HaptiShare: Exploring Shared Co-Located Haptic Experiences with a Mobile Multi-Party Haptic Communication Device

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Abstract

Social Haptic Communication (SHC) is a tactile communication method enabling the transmission of messages through touch, commonly used by interpreters to communicate environmental and social information to Deafblind individuals. While prior work has explored the use of vibrotactile patterns to replicate SHC at a distance, current technologies only allow one-to-one interactions, limiting their use in group settings or one-to-many communication. In this paper, we introduce HaptiShare, a novel assistive communication device that facilitates one-to-many social haptic communication. HaptiShare uses a mobile interface connected to multiple wearable haptic vests, leveraging a tactile interpolation technique to generate smooth, two-dimensional vibrotactile signals with variable speed, intensity, and direction that resemble natural touch movements. Preliminary user testing highlights its potential in supporting interpreters working with a group of Deafblind people, enhancing educational inclusivity, and improving group communication in social and professional contexts. HaptiShare contributes to a growing body of haptic communication devices for accessibility, enabling simultaneous communication with multiple recipients and enhancing accessibility for Deafblind individuals in shared environments.

CCS Concepts

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

Keywords

Haptic Communication, Haptic Wearables, Deafblind, AAC, Vibrotactile interfaces, Tactile Sign Language, Accessibility, Social Interaction, Assistive Technology, Tactile Fingerspelling

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1 Introduction

Social Haptic Communication (SHC) is a tactile communication method involving the transmission of messages, known as haptices, through touch [15]. SHC messages can convey a wide range of information, including emotional states, facial expressions, environmental layouts, and even auditory or visual elements, such as music or art [16]. SHC represents an essential way for supporting social interactions, particularly for Deafblind individuals living with the combination of sight and hearing impairment, where traditional auditory or visual cues are inaccessible [2, 8, 11, 15, 16]. Initially conceptualized by [15] in Finland, SHC has since gained recognition and application in other Nordic countries and beyond, where deafblindness has been acknowledged as a distinct disability [8, 13, 15]. Unlike conventional spoken or signed languages, SHC is not a language system in itself but serves as a complementary approach [6, 14]. It functions alongside other modes of communication, such as spoken, written, or signed languages, enhancing the richness and accessibility of social interactions [2, 15]. The application of SHC involves performing specific tactile signals executed on neutral zones of the body, such as the back, arm, wrist, outer or inner palm, and upper knee (Figure 1). These areas are chosen to respect the comfort and autonomy of the recipient. The selection and agreement upon these zones are crucial for ensuring effective and respectful communication. Signals must be intentional and tailored, fostering clarity and efficiency while accommodating the recipient's preferences [13, 16].

SHC is distinctively versatile, allowing for the discrete transfer of information in real-time and across various contexts. For instance, it enables a Deafblind individual to receive descriptions of unfamiliar environments, interpret emotional feedback, or engage in social interactions while maintaining physical rest. Importantly, these tactile cues can be conveyed both passively and actively, and they

Figure 1: Interpreter performing the SHC signal for "Danger" (left) and "Smile" (right) on a Deafblind person's upper back [13].

are adaptable to settings where the person is sitting or standing. SHC signals can also convey subtle non-verbal cues, enabling the recipient to understand the emotional dynamics of a situation and respond on more equal terms [13, 15, 16].

SHC can significantly enhance the quality of social interactions of Deafblind individuals by improving their access to real-time, spontaneous information about their surroundings [6, 13]. This approach facilitates interaction among Deafblind individuals, interpreters, and other people, reducing social isolation [2]. In recent years, a growing body of accessibility research has explored the use of wearable vibrotactile interfaces for replicating haptic communication, in particular SHC [2, 3, 7, 10–12]. Prior work and early approaches have mainly explored the design [3, 12], evaluation [10, 11], learnability [7], and use of wearable vibrotactile arrays to replicate SHC signals displayed onto the upper back of an individual [2]. While prior work has contributed to the advancement of this field of research at the intersection of haptics research and accessibility, current methods are limited to displaying SHC signals to a single user at a time, with limited applicability in group interactions. In this work, we present HaptiShare, a novel approach that allows one-to-many transmission of natural, free-form SHC signals to multiple individuals simultaneously with the use of a mobile interface connected to multiple co-located wearable haptic vests. HaptiShare allows one SHC interpreter to communicate with multiple Deafblind individuals at the same time, promoting a more effective and natural shared social experience in environments and contexts of use where a group of Deafblind individuals are together.

In this work, we contribute with HaptiShare by building on early work exploring the use of vibrotactile displays to replicate social haptic communication signals [2, 3, 7, 10–12]. We extend current approaches that use grid-based haptic signals [2, 9, 12] by developing a novel interaction technique that allows free-form gestural input of haptic signals that produces smooth, two-dimensional tactile moving strokes with varying speed, intensity, and direction using the tactile brush algorithm [1]. We also significantly extend the current literature by implementing a system that allows one-to-many haptic communication for shared multi-party social interactions.

2 RELATED WORK

There has been a growing body of literature exploring technology-mediated social touch and haptic communication at a distance [3, 5, 6, 9, 14, 17]. The importance of further work exploring haptic stimulus qualities, multimodal cues, and contextual factors in technology mediated social touch is highlighted in [4]. In the context of assistive technologies, Theil et al [2] proposed the tactile board, a mobile augmentative and alternative communication (AAC) device for Deafblind people that allows text and speech to be translated into vibrotactile signals displayed to a user wearing a haptic vest. Similarly, Plaisier and Kappers [10, 11] evaluated the use of an array of vibrotactile actuators to emulate social haptic communication signals, while Olson and Jarvoll [12] proposed HapiDesigner, a platform for creating grid-based haptic patterns that can support social haptic communication at a distance. The learnability of vibrotactile patterns for replicating social haptic communication signals has also been briefly studied in [7]. While prior work has advanced the use of vibrotactile patterns to communicate SHC signals at a distance, all described methods included an oversimplification of touch signals translated into a limited grid of sequential vibrotactile patterns that do not sufficiently replicate the expressivity and nuances of real touch. Furthermore, haptic communication devices have been explored mainly in the context of one-to-one interactions with haptic messages being sent to a single user at a time, which limits the use of such devices in a social group setting where multiple Deafblind people are co-located. Figure 2 illustrates current approaches in SHC technology:

3 HAPTISHARE'S DESIGN AND IMPLEMENTATION

Our novel approach, HaptiShare, is developed using Java and uses a mobile interface (e.g. mobile phone, tablet) connected via bluetooth technology to multiple haptic wearable devices allowing simultaneous high-density two-dimensional tactile communication using sparse vibrotactile arrays in a co-located social environment. Our proof-of-concept uses bHaptics Tactsuit x40 vests with a 4x5 array of ERM vibration motors on the back, allowing multiple individuals, including Deafblind people, to experience the haptic sensations together. As part of the novel approach for transmitting social

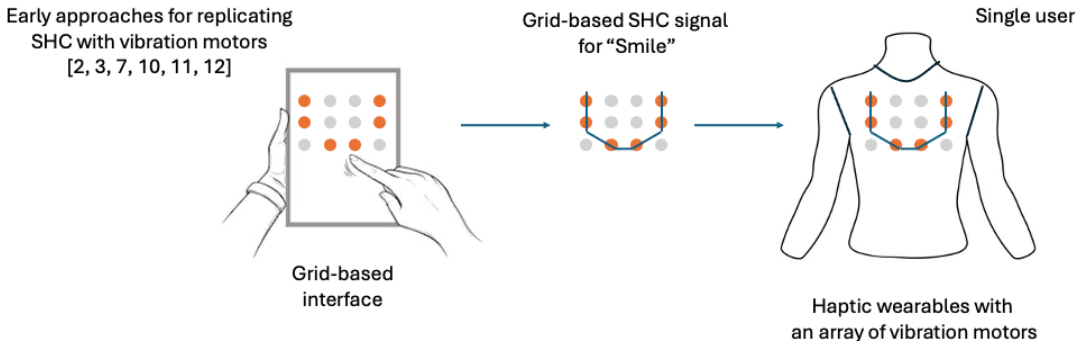

Figure 2: Early approaches for replicating SHC using a grid-based interface of vibration motors displayed to a single user at a time [2, 3, 7, 10, 11, 12].

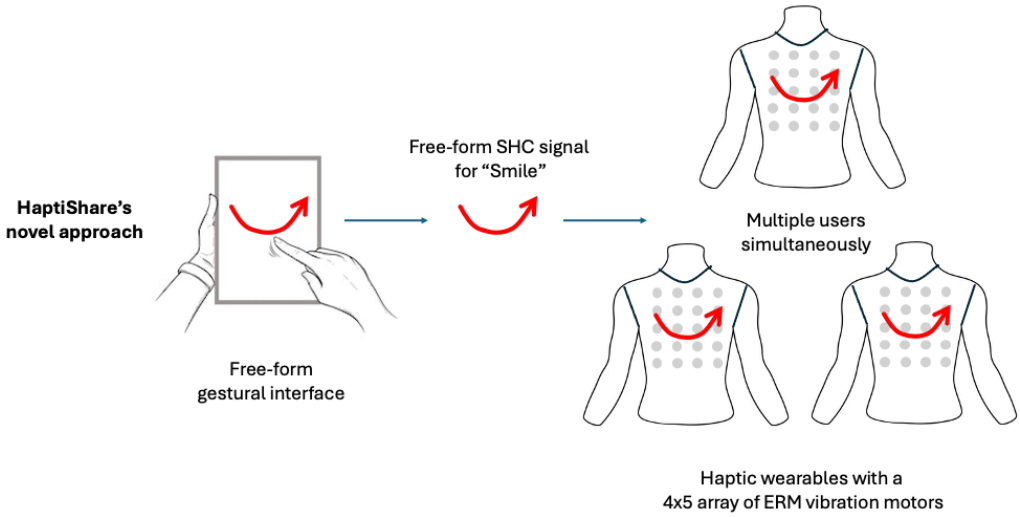

Figure 3: SHC signal for "Danger" (left) and "Smile" (right)

haptic communication signals in a more natural way, we implemented the tactile brush interpolation algorithm to produce smooth, two-dimensional tactile moving strokes with varying frequency, intensity, velocity and direction of motion [1]. Figure 3 illustrates how HapticShare works:

To create smooth haptic sensations that resemble natural SHC signals using the finger, we build on our early work in vibrotactile interpolation [2] and use apparent tactile motion illusions to produce continuous 2-dimensional tactile motion between any two locations on a sparse vibrotactile array of actuators (Figure 3). This novel implementation allows the communication of subtle changes in speed, intensity, and tactile direction to users, enhancing the expressivity of environmental and social haptic information that can be transmitted through touch.

4 USER TESTING

To evaluate the feasibility and usefulness of HaptiShare, we conducted a preliminary qualitative testing of our prototype with five Deafblind individuals and five professionals working in Deafblind support roles, including two social workers, two interpreter-guides, and one teacher of social haptic communication. The in-person co-located testing session involved all Deafblind participants wearing bHaptics vests and exploring the HaptiShare system in a shared space at Birmingham City University. The mobile application was then shared with the professionals for sending haptic messages to the group in real time (Figure 4).

4.1 Preliminary evaluation

All participants responded positively to the concept and implementation of our system, emphasizing the potential impact of HaptiShare in situations where one-to-many communication is essential. In terms of positive aspects of HaptiShare, one Deafblind participant shared: *"It felt like someone was really drawing on my back, not just vibrating. I could understand the motion, it felt alive."* (P1).

A professional interpreter-guide highlighted the potential to address the shortage of trained SHC interpreters: "*In situations where I'm the only interpreter for a group, this technology could be*

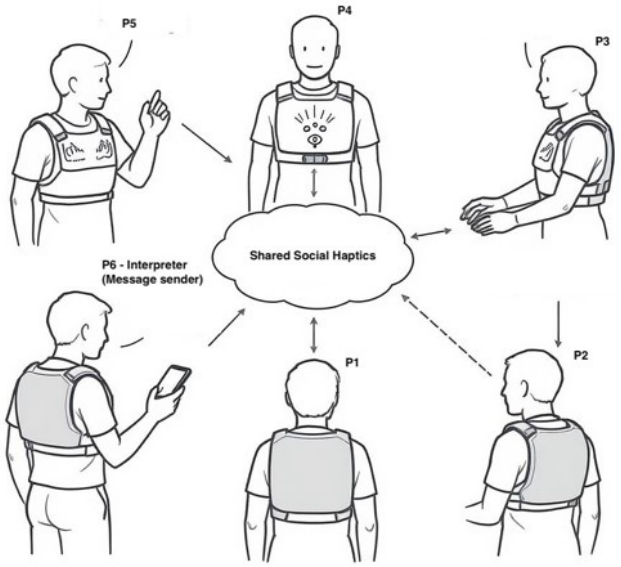

Figure 4: Co-located testing space with 5 Deafblind users wearing haptic vests and one messenger using the HaptiShare mobile app.

a game-changer. I can send the same message to everyone at once, without touching each person individually." (P6).

While most participants praised the smooth tactile rendering and group communication potential, they also identified areas for refinement: *"It was clear at first, but when messages came quickly, I couldn't tell if it was one long signal or two short ones."* (P2). Similarly, the ability to adjust and personalize the intensity of vibrations was mentioned by P3 and P5: *"Sometimes the vibrations were too soft for me to feel properly. I'd like to tune the strength myself."* (P3).

4.2 Potential Use Cases

Three prominent use cases emerged from participant feedback. Professionals noted that HaptiShare could help mitigate the persistent shortage of qualified SHC interpreters by enabling one-to-many communication, supporting the work of current interpreters. A teacher of SHC explained: *"It's rare to have one interpreter per person. Often it's one interpreter per group. This technology could lead to more equitable access during shared activities."* (P10).

Similarly, several participants saw opportunities in inclusive classroom and educational settings, where Deafblind students could benefit from being included in simultaneous haptic communication. One social worker observed: *"In a mixed-ability classroom, it's hard to support everyone equally. Such wearable devices could help Deafblind children stay informed about what's happening without constant physical redirection."* (P7).

Participants also envisioned using HaptiShare in large gatherings, such as conferences or social events. As one Deafblind participant shaerd: *"Sometimes I feel isolated in a group, not knowing what's going on around me. If I could get updates, like someone laughing or something urgent, without interrupting the event, that would help me feel included."* (P4).

5 CONCLUSION AND FUTURE WORK

We present HaptiShare, a novel assistive communication device that allows social haptic communication signals to be sent to multiple users simultaneously. With HaptiShare, an interpreter can draw a haptic signal on a touchscreen and transmit it simultaneously to multiple users wearing haptic vests with an array of vibration actuators that use an interpolation technique to produce smooth, two-dimensional tactile moving strokes with varying frequency, intensity, velocity and direction of motion. These vibrotactile tactile signals replicate traditional social haptic communication signals Deafblind people use to receive environmental and social information through touch. Future work should explore the effectiveness of HaptiShare in specific use cases such as in education or social events, and evaluate the impact of shared haptic experiences in enhancing access and participation for people living with multisensory disabilities.

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References

[1] Ali Israr and Ivan Poupyrev. 2011. Tactile brush: drawing on skin with a tactile grid display. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11). Association for Computing Machinery, New York, NY, USA, 2019–2028. https://doi.org/10.1145/1978942.1979235

[2] Arthur Theil, Lea Buchweitz, James Gay, Eva Lindell, Li Guo, Nils-Krister Persson, and Oliver Korn. 2020. Tactile Board: A Multimodal Augmentative and Alternative Communication Device for Individuals with Deafblindness. In Proceedings of the 19th International Conference on Mobile and Ubiquitous Multimedia (MUM '20). Association for Computing Machinery, New York, NY, USA, 223–228. https://doi.org/10.1145/3428361.3428465

[3] Eva Lindell *et al.* 2021. Physical Add-Ons for Haptic Human-Surrounding Interaction and Sensorial Augmentation. In Human Interaction, Emerging Technologies and Future Applications III: Proceedings of the 3rd International Conference on Human Interaction and Emerging Technologies: Future Applications (IHIET 2020), August 27-29, 2020, Paris, France (pp. 183-188). Springer International Publishing

[4] Gijs Huisman. 2017. Social touch technology: A survey of haptic technology for social touch. IEEE transactions on haptics 10.3 (2017): 391-408

[5] Haerim Kim, Minho Chung, Eunchae Kim, and Yongjae Yoo. 2024. Automatic Video-to-Audiotactile Conversion of Golf Broadcasting on A Refreshable Pin Array. In Proceedings of the 2024 ACM Symposium on Spatial User Interaction (SUI '24). Association for Computing Machinery, New York, NY, USA, Article 15, 1–8. https://doi.org/10.1145/3677386.3682092

[6] James Gay, Moritz Umfahrer, Arthur Theil, Lea Buchweitz, Eva Lindell, Li Guo, Nils-Krister Persson, and Oliver Korn. 2020. Keep Your Distance: A Playful Haptic Navigation Wearable for Individuals with Deafblindness. In Proceedings of the 22nd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '20). Association for Computing Machinery, New York, NY, USA, Article 93, 1–4. https://doi.org/10.1145/3373625.3418048

[7] Jessica G. J. Vuijk, James Gay, Myrthe A. Plaisier, Astrid M. L. Kappers, and Arthur Theil. 2021. PatRec: A Mobile Game for Learning Social Haptic Communication. In Proceedings of the 23rd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '21). Association for Computing Machinery, New York, NY, USA, Article 81, 1–4. https://doi.org/10.1145/3441852.3476563

[8] Laura Volpato. 2023. The development of a social-haptic communication dictionary, a new communication resource for the deafblind in Italy. *INTED2023 Proceedings*. IATED

[9] Mingzhe Li, Mingming Fan, and Khai N. Truong. 2017. BrailleSketch: A Gesture-based Text Input Method for People with Visual Impairments. In Proceedings of the 19th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '17). Association for Computing Machinery, New York, NY, USA, 12–21. https://doi.org/10.1145/3132525.3132528

[10] Myrthe A Plaisier and Astrid ML Kappers. 2021. Emulating social haptic communication with vibration patterns. 2021 IEEE World Haptics Conference (WHC). IEEE, 2021

[11] Myrthe Plaisier and Astrid Kappers. 2021. Social Haptic Communication mimicked with vibrotactile patterns - an evaluation by users with deafblindness. In Proceedings of the 23rd International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '21). Association for Computing Machinery, New York, NY, USA, Article 88, 1–3. https://doi.org/10.1145/3441852.3476528

[12] Nasrine Olson and Jonas Jarvoll. 2022. Haptic Pattern Designer Toolkit–HaptiDesigner: Software and Hardware for Creation of Actuation Patterns. In International Conference on Human-Computer Interaction. Cham: Springer International Publishing, p. 489-509

[13] Pia Hesse and Gerd Nielsen. 2018. Haptic Signals – 139 new and known signals. The Danish DeafBlind Association

[14] Raj Gangakhedkar and Arthur Theil. 2024. FingARspell: A Mobile AR Tool for Learning the Deafblind Manual Alphabet. In Proceedings of the International Conference on Mobile and Ubiquitous Multimedia (MUM '24). Association for Computing Machinery, New York, NY, USA, 478–480. https://doi.org/10.1145/3701571.3703390

[15] Riitta Lahtinen and Russ Palmer. 2008. Haptices and haptemes–environmental information through touch. In *3rd International Haptic and Auditory Interaction Design Workshop*

[16] Russ Palmer and Riitta Lahtinen. 2023. History of social-haptic communication. DbI Review 50 (2013): 68-70

[17] Taciana Ramos Luz *et al.* 2024. Caeski: an assistive technology for the communication of persons with deafblindness. *Disability and Rehabilitation: Assistive Technology* 19.2 (2024): 281-291