [31] and balanced diets [1]. Specifically, come from an Eastern philosophical tradition essential role of the body in everyday hum- ence [46]. Although these mainstream trends the importance of embodied interactions has c in the design of assistive technologies – parti- and alternative communication (AAC) device

Since the 1960s, AAC that generates speech- ating devices or SGDs) emerged as a technol- opportunities for people living with complex c (CCN) to produce electronic speech through- using symbol or lexical representations of l Yet, recent research has found this AAC design communities' pre-existing autonomy and n of communicative expression [9, 38, 40]. Lo- dialogue, many people with CCN actively h- verbal communication strategies (i.e., gestur- and physical props etc.) to successfully comm-

Embodied Perspective

AAC Insight



Envisioning the (In)Visibility

of Discreet and Wearable AAC Devices

In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23), April 23-28, 2023, Hamburg, Germany. ACM, New York, NY, USA, 19 pages.

<https://doi.org/10.1145/3544548.3580936>



Envisioning the (In)Visibility of Discreet and Wearable AAC Devices

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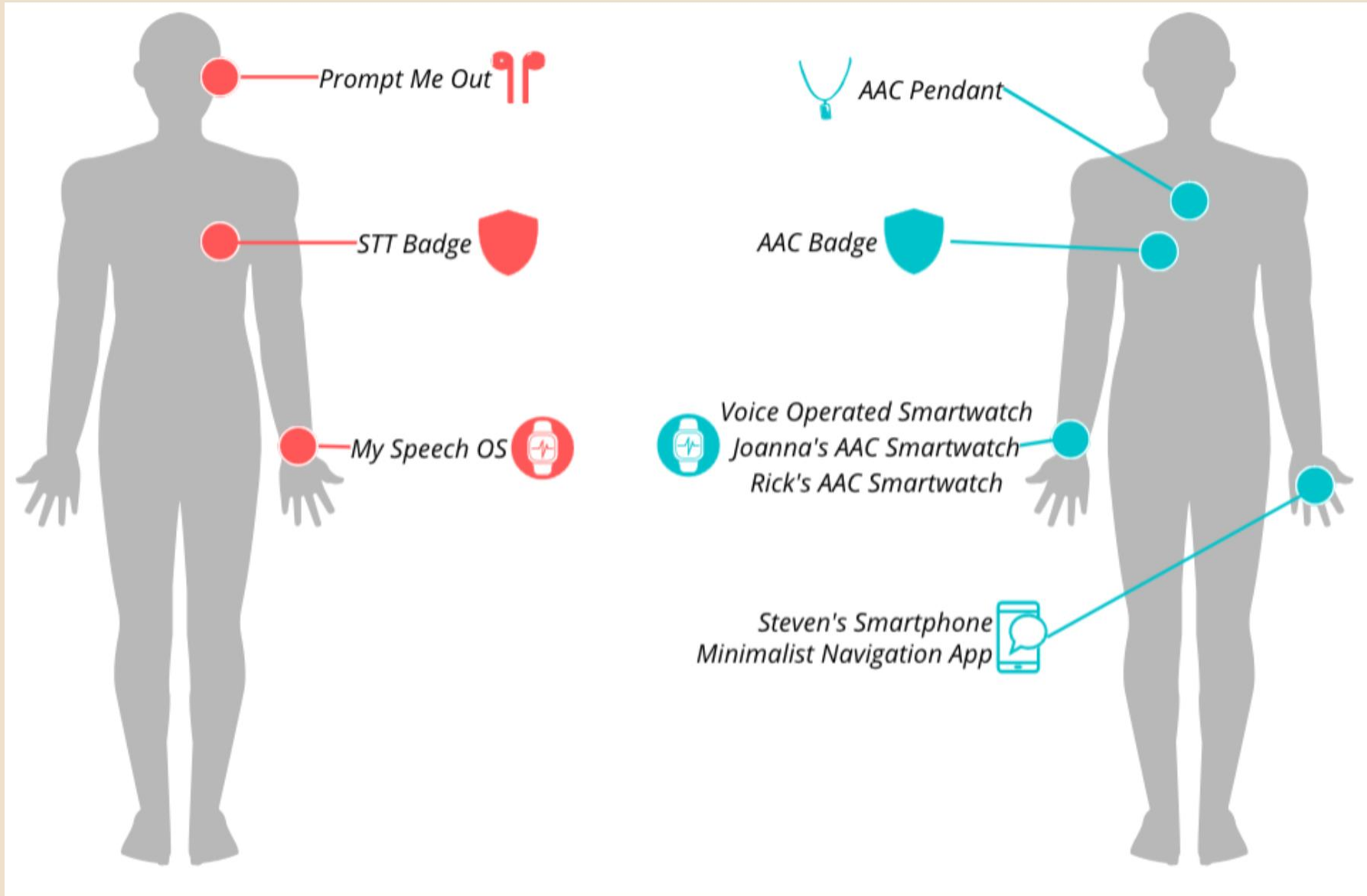
1 INTRODUCTION

Discreet and alternative communication (AAC) devices provide communication support for those with complex communication needs (CCNs). Unfortunately, these devices are often abandoned due to many factors – a lack of visibility of the device and other essential modes of communication like hearing (DHH), have autism spectrum disorder (ASD), developmental disabilities (IDD), motor impairments such as dementia and language impairments such as aphasia. People living with CCNs are at a higher risk of employment challenges [63], reduced social isolation [46], emotional distress [12] and, additionally, people with CCNs could face barriers to accessing and language therapy as global health systems face increasing and unrelenting service demands [18, 30, 41]. Discreet and alternative communication (AAC) encompasses a range of strategies, techniques, and tools that support individuals in expressing thoughts, desires, feelings, and needs. Previous research has even found that people with CCNs benefit from high-tech AAC to support their communication needs independently [35, 72]. Yet overall, adoption of high-tech AAC is low amongst many communities with CCNs. Recent investigations have established complex barriers to high-tech AAC interventions – culminating in the frequent and long-term abandonment [55, 76]. Some of these barriers include the invisibility of high-tech AAC devices, the lack of visibility of high-tech AAC devices, and the lack of visibility of high-tech AAC devices.

PTS

Discreet computing → Accessibility technologies.

With an ageing Western population and increasing prevalence of complex communication needs (CCNs) – there are greater numbers of individuals who live with complex communication needs (CCNs). These needs can be onset from a wide range of developmental conditions including populations that are deaf-blind (DB), hearing (DHH), have autism spectrum disorder (ASD), developmental disabilities (IDD), motor impairments such as dementia and language impairments such as aphasia. People living with CCNs are at a higher risk of employment challenges [63], reduced social isolation [46], emotional distress [12] and, additionally, people with CCNs could face barriers to accessing and language therapy as global health systems face increasing and unrelenting service demands [18, 30, 41]. Discreet and alternative communication (AAC) encompasses a range of strategies, techniques, and tools that support individuals in expressing thoughts, desires, feelings, and needs. Previous research has even found that people with CCNs benefit from high-tech AAC to support their communication needs independently [35, 72]. Yet overall, adoption of high-tech AAC is low amongst many communities with CCNs. Recent investigations have established complex barriers to high-tech AAC interventions – culminating in the frequent and long-term abandonment [55, 76]. Some of these barriers include the invisibility of high-tech AAC devices, the lack of visibility of high-tech AAC devices, and the lack of visibility of high-tech AAC devices.



Watch Your Language

Using Smartwatches to Support Communication

In The 25th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '23), October 22-25, 2023, New York, NY, USA. ACM, New York, NY, USA, 21 pages.

<https://doi.org/10.1145/3597638.3608379>



Watch Your Language: Using Smartwatches To Support Communication

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1 INTRODUCTION

Population and increased prevalence of people living with communication needs there is a growing need for high-tech augmentative and alternative communication (AAC) devices to support agency and social participation. Currently difficult to regulate the prominence of high-tech AAC devices and tablet-based apps – conspicuous, offer poor portability, are aesthetically unappealing, and obstruct vital non-verbal communication. In response to this, we leverage participatory design to design and evaluate two discreet and inconspicuous smartwatch apps. We engage with a community of people living with language impairment/aphasia, to collaboratively design a smartwatch app for 'public' communication: 'Watch In' private cognitive support. Following this, we conducted two smartwatch apps during an experience prototyping workshop and subsequently focus group. We report results from interaction interactions with both apps, interviews and focus groups. Participants were not only successful in using smartwatch apps but, critically, the wearable and smartwatch did not restrict users' agency and non-verbal

PTS

Personal Technology Support → Accessibility technologies.

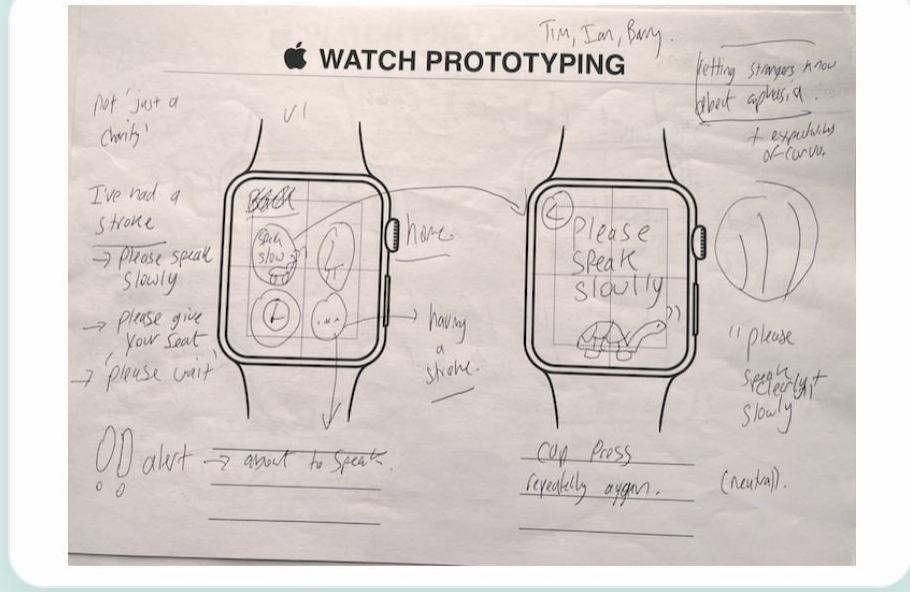
AC, Alternative and Augmentative Communication, Discreet and Wearable Devices

Format:

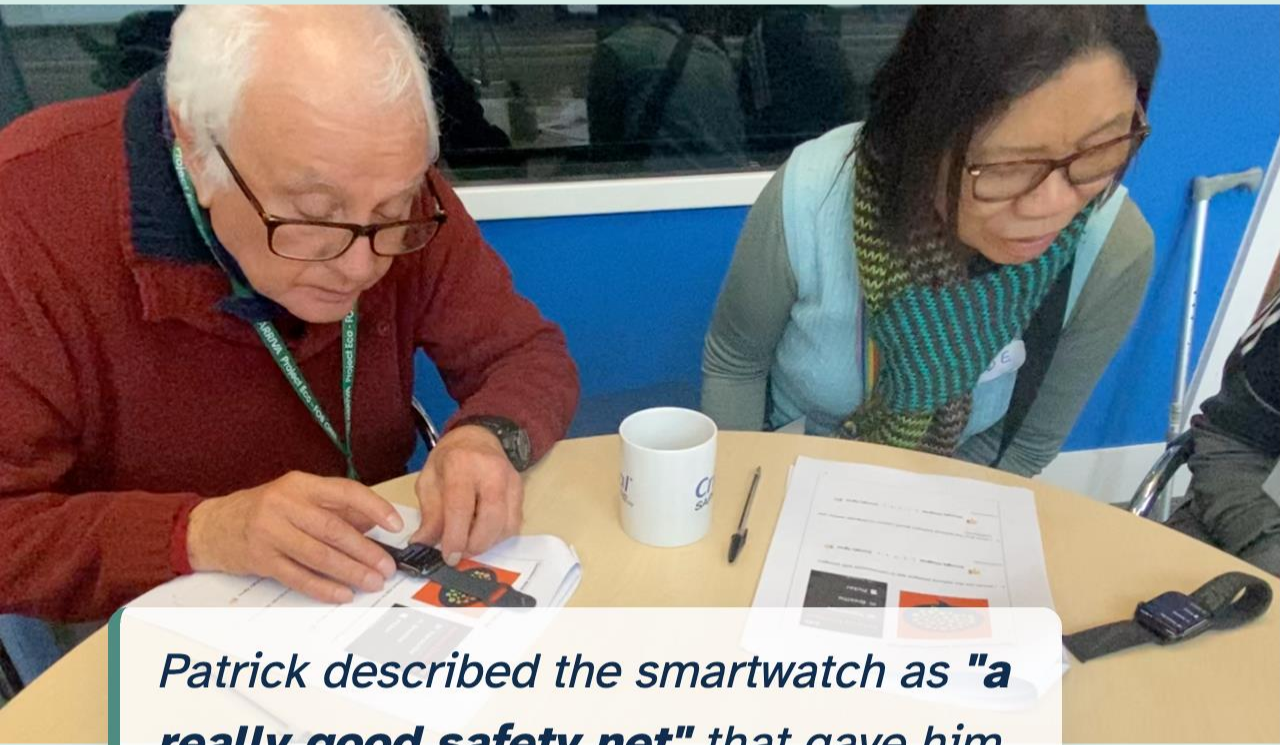
Humphrey Curtis and Timothy Neate. 2023. Watch Your Language: Using Smartwatches to Support Communication. In *The 25th International ACM Conference on Computers and Accessibility (ASSETS '23)*, October 22-25, 2023, New York, NY, USA. ACM, New York, NY, USA, 21 pages. <https://doi.org/10.1145/3597638.3608379>

Augmentative and alternative communication (AAC) devices offer a diverse range of tools, strategies and techniques to support people living with diverse communication needs (CCNs) in social contexts [56]. Yet, adoption of AAC remains low and abanquished [57, 91, 93, 97]. Recent research has highlighted that smartwatch devices detract socially and have the potential to obstruct communication breakdowns [8, 35, 62]. Key AAC design considerations include that they are not intuitive to use¹, too large and not prominent² [73]. Instead, AAC device design has shifted to focus on accurately outputting verbal dialogues and unambiguous communication exchanges³ [9, 35, 36]. We argue that there is undeniably more nuance and ambiguity in strictly *accurate* speech when communicating in social contexts. Most AAC devices fail to support non-verbal communication [33–35, 75], which make up a vital part of communication. Consequently, our work considers the importance of *communication*, which people with CCNs already leverage to communicate⁴ [75]. This expansionist framing of communication is rarely considered in the design of AAC and perhaps exacerbated by the proportionally smaller number of AAC devices available to communities living with CCNs [17, 18].

Against this context, over the last two decades smartwatches have become *much* more socially prominent. Estimates suggest that Apple has sold 100 million smartwatches alone since 2015, the growing functionality of smartwatches means they are almost as feature-rich as their counterpart smartphones. However, smartwatches serve – at least in part – an aesthetic purpose – acting as artefacts⁵ [64, 69]. Additionally, they are also generally designed to be *readable* at a glance and therefore have the potential to serve as a just-in-time support tool for people with CCNs [17]. We design a quick-access trigger for existing AAC applications. Proloquo2Go now supports a watch companion app that allows users to quickly access functionalities of their tablet. In spite of these technologies, previous work has not considered smartwatch apps *directly* with communities with







Patrick described the smartwatch as **"a really good safety net"** that gave him **"confidence to fall back onto it"** if his fluency dropped.



(a)
Patrick: Hello!
[waves hand]
Actor: Hi!



(b)
Patrick: Err... [Hits buzzer on display to draw attention]



(c)
Patrick: [Shows Actor] Could you please let me have your seat? expression]
Actor: Okay!



(d)
Patrick: Thank you [with a thumbs up gesture]



(e)
Patrick: Thank you! [Repeating]
Actor: Thanks!

Breaking Badge

Augmenting Communication with Wearable AAC Smartbadges and Displays

In Proceedings of the CHI Conference on Human Factors in Computing Systems (CHI '24), May 11-16, 2024, Honolulu, HI, USA. ACM, New York, NY, USA, 25 pages.

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Breaking Badge: Augmenting Communication with Wearable AAC Smartbadges and Displays

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1 INTRODUCTION

With complex communication needs employ multi-modal communication including: limited speech, paraverbal communication and leveraging low-tech devices, most augmentative and alternative communication interventions undermine end-users' agency by obstructing intuitive communication pathways. In this paper, we address contextual communication challenges, before prototyping and wireframing wearable AAC displays. We culminated in two low-input wearable AAC prototypes, scaffold users' pre-existing communication and the *InkTalker* is a low-power and affordable eInk device designed to discreetly reveal invisible disabilities communication prop. Secondly, *WalkieTalkie* is a prototype that converts smartphones into a feature-rich wearable via multimodal input/outputs. We offer communication interactions with both devices, discuss user responses. Participants used both AAC devices to socially socialise with others and augment pre-existing abilities.

EPTS

Extended computing → Accessibility technologies.

S

Speech and Augmentative Communication, Accessibility, Wearable Devices, Smart badges

Format:

Ying Hei Lau, and Timothy Neate. 2024. Breaking Badge: Augmenting Communication with Wearable AAC Smartbadges and Displays. In *Proceedings of the CHI Conference on Human Factors in Computing*

People with complex communication needs (CCN) require augmentative and alternative communication (AAC) systems to support their evolving communication abilities [3]. The demand for AAC will likely increase as people living with communication disabilities become more common due to increased incidence of disability [1]. The global population increasing likelihood of stroke [2] and other conditions commonly, AAC device input includes mechanical buttons, touch (i.e., capacitive touchscreen), eye-gaze and brain-computer interfaces (BCIs), for audio output with the device generated speech aloud using a synthetic voice [17, 26, 89]. Although AAC is used by non-verbal people living with CCN, the interaction with AAC stream AAC technology often fails to embrace and support naturally verbal users' pre-existing communication skills.

Specifically, AAC devices typically detract from users' agency and faster multimodal communication pathways. The design of: natural voice (i.e., paralinguistics) [65], access to communication through natural speech building blocks [90], multimodal communication (i.e., gestures, facial expression, eye-gaze, appearance) [41] and total communication¹ [78]. *many* pre-existing AAC technologies face low rates of adoption across many communities [65, 98] and high user abandonment [6, 59]. Other identified problems with AAC adoption includes: slow communication rates [31, 65], limited facial expression [98, 99], high learning demands [39], limited facial difficulties [41, 42], limited agency [50, 54, 94] and limited input from prominent form-factors [18].

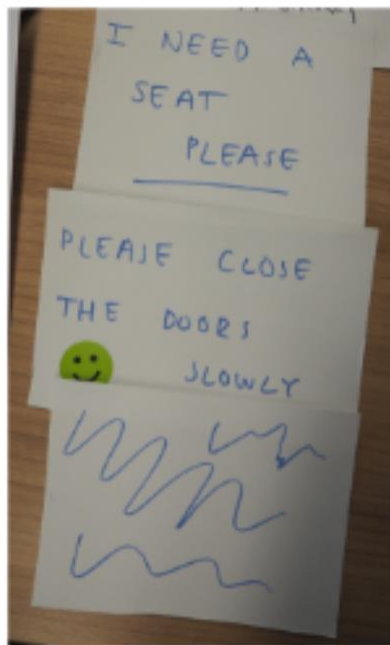
In light of this, Bircanin et al. [6], has advocated for multi-tech AAC interventions and Pullin [76] has called for interdisciplinary AAC research to improve AAC extension and interaction possibilities. Therefore, in this paper, we make a contribution to explore badge form-factors to support communication. Specifically, we co-design directly with communities living with CCN. The design of two wearable AAC prototypes take a



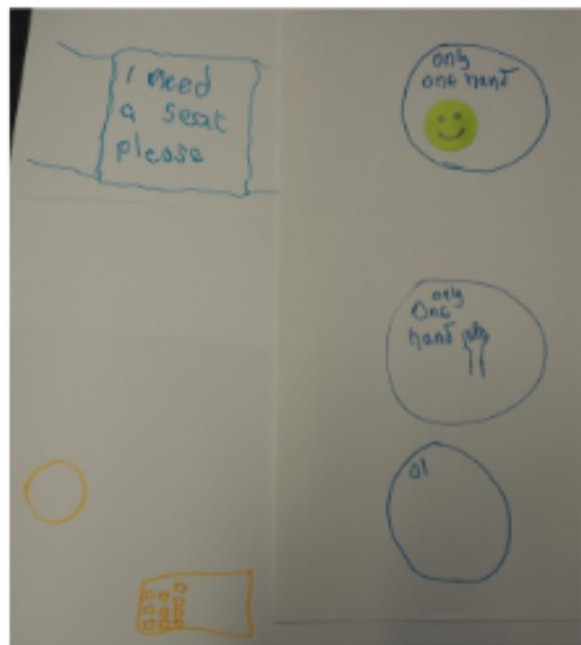
AAC jumper



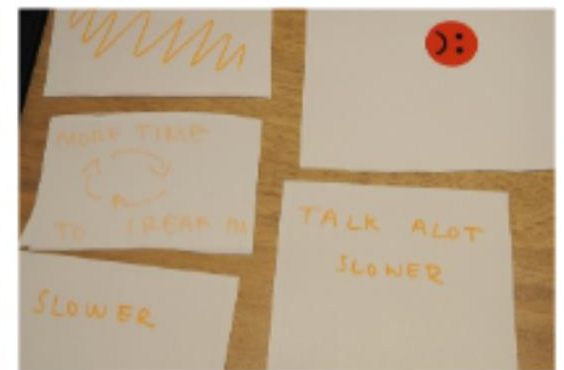
Shh! Smartbadge



Cross-device smartbadge



Attachable smartbadge AAC



Speed-aware AAC



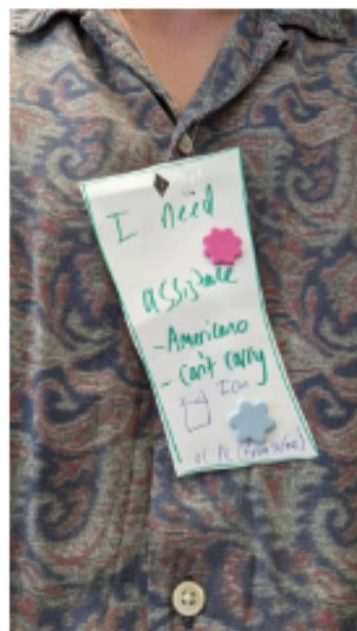
AAC bell



AAC smart ring



Image-based AAC



AAC lanyard display



Interdependent AAC



Smartwatch AAC



AAC smartbadge displays for ordering coffee



Text to speech functionality



*The long battery life was popular, and the e-ink display felt **"nostalgic"**, reminding Immanuel of **"his old Nokia."***

Hana also liked being able to clip it onto her lightweight cross-body bag, which worked well alongside her hemiplegia.

Looking Past Screens

Exploring Mixed Reality and Discreet AAC

In Proceedings of the 26th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '24), October 22-25, 2024, St John's, Newfoundland, Canada. ACM, New York, NY, USA, 22 pages.

<https://doi.org/10.1145/3663548.3675655>



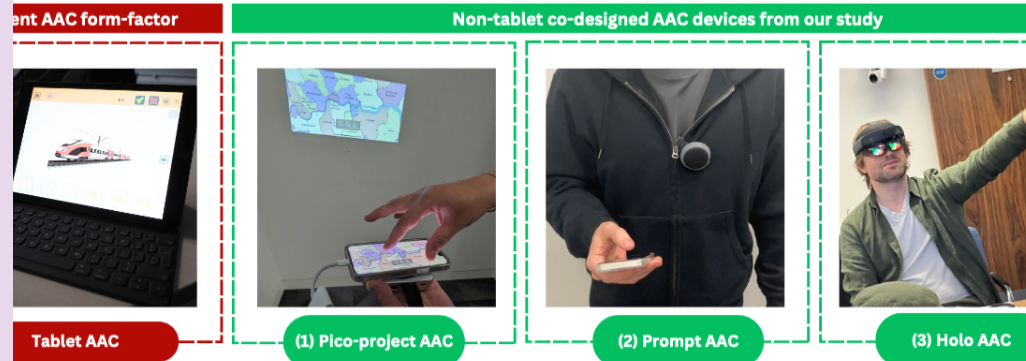
Looking Past Screens: Exploring Mixed Reality and Discreet AAC Devices

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On the left, mainstream tablet-based AAC device photographed at the clinic on iPad versus AAC device from our study: (1) Pico-project AAC, (2) Prompt AAC and (3) Holo AAC.

and alternative communication (AAC) technologies in mainstream mixed-reality mobile devices, which can be physically and visually identifiable – perpetuating public stigmatization of non-verbal communication. These qualities are shared by many AAC-using communities including stroke survivors who can have complex communication needs onset by conditions such as epilepsy or body paralysis. Furthermore, underrepresented communities such as people with aphasia are often underrepresented in the design of emerging technologies. We contest these assumptions and explore what these emerging and future technologies can offer for communication support. To do this, we envision a future of mixed reality and discreet assistive technologies that can support communication with people living with aphasia. We report

results from the co-design process, including participatory design activities on nascent mixed reality, diegetic technologies, and user feedback from low-fidelity AAC prototyping. These activities informed the design of three high-fidelity prototypes with different characteristics and form-factors: *Pico-project AAC*, *Prompt AAC* and *Holo AAC*. These prototypes embody projection, worn audio devices, and headset-based mixed reality. From subsequent focus groups, we present findings from the evaluation of all prototypes, reflecting on the possibilities and challenges of future mixed-reality technologies to augment communication.

CCS Concepts

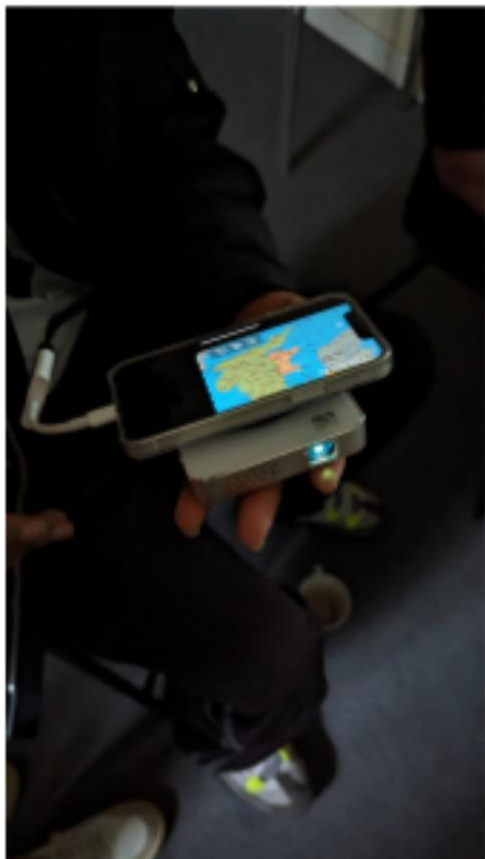
• **Human-centered computing** → **Accessibility technologies**

Keywords

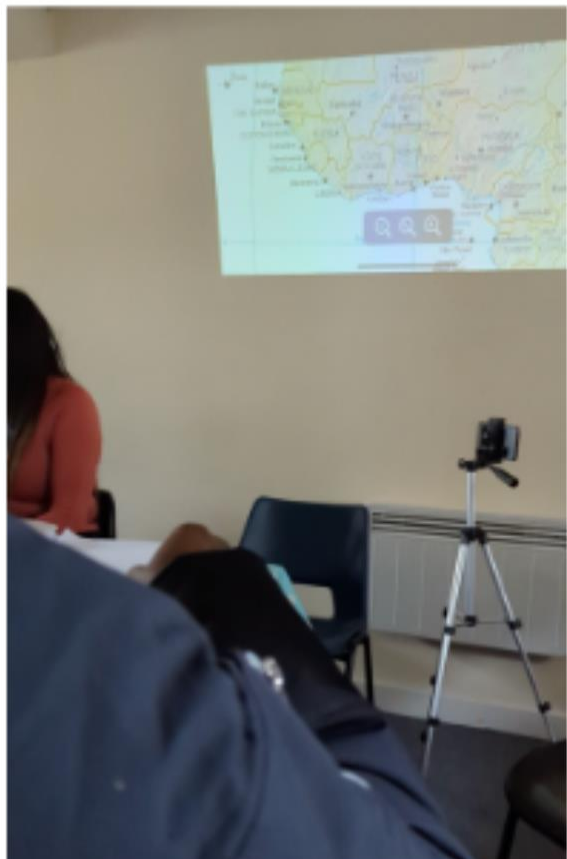
Mixed Reality, Pico Projection, AAC, Alternative and Augmentative Communication



Pico-project AAC in-use



Chat about holiday in Accra



Tube commute discussion



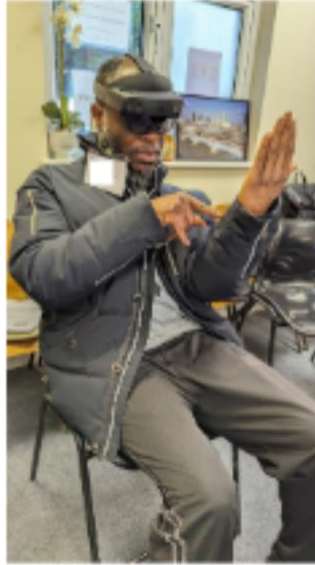
Projected chair request



Participants with hemiplegia test Holo AAC Near Menu



Testing Hand Menu



Holo AAC beverage symbols, Hand Menu, Tube Map, London Map and Near Menu deployed



Participant with hemiplegia tests scalable London Map



Testing map based interaction



Holo AAC Hand Menu, London Map, Tube Map, Near Menu and cat deployed

Rowland felt the headset was "too overwhelming" and said it would be "hard to control" for a person who had a stroke.

An Old Bastard in Bright Orange Satin

Zuzenna's Aphasia Diary

In Proceedings of the 27th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '25), October 26-29, 2025, Denver, CO, USA. ACM, New York, NY, USA, 20 pages.

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'Id Bastard in Bright Orange Satin!': Zuzenna's Aphasia

And Lessons Learned from DIY Augmentative and Alternative Communication

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From left: Zuzenna's light-blue diary cover inscribed, 'Time to fill this book with plans and dreams. Or do something else.'; Zuzenna's colorful tissue-paper artwork – a colorful tissue-paper piece embodying her stroke experience. Finally, a still from Part 3's video showing Zuzenna expressing herself while pointing to her diary pages.

Keywords

Assistive Technology, Accessibility, Aphasia, AAC, Augmentative Communication, DIY, Single-Subject, E

ACM Reference Format:

Humphrey Curtis, Filip Bircanin, and Timothy Neate. 2025. 'Id Bastard in Bright Orange Satin!': Zuzenna's Aphasia Diary : And Lessons Learned from DIY Augmentative and Alternative Communication. In Proceedings of the 27th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '25), October 26–29, 2025, Denver, CO, USA. ACM, New York, NY, USA, 20 pages. <https://doi.org/10.1145/3663547.3746369>

1 Introduction

Aphasia is an acquired language impairment and disability commonly caused by a stroke later in life [7]. Aphasia presents profound social and psychological challenges; as stroke researcher Debra Meyerson writes, "since so much of our identity is tied up in language, aphasia can obliterate that feeling of belonging" [50, 60]. Augmentative and alternative communication (AAC) technologies prescribed as scalable interventions, which can enhance communication abilities and quality of life of people living with aphasia [51]. AAC encompasses a spectrum of tools and technologies that supplement or replace the language of people living

with aphasia. The long-term abandonment continues to hinder the long-term adoption of augmentative and alternative communication (AAC) devices among communities living with aphasia. Challenges with AAC are ranging from poor personalization and stigma to prohibitive costs. Critics argue that many AAC tools reflect top-down, one-size-fits-all models shaped by ableist assumptions and commercial imperatives. In response, this paper presents bottom-up perspectives from a 12-month qualitative study of Zuzenna's DIY AAC: a self-developed communication diary. Far from a prescribed device, her diary is an organically evolving tool that empowers her daily life after stroke. We offer a re-imagining of AAC design informed by lived experience, highlighting how future tools might be designed to support genuine communion through share-ability, (b) uphold and empower self-expression, (c) value personal labour and growth. Zuzenna's diary reveals that AAC does not need to be techno-centric or expensive to be powerful – it just needs to be personal.

Concepts

Personalized, user-centered computing → Accessibility technologies.

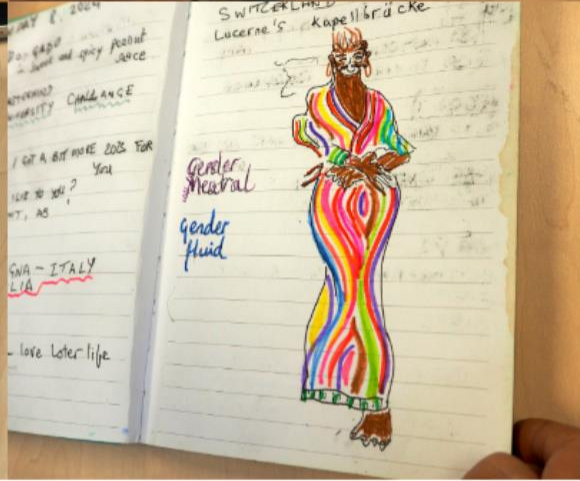
Doodles



India travel sketches



Jackson Pollock themed



Discussion & contributions

- We re-frame AAC as **embodied, multimodal and co-constructed**
- Expand the design space through **wearable and discreet AAC**
- Show that **confidence, discretion, non-verbal communication and partner-awareness** matter in everyday use
- Demonstrate that people with aphasia can shape technology through **accessible co-design**

Gareth Jones, 1959-2026

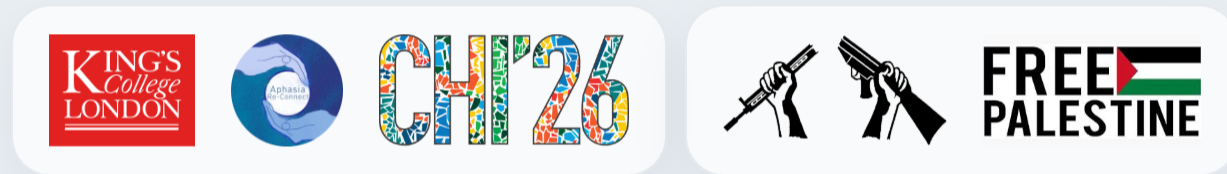


Thank you

Questions?

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Link to full thesis