

# Re-imagining Deafness as a Resource for Design

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**Abstract:** This contribution sets out the necessity to re-imagine the notion of deafness in order to open up the potentials of this multifaceted cultural and linguistic phenomenon for technology design. The paper challenges common normative assumptions about deafness that are derived from some audiometric hearing “norm” and therefore bound our imagination by drawing attention to inabilities, difficulties and deficiencies. Based on a literature review of cognitive studies and long-term fieldwork, a variety of benefits arising from deafness and use of sign language are discussed. As a result of this discussion I propose considering signing deaf individuals as experts in visual, spatial and embodied matters. I argue, therefore, that this perspective is especially beneficial for designing innovative technologies and thinking out of the box. To exemplify this statement a couple of concepts for inspiration that emerged from five design and development projects are depicted. I call these concepts *inspiration rooms*.

**Keywords:** Deafness, Reconfiguration, Innovation, Design, Co-Design, Inspiration Rooms

## 1 Introduction

It is widely accepted that co-designing with people who are potential users of co-created products not only helps to gain more knowledge about the context of use, but also can foster creative processes and thinking, cf. (Muller 2002). However, what exactly do hearing designers gain when co-designing with signing deaf participants? What kind of “creative gains”<sup>4</sup> may arise from this collaboration? In order to be able to properly answer these questions we firstly need to question the common notion of deafness. This paper aims at shedding light on this matter. It therefore proposes opening up deafness and the day-to-day experience with visual-gestural languages – i.e. sign languages – as a resource for design by considering deaf signers as experts for visual, spatial and embodied matters. Following this reconfiguration of deafness and as a result of five co-design projects the paper exemplarily introduces concepts – called *inspiration rooms* – that are based on the unique linguistic and cultural experience of deaf signers. These *inspiration rooms* are not only serving the argument in this paper, they moreover can be actually employed in design practice to stimulate creative thinking.

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<sup>4</sup> By using this term I refer to the book “Deaf Gain” (Bauman and Murray 2014) where it has already been employed in the context of deaf studies.

## 2 Background

The traditional notion of deafness as a disability to perceive auditory phonetic language, cf. e.g. (Elzouki et al. 2012), shapes a perspective that draws attention to dysfunctions, deficiencies, and difficulties. This perspective and an accompanying set of practices are socially constructed and widely institutionalised. They originate from the “primordial fear of difference” (Fiedler 1996, p. 44), from the deepest anxiety to deviate from an assumed “norm” and to “lack” certain desired abilities, cf. (Rothschild 2006).

As a consequence, the prevailing social attitude generally is to make the apparently uncomfortable otherness disappear. “Using whatever scientific, technological, social, or legal measures available, the aim is to make disability just go away.” (Rothschild 2006, p. 229) One prominent example of this aspiration delivers the “treatment” of deafness by cochlear implants.

In the field of human-computer interactions (HCI), therefore, the majority of approaches and applications that address the needs of signing deaf users are focused on their inability to hear. These applications usually aim to support deaf signers w.r.t. difficulties some of them experience when reading and writing. The reason for such difficulties lies in the fact that scripture is a notation of acoustic features of spoken languages that are not directly accessible to prelingually deaf people, i.e. people who became deaf before acquiring a spoken language. The “natural” form of communication of prelingually deaf people resides instead in the visual-gestural domain, i.e. through a sign language.

It is, therefore, only logical that the majority of the scientific contributions in HCI are concerned with the accessible representation of textual content. Two main lines of research can be identified here. Firstly, there are contributions aimed at questions related to the use of pre-recorded sign language videos (Debevc, Kosec, and Holzinger 2011; Kaibel et al. 2006), or signing avatars (Cox et al. 2002; Kennaway, Glauert, and Zwitterlood 2007; Schnepf et al. 2012). Secondly, there are attempts to use text simplification (Vettori and Mich 2011). The last approach is, however, highly controversial in the deaf community. Moreover, there are case studies of various experimental applications available such as a visual display and a haptic chair for the enhancement of musical experience (Nanayakkara et al. 2009), or mobile systems for the visualisation of ambient sounds to deaf users (Matthews, Fong, and Mankoff 2005).

In addition to the scientific case studies there are accessibility guidelines available from the World Federation of the Deaf (WFD 2014) and the Web Accessibility Initiative (Caldwell et al. 2008) of the World Wide Web Consortium. Although these guidelines address important accessibility qualities for interactive products and may be helpful for the formal assessment of such products e.g. by governments, they are less suitable for being used in design practice, especially when it comes to thinking out of the box and creating innovation.

In conclusion, all these approaches to the accessibility for deaf users in HCI take the “classic” perspective on deafness as stated above. Based on a series of qualitative investigations set out in the next section as well as on the insights from the literature review on cognition in deaf signers, I argue for the need to re-imagine the notion of deafness. Such reconfiguration of deafness towards opening up its gains instead of solely highlighting difficulties is not only a necessity for being able to adequately address signing deaf experience, in fact it creates a space of opportunities and, thus, may provide the impetus for innovation.

### **3 Methodological Approach in this Contribution**

This contribution is based on a literature review of cognitive studies and a more than three year long field research conducted in the context of five Web co-design and development projects in Germany: Vibelle (completed in 2012), Gateway (completed in 2013), DeafTrain (completed in 2015), DeafExist (in progress) and DeafMentoring (in progress). The websites resulting from the four of five projects can be accessed online via the following URLs: <http://vibelle.de/>, <http://gateway-online.de/>, <http://deaftrain.de/> and <http://deafexist.de/>. The development in the fifth project DeafMentoring is in its initial stage with the first series of explorative co-design sessions having just passed. Although the DeafMentoring website <http://deafmentoring.de/> already presents its purpose relevant information, it is not yet a result of the appropriate co-design activities. All five projects share the same general objective that is to facilitate the entry of signing deaf people into working life. During the projects, deaf and hearing co-designers closely work together on the creation of websites that support project operations and serve the overall objective.

United by the common general objective, the five projects address different topics, and each of them serves its own specific purpose. The project Vibelle was concerned with the development of a multimedia information and eLearning platform aiming at the increasing vocational qualification of deaf adolescents. An information portal for deaf and blind students was developed in the project Gateway. The DeafTrain portal was designed to facilitate the entry of young signing deaf people into working life, in particular by educating and sensitising their teachers. For this purpose blended learning seminars were developed, i.e. the seminars fuse classroom and eLearning activity. The DeafExist project was founded in support of signing deaf entrepreneurs in their business start-ups. Finally, the DeafMentoring project is aimed at supporting signing deaf teenagers in the planning of their professional development by connecting them with experienced and successful deaf signers. Thereby a peer-counselling practice and appropriate supportive tools are elaborated in the project.

During the field research a combination of qualitative approaches to data elicitation has been employed. Participant observations, group discussions and interviews have been applied in a variety of situations at work and outside. The situations at work include:

- Seven co-design workshops, cf. (Sanders and Stappers 2008), for about four hours each with the average four signing deaf and three hearing participants;
- Two design studios, cf. (Ungar and White 2008), for about one and a half hours and with three participants each (five of whom were deaf signers);
- 13 qualitative interviews with four signing deaf experts in Deaf Education, one young deaf intern, two signing deaf external volunteers, as well as three hearing experts in Deaf Education, one hearing graphic designer, and two hearing developers who were involved in the co-design projects;
- Five formative usability evaluations with gestural think aloud protocols (GTAP), cf. (Roberts and Fels 2006);
- More than ten group discussions with on average six signing deaf participants (22 different deaf signers in total).

Altogether 25 signing deaf people have participated at different stages of the study so far. Most of them, except for two external volunteers, were involved in the project work and had specific roles, e.g. conception and organisation of further training for deaf people, and production of content also in the form of sign language videos.

In order to facilitate the collective creativity between signing deaf and hearing co-designers the main language of communication was the German Sign Language (DGS<sup>5</sup>). However, because not all hearing team members have strong DGS skills, in almost all sessions sign language interpreters were employed. To achieve mutual visibility attendees were sitting according to a circular or semi-circular layout. As exemplified in Figure 1 when brainstorming or discussing certain design ideas in workshops, group discussions and at times in interviews, the ideas were simultaneously sketched.

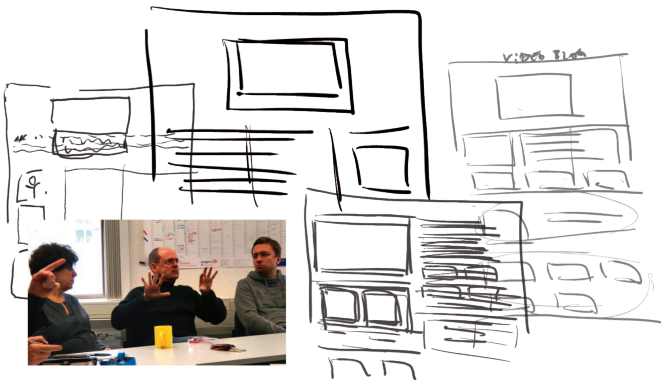


Figure 1. A snapshot from a co-design workshop and examples of sketches. The participant in the centre explains his idea. The explanations are simultaneously sketched and made visible for everyone.

<sup>5</sup> DGS stands for Deutsche Gebärdensprache.

This field research has mainly been conducted within the projects DeafTrain, DeafExist and DeafMentoring. The co-design results and experience of the older projects Vibelle and Gateway have been accessed through the qualitative interviews with the members of these projects as well as group discussions about the resulting websites.

## 4 Re-imagining Deafness

A growing amount of scientific work on human cognition, e.g. in such fields as psycholinguistics or neuroscience, provides evidence of enhanced cognitive, psychological and social capabilities. To give a couple of examples of particular enhancements of visual cognition in deaf individuals there are studies supporting a higher level of peripheral attention (Bavelier, Dye, and Hauser 2006; Dye, Hauser, and Bavelier 2009), or of facial processing (McCullough and Emmorey 1997), or a better skill in mental transformation like mental rotation of spatial images (Emmorey, Klima, and Hickok 1998) compared to hearing people. These cognitive gains of deaf people originate mainly from three circumstances. Firstly, it is the ability of visual and auditory cortical regions to reorganise across modalities, which is called cross-modal plasticity (Finney et al. 2003). Therefore, auditory cortical regions of prelingually deaf people begin to process varieties of visual input extending the visual processing capacities already provided by the visual cortical regions, cf. (Campbell and MacSweeney 2004; Bavelier, Dye, and Hauser 2006). Secondly, the development of a visuospatial rehearsal loop in the short-term memory in deaf signers (Wilson and Emmorey 1997) leads to effects on visual perception as well (Wilson and Emmorey 2003; Dye, Hauser, and Bavelier 2009). Thirdly, it is the everyday use of sign language (Emmorey 2002).

In addition to the extensive research on visual cognition there were certain psychological and social benefits of deaf signers documented, such as the benefits related to interpersonal relationships originating from the maintaining of eye contact, or embodiment of reciprocity when together with others navigating through space, cf. (Bauman and Murray 2014).

Moreover, the everyday use of sign language contributes to the development of fine motor skills and facial expressiveness (Emmorey 2002). Other studies report an enhancement of tactile sensitivity (Levänen and Hamdorf 2001).

Taking together the scientific insights summarised above we can now state that deafness is not solely an experience of not hearing, but rather a “distinct way of being in the world, one that opens up perceptions, perspectives, and insights that are less common to the majority of hearing persons” (Bauman and Murray 2014, p. xv). Moreover, we can acknowledge certain superior abilities in signing deaf people. Therefore, I suggest considering deaf signers as experts in visual, spatial, and embodied matters. In the next section I argue that this perspective may be particularly beneficial in the area of technology design.

## 5 Deafness as a Resource for Design

The potential impact of considering deaf people as experts in visual, spatial and gestural matters resides at different levels. Firstly, signing deaf people themselves may benefit from an overall improvement of the user experience that is coevolving with a general growth of understanding of deaf experience by hearing technology designers. Deaf signers may furthermore benefit from being empowered to contribute and consequently being valued as experts. Secondly, hearing design practitioners may gain inspiration and insights from other ways of being. They may gain new perspectives and ways to interpret their designs and learn from the experts in visual-gestural language, e.g. to more effectively communicate with each other, as it has been shown in the case of professional communication among students in architecture by Klaudia Grote et al. (Grote et al. 2016). Moreover, co-designing with signing deaf participants may foster divergent thinking (Raïke, Pylvänen, and Rainò 2014), which is partially grounded in the use of sign language and its effects on the formation of stronger connections between syntagmatically related concepts, i.e. related through associations, cf. (Grote 2013). The insights above are additionally supported by the analysis of the qualitative data gathered within our field study. Extrapolating these insights points to the third potential long-term impact, namely on society in general. In fact, societal gains may arise for instance from the innovation boost resulting from collaboration between deaf and hearing co-designers, and as a potential consequence, a better user experience not only for deaf signers but for some non-deaf people as well.

My approach in supporting these “creative gains” is twofold. Firstly, in order to actually enable fully-fledged active collaboration between deaf and hearing co-designers such co-design approaches can be adopted as co-design workshops, design studios, and group discussions. Secondly, to support hearing designers without available resources for co-design activities, a number of “rooms” for inspiration are being developed. These *inspiration rooms* are aimed at explaining the deaf perspectives and at igniting the imagination of hearing designers. In the following, three examples of *inspiration rooms* are depicted to illustrate the idea.

### Most Important in the Centre

This inspiration room is dedicated to the social and linguistic practice of signing deaf people. This practice puts emphasis on the visual field when perceiving the world, or communicating with other people, and on the role of the central perspective.

During one of the sessions a signing deaf participant mentioned: “*I’m looking in the centre. For me, there is the most important information in the centre. And this is what is viewed first. And the rim is then rather less interesting. ... There, where I hold my view, I get the important information.*”



Figure 2. The screenshot shows an interactive globe navigation in a state after multiple click actions: first on the “eLearning” item, then on “Mathematik”, followed by “Kurs I Grundrechenarten” (i.e course I - basic arithmetics). In this state the globe menu provides several affordances: going to more general categories, opening current topic described in sign language in the central globe and navigating to the two more specific topics represented by the globes “Addition und Substraktion” and “Multiplikation und Division”.

Design thinking in this direction may lead to innovative, and unconventional design solutions, such as the navigation principle developed for the Vibelle website. Figure 2 shows the so-called “globe menu” that presents a short sign language description of the contents below in the central globe. The different contents are aligned in space around the central globe.

### The Semantic Dimension of Space

When using sign languages, meanings and semantic relationships are created in space. Thereby not only the locations of signs, but also the dynamics of their production play an important role. Therefore, the day-to-day use of sign language trains the spatial perception, including the visuospatial short-term memory, making deaf signers be more attentive to the visual signals produced – e.g. by interactive systems – and to their possible meanings in space and time.

To give an example, in particular for the attentiveness to the spatial component of meaning, in one of the workshops the following situation occurred. When co-experimenting with different layouts for the DeafTrain website, signing deaf participants explicitly refused to accept any layout with vertical menu alignments in order to depict more or less equally important categories of a website. Figure 3 shows the horizontal menu implemented on the website.



Figure 3. Main menu and its subpages fly-out menu are both horizontally aligned in the header of the page. The screenshot shows the state of the menu on the page “Seminare” when mouse is over this main menu item: All eight subtopics unfold horizontally under the selected menu item.

The reluctance of signing deaf participants to put equally important items, into a vertical structure can be explained from the linguistic perspective by the fact, that sign language users linguistically relate true or imagined objects or people to each other, i.e. it uses space to invoke patterns of meaning. In this regard, arranging items vertically means that items have an order, or priority. In contrast, organizing items horizontally signifies a similar level of importance. This simple co-design experiment suggests that deaf users, due to the modality of their language, experience a stronger conventionalization when appropriating spatially arranged design elements.

### **Futures to See and Feel**

Within a heated discussion about the differences between the linguistic and cultural experience of deaf and hearing people in relation to semantic categorization during one of the workshops, one of the interpreters stopped the impassioned signing participants, who started to sign very fast, in order to interpret: *“We don’t know what is coming. We cannot hear that,”* and then added the following: *“I think ... this is incredibly important – and it is also not clear to hearing people – that sounds, and they are not solely an alarm function, are the future: it is already happening! ... If two people are arguing, and the door slams shut with a loud bang, then I ((points to herself)) know why (because I just have heard it). This is what completely evades deaf people: The future is always a mystery!”*

The deaf participants expressed their appreciation for these words with signs SUPER and APPLAUSE. This particular debate culminated in a conclusion that this situation, with respect to the use of information and communication technologies, in particular webpages for deaf people, is quite the same. Therefore, e.g. any information that is concealed in some hierarchical structures appears to be not inline with the syntagmatic, i.e. associative, thought structures shaped by sign language use.

This concept may be seen in relation to what Paul Dourish and Graham Button (Dourish and Button 1998) called “accountability” of an interface, i.e. “first, the very way in which it is organised provides to others the means to recognize it as what it is (accountable), and, second, does so within the very fact of its production (reflexivity), rather than within some wider frame of ‘social meaning’.” (Dourish and Button 1998, p. 398)

Taking together the concepts of accountability and of futures to see and feel, the characteristic of an interactive system to represent its own behavior can now be thought in terms of (visually or tactile) describing what will or may happen in the context of its use in the near future. Following this line of thought may inspire designers to create novel meaningful solutions.



## 6 Conclusion and Future Work

Instead of focusing on the inability to hear this paper proposed re-imagining the common notion of deafness, and by doing so facilitating “creative gains” at different levels. This reconfiguration of deafness is grounded in a variety of studies from the cognitive sciences, psychology and sociology, as well as qualitative investigations outlined in this paper. These studies provide a foundation for the recognition of the specific superior abilities in signing deaf people compared to hearing w.r.t. cognitive, social and psychological gains. Therefore, for purposes of technology design, I propose considering signing deaf individuals as experts in visual, spatial and embodied matters.

In this paper I argue that this reconfiguration of deafness may create a space of opportunities for technology design and, as a consequence, boost innovation. Moreover, in order to facilitate collaboration between hearing and deaf co-designers there is a need for a higher awareness especially among hearing participants of the linguistic and cultural perspectives related to deafness. To facilitate this understanding and stimulate imagination, I am elaborating a set of empirically grounded concepts for inspiration collected in, as I call them, *inspiration rooms*. Three of these concepts are depicted in this paper to exemplify their potential for the design thinking and creating innovation. The elaboration of *inspiration rooms* has not yet been completed, therefore, it is one of the further research activities.

A more in depth discussion on best practices of how to facilitate a fully-fledged participation of deaf signers in predominantly hearing development teams, is, however, out of the scope of this paper, but is planned as a separate contribution in the future. Another interesting direction for future work is about the limits of the societal impact of co-designing with signing deaf participants. It is for instance quite straightforward that this approach cannot promise well-accessible solutions for deaf-blind or blind users. However, it is conceivable that there are people with some other sensory disabilities who may benefit from its results.

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