Sign Language Interfaces: Discussing the Field's Biggest Challenges

Danielle Bragg
Meredith Ringel Morris
Microsoft Research
Cambridge, MA, USA &
Redmond, WA, USA
{danielle.bragg,merrie}
@microsoft.com

Christian Vogler
Raja Kushalnagar
Gallaudet University
Washington, DC, USA
{christian.vogler,raja.kushalnagar}
@gallaudet.edu

Matt Huenerfauth
Rochester Institute of Technology
Rochester, NY, USA
matt.huenerfauth@rit.edu

Hernisa Kacorri
University of Maryland
College Park, MD, USA
hernisa@umd.edu

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Abstract
Sign language interfaces offer rich, timely research problems. Recent advances in computational methods have made a wider range of sign language interfaces possible. At the same time, a recent interdisciplinary review and call-to-action outlines the most pressing challenges for the field, given these recent advances. This special interest group (SIG) will meet to discuss and make progress along these challenges, providing continuity for researchers working in this space, while exchanging ideas with the broader HCI research community.

Author Keywords
sign language; interface; interdisciplinary; design; metrics;

CCS Concepts
•Human-centered computing → Accessibility; Natural language interfaces; •Information systems → Multimedia information systems;

Introduction
Designing, building, and evaluating sign language interfaces present compelling and timely research challenges, and require collaborative efforts to address. Worldwide, about 17.5 million deaf people use a sign language as their primary language. Sign languages are visual languages, and do not have a standard written form. Most interfaces

are geared towards spoken language users, not sign language users. As a result, spoken or written language is typically a fundamental component of existing interfaces. Because sign languages are not spoken, and are not typically written, these interfaces do not serve signers well. To meet these users' needs, it is essential to research and develop interfaces that incorporate sign language.

The need for sign language interfaces impacts many deaf and hearing people worldwide. The only known national survey that counted U.S. deaf signers found about 500,000 deaf people using American Sign Language (ASL) at home [8], which is around .25% of the population. Extrapolating to a total global population of 7 billion yields around 17.5 million deaf signers worldwide. Furthermore, there are around twice as many non-deaf signers as deaf signers – children, spouses and friends, and many more non-deaf people who have taken a sign language as a second language in high school or college. Combined, there may be around 100 million people with significant exposure to sign language.

The lack of a standard digitized representation of sign language impacts access, including educational and governmental recognition and support. For example, the U.S. Census Bureau does not count ASL as a non-English language, even though ASL is a separate language. ASL is counted as English, on the grounds that sign languages are not written, and therefore cannot be included in survey/ballot materials. Therefore data on reported ASL use are never encoded and do not appear in U.S. Census reports [9].

Sign language interfaces introduce a wide array of research problems. For example, building search interfaces that support sign language is difficult; such interfaces require a sign language query input method and a way to index content to enable efficient matching. Traditional search engines use text for query formulation and indexing, which does not apply well to unwritten sign languages. Poor search support hinders information access, as increased search effort more likely leads to failed searches [12]. Similarly, websites are typically text-based, and digital personal assistants respond to and generate spoken language. Developing sign language interfaces to parallel such existing written/spoken language technologies remain open problems.

Conditions are ripe for sign language interface research and discussion. Recent advances in machine learning, and in particular deep learning, have increased what is technically possible for sign language processing. These advancements relax the technical constraints within which sign language interfaces have previously had to be designed, e.g. as discussed in this 2009 survey of sign-language interface research [7]. These advances open new possibilities for interface research. Furthermore, the first interdisciplinary review and call to action for the field was recently published [4], outlining the most pressing avenues of research given the current technical landscape. This SIG will discuss those challenges facing the field, providing continuity for stakeholders and researchers already working in this space, and the opportunity for the broader HCI community to learn about and contribute to this burgeoning field.

Vested Communities

The Deaf community has a particularly vested interest in sign language interfaces. Sign languages are the primary languages of many members of the Deaf community, and interfaces must support these users in order to provide equitable access, supported by legal initiatives such as the Convention on the Rights of Persons with Disabilities [2], Section 508 [1], and the European Accessibility Act [3]. It is important to keep in mind that even the written form of spoken languages can be inaccessible to many Deaf people. There is great diversity in written language literacy skills

among members of the Deaf community, but standardized testing has revealed lower levels of written literacy among Deaf adults, as compared to their hearing peers [6, 11]. Furthermore, sign languages are an intrinsic part of Deaf culture, considered sacred by some in the community [10].

Sign language interfaces are also of interest to many people who are not Deaf but use sign languages or interact with sign language users. Such sign language users include CODAs (children of Deaf adults), sign language interpreters, and sign language students [5]. Hearing people who do not know a sign language also have a vested interest in these technologies, as they interact with sign language users in daily life. Examples include mixed work environments with both hearing and Deaf peers, and interactions around services (e.g., doctors interacting with patients, salespeople interacting with customers, etc.).

Sign language interfaces are of interest to a wide range of academic disciplines. Involved domains include: human-computer interaction, accessibility, computer vision, computer graphics, machine translation, natural language processing, linguistics, and Deaf studies. These diverse disciplines are necessary to enable sign language input and output, to model and process sign languages appropriately, and generally to develop interfaces that align with users. CHI is an ideal venue for a SIG to convene, as human-computer interaction is the disciplinary glue binding together the relevant disciplines and their technical and social perspectives.

Materials:

Scratch paper, individual laptops for note-taking. Interpreters will be present to facilitate communication.

Schedule:

10 min: Introductions, outlining the discussion points and structure of the SIG.
50 min: Discussion groups centered around the five calls-to-action from [4].
15 min: Wrap-up, exchange contact information, and collect notes.

Topics of Discussion

The SIG will discuss the most pressing challenges facing the field, as outlined in Bragg et al., 2019 [4] (calls to action 1-5). To facilitate discussion, we will break into smaller discussion groups. At the end of the SIG, we will collect notes from each group. Afterwards, we will compile the results, share them with interested attendees, and release them at an appropriate venue depending on the findings' depth (e.g., short paper, whitepaper, or blog post). The main discussion topics are:

Partnering with the Deaf community (Call 1): Involving Deaf team members throughout sign language technology research is essential to respecting the community's ownership over their language, incorporating key insights that the lived Deaf experience can provide, and ensuring that projects align with community wants and needs. We will discuss strategies for facilitating such collaborations.

Real-world applications (Call 2): Focusing on real-world applications is essential to building systems with real-world use and impact. The SIG will discuss and identify specific real-world applications that are currently appropriate to pursue (i.e., are technically feasible, and valuable to the Deaf community).

User Interface guidelines (Call 3): General user interface guidelines for sign language systems would enable researchers and practitioners to efficiently design, build, and evaluate systems, rather than re-discovering patterns independently. We will discuss and attempt to define design guidelines, as well as metrics that can be used to evaluate sign language interfaces in a consistent manner.

Public, representative dataset curation (Call 4): The lack of public, large-scale, representative (i.e. diverse and Deaf-centric) datasets is a current limitation to sign language interface development. We will share information on newly released datasets, and discuss how existing datasets might be merged, as well as data collection mechanisms.

Notation standards and support (Call 5): Standardizing

the sign language notation system would enable more efficient collection, labelling, and merging of sign language datasets, as well as general reading and writing in a sign language. We will discuss existing notation systems, criteria for standardization, and ideas for how to automatically support notation.

Conclusion

Sign language interface research requires input from a variety of stakeholders, including researchers, diverse disciplinary experts, the Deaf community, and hearing peers. The goal of this SIG is to provide a venue for stakeholders to meet and make progress on some of the field's biggest challenges. Going forward, we plan to publish any new results from the SIG meeting, continue organizing meetings and events around this research area, and continue developing equitable interfaces.

We hope that this SIG will be informative and inspiring to the broader HCI community. Video is a primary medium for sign languages, and as we move towards an increasingly multi-modal word (e.g., VR and AR), developing systems that support video-based interactions becomes increasingly relevant to all users. Simultaneously, sign language interface research would benefit from an injection of ideas from HCI researchers in a variety of subdomains, including multimedia search, video-based system design, and ubiquitous computing.

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