

Best Practice Protocol

on the Use of Sign Language Avatars

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Avatars that display signed languages can contribute to more accessibility for deaf sign language users. However, the use of animated avatars instead of professional human interpreters is regarded very critically from different perspectives. For their entire lives, deaf people rely on dependable and continuous access to professional translation/interpretation services. Without professional and sufficient translation services, their participation in education, society and general social life is not possible (as long as majority members are not sign language competent). In that effect, the *World Union of the Deaf (WFD)*, together with the *World Association of Sign Language Interpreters (WASLI)*, issued a statement in 2018 on signing avatars¹.

In June 2019, the *Austrian Association of Applied Linguistics (verbal)* as well as the *Austrian Federation of the Deaf (ÖGLB)*, and the *Austrian Sign Language Interpreters and Translators Association (ÖGSDV)* both published statements on the use of signing avatars².

The Best Practice Protocol at hand is intended as a guideline to develop and deploy signing avatars in ways that will actually make them an asset for deaf sign language users. This concerns avatars both as presenters of signed text as well as the translation processes beforehand (by humans, machines or mixed).

This protocol covers topics and issues that should be considered when it comes to the implementation and use of signing avatars. Most of these topics are independent of the rapidly advancing technical development in the field of avatars, therefore no minimum technical requirements or other related issues are specified here.

¹ <https://wfdeaf.org/news/wfd-wasli-issue-statement-signing-avatars/> (August 30, 2021)

² <https://startseite.verbal.at/109-2/verbal-stellungnahmen/> (August 30, 2021) and https://www.oeglb.at/wp-content/uploads/2021/05/Avatare_OeGLBOeGSDV_Stellungnahme-2019.pdf (August 30, 2021)

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0. Introduction: On the Preparation Process of this Best Practice Protocol

In 2021, a research project was conducted at the University of Vienna on the topic of avatars for sign language. The purpose of the project "Avatars and Sign Languages. Development of a Best Practice Guideline on Quality in Accessibility" (Principal investigator: Verena Krausneker, in co-operation with Sandra Schügerl) was to compile a guideline based on qualitatively collected data that regulates the use of sign language avatars.

For this purpose, **10 focus group discussions** were conducted, four with hearing, and six with deaf participants. The stimulus material was gathered specifically for these focus groups and consisted of four short, variegated videos (one speech by a political leader, one informative, art-mediating text, one commercial, and short holiday greetings). The videos were translated and signed in Austrian Sign Language (ÖGS) by both an avatar and deaf interpreters. Thus, four video pairs were used, some of which featured captions in German. The avatar in human shape shown in all four videos is that of the Austrian company SIMAX, which produces semi-automatic translations based on written texts and is 3D animated³. The four twin videos were created by two deaf interpreters.

The result of this elicitation process was analysed by a linguist and a deaf interpreter to jointly create a first version of the Best Practice Protocol at hand. This draft version was then sent to 10 deaf and hearing experts around the world, and additions, comments, etc. were solicited in **expert interviews** and subsequently incorporated.

The experts are:

- Sarah Ebling, University of Zurich, Switzerland.
- Nadja Grbić, Department of Translation Studies, University of Graz, Austria.
- Thomas Hanke, Universität Hamburg, Germany.
- Helene Jarmer, president of the Austrian Association of the Deaf.
- Hernisa Kacorri, University of Maryland, College Park.
- Melissa Malzkuhn, Director of Motion Light Lab, Gallaudet University, USA.
- Christian Pichler, Austria.
- Antti Raike, Aalto University, Finland.

³ For more details on our focus groups, see <https://avatar-bestpractice.univie.ac.at/>

- Georg Tschare, founder and CEO Sign Time GmbH, Austria.
- Rosalee Wolfe, Institute for Language and Speech Processing ATHENARC, Athens, Greece.

We thank the experts for the many constructive and valuable contributions!

The final result of this collaborative process is the present Best Practice Protocol, which is structured in **six topics**. For each topic there is introductory information grounded in the focus group discussions. Chapter VII lists the specific **best practice recommendations** associated with each topic, which also have their origin in the focus group discussions. A one-page summarizing **conclusion** completes this guideline.

Comment: This protocol intends to be of general use and validity, although it is very clearly shaped by the Austrian situation. Austria is a small country with a notorious shortage of sign language interpreters and a very productive company that has for many years now commercially supplied the market with signing Avatars.

I. Linguistic Aspects

All studies regarding the intelligibility of signing avatars clearly show that it is not yet sufficiently given or judged as unsatisfactory by deaf sign language users (as of 2021)⁴. It can therefore be assumed that signing avatars are still in the process of development (and depend on the development of Artificial Intelligence as well as Sign Language Research). Likewise, the avatar deployed in the present research project was not understood by all deaf focus group participants. The deaf participants criticized lacking facial expressions, imprecise coordination of manual and non-manual components of a sign, missing phrase melody, jerky, hard, mechanical, wooden, robotic, somnolent, unnatural, incomplete signs and missing transitions between them. Furthermore, a lack of mobility of the upper body, shoulders, cheeks, and a lack of or unclear mouthings and also mouth gestures were reported.

In all focus groups with deaf participants, it was noted that the avatar "closely follows the German syntax", which was described as unpleasant, tiring, not mature, as a "gimmick", "nice experiment" and even as a "botch-up". The resulting lack of comprehensibility of the avatar demanded maximal cognitive attention and caused viewers to have to "try" or "strain" very hard to follow, calling it a "struggle". In two focus groups, comparisons were even made to forced lip-reading in the oral schools attended as a child. The memories triggered by trying to understand the avatar resulted in the participants "feeling sick".

It was also noted in all deaf focus groups that the content provided by the avatar would only be fully comprehensible if viewers simultaneously read captions. However, this carried the challenge of constantly switching languages between written German and Austrian Sign Language (ÖGS). This is in line with the results of the prototype study on SIMAX's avatar which posed follow-up content questions and documented only 52% correct answers by the 247 participants (Pauser 2019).

Deaf focus group participants criticized that this kind of avatar was completely incomprehensible for people who do not have ÖGS as a first language (people who learned ÖGS later in life, people from migration or refugee backgrounds), as well as senior citizens and people with little formal education and little German competence. It was also criticized that these avatars did not present children with good linguistic role models.⁵ In contrast, one group pointed out that interpreters were also role models for deaf adults as the entire community

⁴ A list with relevant academic publications is available here: <https://avatar-bestpractice.univie.ac.at>

⁵ Experts remarked that studies clearly show how Alexa, Siri etc. have an effect on hearing users and their linguistic behaviour.

can benefit from them (such as learning about linguistic styles and registers of political speeches or art historical information in museums, for example).

Hearing and deaf participants alike demanded full intelligibility of signing avatars used in public. "I don't want something mediocre, but I want something good", one hearing participant put it. Deaf participants further clarified that they considered it unacceptable to be "informed" by prematurely released (i.e., not fully intelligible) avatars in important areas of everyday life.

Both deaf and hearing participants discussed the prospect that an avatar could be a facilitator in everyday life by, for example, providing a signed "rough translation". This would be especially helpful for deaf people with low literacy skills.

Finally, all participants were sure that in the future the quality of avatars would improve significantly and that then they could possibly serve as a valid supplement to interpreters. That would mean more flexibility and independence for deaf people in their everyday life. The question was also discussed whether Artificial Intelligence could contribute to avatars producing authentic, appropriately signed language.

According to one deaf participant, avatars would be "a dream" if there were no qualitative and linguistic differences between the performance of human interpreters and of avatars. Experts remarked that the path to fulfilling this dream may be complicated, non-linear and maybe even ugly.

II. Aspects of Translation Competence

Many deaf people distrust the quality of avatar translations because, unlike with human interpreters, it is unclear who provided the translation and to which professional code of conduct that person is committed. It would increase viewers' confidence in any longer, complex text signed by an avatar if it were disclosed who did and reviewed the translational work (human-machine, machine-human). It should be clear what language skills or interpreter training and affiliations that person has.

In the deaf focus groups, it was often demanded that commercial avatar products (i.e., videos with an avatar) that are sold and used publicly, should only be released after a thorough quality control by specialists. More specifically, these specialists are bilingual deaf sign language interpreters with special competencies in post-editing. Experts remarked that also pre-editing of texts for avatar videos required a special training.

Note: Both hearing and deaf focus groups did not differentiate between the quality of translation and the quality of animation/performance. Mostly it was discussed what was seen, and not the quality of the translation.

III. Ethical Aspects

The deaf participants emphasized that in terms of participation, deaf interpreters, animators, project managers, as well as the entire deaf community need to be involved in the development and production of avatars. Members of the deaf community should not only serve as study participants or providers of feedback. On the one hand, deaf people assumed that hearing people were "delighted" with and fascinated by signing avatars. On the other hand, they know that hearing non-signers usually have no competence to assess the intelligibility and the linguistic and translational quality of signing avatars. Furthermore, hearing people usually are so unfamiliar with deaf everyday life that they cannot genuinely understand the needs of deaf people.

It was stressed that not only clients/customers, but also sponsors should coordinate their decisions about avatar projects with the self-advocacy associations of deaf people. Experts remarked that this would also build knowledge within the deaf community about the realities of research and the complicated processes of acquiring funding.

According to the participants in all focus groups, it is preferable that "not solely economic interests" are pursued. Trustworthy, seminal research and - in the case of commercial companies - close cooperation with universities and research groups were called for. According to the participants, it would also be desirable for the various researchers and developers in the field of avatars to exchange ideas and learn from each other in a non-commercial setting. This could help raise the quality of avatars to a truly satisfactory level instead of "everyone doing their own thing", as one participant put it. Experts remarked that there was a certain tension between the wish to calmly and cooperatively develop an appropriate quality in sign language avatars and the demand of the market which usually seeks "fast and cheap" solutions. In addition, experts deemed it desirable that research leads to high quality while commercial providers of avatars can conduct their business. Nevertheless, the situation of sign language avatar development cannot be compared with the development of speech synthesis, where in the beginning lesser quality was seen as acceptable and users experienced and accompanied gradual improvements. Since sign languages are minority

languages there is the danger that they are negatively influenced (and perceived!) by the spread of bad language data.

Experts furthermore remarked that when using language data, the question of ownership and also representation always arises: Who is a good linguistic model? To whom do the data ultimately belong?

In all hearing focus groups, it was emphasized that the decision about whether an avatar is appropriate and where it can be used, should be up to deaf people. Various institutionalized approaches were suggested, e.g., a panel of qualified deaf people, the certification of the avatar manufacturer or the consultation of a diverse group of deaf people with different backgrounds.

Deaf participants also argued that avatar development was one of the few areas where deaf people shall be prioritized for employment. Even a sense of "exploitation" was mentioned, when hearing people profit from sign languages while deaf people may provide only language expertise but have no say in the matter. It causes great discomfort that people without sign language expertise determine the quality and use of avatars while they cannot communicate directly with their deaf co-workers.

Furthermore, it was also pointed out that the financial argument (presumably, avatars are cheaper than interpreters) must not be the most important one. Avatars could mislead to the illusion that "everything is now done" for deaf people. However, whether an avatar actually does contribute to more accessibility can only be assessed and decided by deaf sign language users.

Experts remarked that deaf sign language using staff should always be involved in the development and production of signing avatars and should become specialists in these processes so that they can constructively accompany and guide it.

IV. Situational Appropriateness

Avatars enable one-way communication only. Thus, it should be avoided that the many opportunities hearing people have to engage in dialogue are even more limited for deaf people.

Just as with computer voices, concentrating on avatars is cognitively very tiring after a while. Deaf participants' suggestions on acceptable length of videos signed by an avatar varied from "five sentences," "one minute" to "short messages". In any case, the two-minute stimulus

video presented to the focus groups was perceived as "too long". (Note: It should be taken into account that also hearing people leave all kinds of videos on the web rather early on.)

The following possible areas of application for avatars were specifically mentioned: Vocabulary training, greeting messages, animated films, cartoons, advertising clips, computer games, signing a logo, announcements in public transport, signposts, emergencies, weather warnings, descriptions, manuals and calls in waiting areas (by fingerspelling). It would also be possible to add definitions/explanations by an avatar to individual words in a digitally available text.

In summary: Content that is short, repetitive and structurally similar was described as acceptable for an avatar. It was very clear that there is great reluctance when it comes to content in which life is at stake, such as patient information leaflets. Avatars were deemed as appropriate for "playful" content.

"Quality" was stated by all deaf participants as the main criterion for deciding where and when avatars can be legitimately deployed. Specifically, avatars must be fully intelligible, without any loss of quality compared to a human interpreter. It was repeatedly stressed that avatars could not be "taken seriously" as a trustworthy provider of information and the animation created the impression of fiction. The appropriateness of avatars for children was also discussed, because avatars are perceived as linguistically unsuitable, especially when keeping in mind that deaf children usually have scarce access to linguistic role models.

However, deaf participants were also considering the possibility of remaining anonymous by using an avatar, for example by signing their own text but replacing their face and body by an avatar. This was regarded as useful for certain situations, like calling a helpline or claiming a lottery win. That would require avatars to be freely accessible and available for everyone as an application.

With regard to the currently available options for hearing people (human speakers, computerised voice and animated figures), one participant made the following suggestion:

1. In all situations/media where human, real voices are heard, human interpreters should be seen.
2. In situations where computer voices are heard, avatars can be deployed.
3. In videos and films with animated characters, such as elves, angels, Santa Claus etc., avatars created with motion capture technology can be deployed if they are a sensible addition to interpreters.

V. Social Aspects

Both deaf and hearing participants were concerned with the question of what it would be like to increasingly or solely experience artificial, computer-animated sign language. Deaf focus group participants emphasized that in their everyday life they would "not want to see avatars only". They are worried that the number of their social interactions beyond the screen/internet would be even more limited than now. For many deaf people, interpreters are important social contacts, "real people from the real world", as one participant described it.

Likewise, hearing participants emphasized that it was certainly much more pleasant to have a human as a counterpart and that everybody needed personal interactions. They were also concerned that the increased use of avatars would lead hearing people to no longer have a realistic perception of deaf people. Avatars could also contribute to the misconception that sign languages are something "completely different" and would therefore reinforce the impression of "otherness".

Deaf participants were equally concerned about the perception of their natural language by hearing people and considered only real humans, not avatars, as appropriate representatives.

Experts stressed that avatars should be something deaf people are offered, but not obliged to use.

VI. Aesthetic Aspects

In the focus groups, both deaf and hearing participants commented on the appearance and impact of both avatars and human interpreters. In all hearing groups, the four human shaped avatars were described as a "comic figure", "children's book character", "cartoon character", "Disney", but at the same time they were perceived as calmer, nicer, tidier, less disturbing, more precise, clearer and less emotional compared to the human interpreters. The human interpreters, in contrast, were perceived as more likeable, more truthful, more serious and more genuine, but their facial expressions were also perceived as somewhat stressed. In all hearing groups it was also stated that the human interpreters, with their expressive body language and facial expressions, could distract viewers from the content.

Similarly, in the deaf focus groups, the avatars were referred to as a "robot", "comic face" or an "artificial figure". However, the possibility of changing the look of avatars in order to adapt them, for example, to fairy tale or children's book characters was considered "great".

The appearance of the avatars led all participants to firmly attribute them to the unreal, animated world. Younger participants were familiar with the uncanny valley effect⁶ and discussed this aspect. It is important to keep in mind that this perception could undermine serious topics to be conveyed. Deaf participants also felt that it was inappropriate for them as adults to be informed by a "cartoon character". The playful, slightly childish quality of avatars could in the long run damage the perception of sign languages in society, because it leads away from an understanding of signed languages as fully-fledged, complex languages.

Experts commented that different avatars should be deployed for different types of content and goals, e.g., photo realistic looks for serious/important content and comic type looks for children's and animated films.

Both hearing and deaf participants would prefer the avatar in a picture-in-picture (unless it is featured in the centre of the video), so that it does not merge with the rest of the image and thus interferes with it (exception: animated films).

Note: Neither looks, gender nor ethnic appearance etc. of avatars were discussed in any of the focus groups and no participant commented on these topics. Experts remarked that the entire appearance of avatars should be situationally appropriate.

VII. Best Practice Recommendations for the Use of Sign Language Avatars

Linguistic Aspects

1. The linguistic quality of signing avatars depends on the degree of proximity to the human range of movement. Avatars whose primary focus is on the arms, do not provide the means to appropriately and intelligibly display a signed language. In the animation process, the torso, pelvis, shoulders (individually and together), all parts of the face, including the eyes (direction of gaze), and the entire head must be moved completely and appropriately.
2. Signing avatars only deliver high quality linguistic performance if they offer diversity in style and register, as well as linguistic variants within a text. Attention should be paid to diversity within the production team and to representing a variety of different signers (especially in motion capture technology but also in machine translation).

⁶ The uncanny valley effect describes the fact that people find highly abstract, clearly artificial looking figures more acceptable than figures that are designed in a way that they very closely resemble humans.

3. In avatars, special attention must be paid to a precise (frame exact), harmonious interplay of manual and non-manual components of a sign.
4. It is recommended that avatar videos (for example in the area of public transport) also feature pictograms, such as images of buses, platform numbers, and trains.
5. The intelligibility of signing avatars must be granted for *all* deaf sign language users who depend on the conveyed information.⁷ This includes persons with little formal education, or who did not acquire a sign language as their first language, diverse age groups etc.⁸
6. Avatars are no substitute for captions because captions are needed by all people with hearing impairments who are *not* sign language competent.

Aspects of Translation Competence

7. Texts presented by avatars must undergo quality control before they are published/released. This quality control should be conducted by deaf, bilingual specialists, preferably native signers, who are highly competent in both languages (the source language of the text and the language the avatar signs) and who have translation skills and knowledge.
8. It would be conceivable to establish an independent, deaf-led quality control centre where companies can submit their avatars or individual texts presented by avatars to be certified and released by a panel.
9. If the quality control concerns a computer-generated or partially computerized translation, these specialists must be trained and qualified interpreters.
10. An empirically developed set of criteria for quality control of avatar translations is urgently needed.⁹ This generally applicable quality management (for movability, fine motor skills of the animation, ease of perception and translation quality, just to name a few examples) would enable not only developers but also customers and sponsors to assess the product in question.

Ethical Aspects

⁷ This does not imply a simplification of content or text but appropriate linguistic quality of the animation.

⁸ Only about 10% of deaf children have deaf parents and thus access to a fully fledged and fully accessible language. Most deaf people acquire or learn their sign language late and not from their primary caregivers.

⁹ The norm DIN EN ISO 17100 is not sufficient.

11. Sign languages originate from deaf communities and have been preserved by deaf people even in the most hostile conditions. Deaf people helped the language to flourish even under great pressure. The deaf communities of the world wish to see their languages treated with respect. This includes that economic interests are not placed above the protection and preservation of sign languages.
12. Deaf people should never have to choose between avatars and human interpreters. Avatars are not a substitute for human interpreters, they may be an addition.
13. Deaf people must guide the decision where avatars can be appropriately deployed. It's conceivable that in the future, many different avatars are available and deaf users may have free choice between the different services.
14. Deaf people must lead in the creation of sign language avatars, the translation process, and in the quality control (pre- and post-editing) prior to the delivery of an avatar video to the customer.
15. If avatar developers are actually concerned about quality rather than only about profit, they need to cooperate with each other and with the self-advocacy associations of deaf communities.
16. Avatars should be developed and researched in interdisciplinary teams: co-operations are required between visual studies, 3-D animation, linguistics (not only computer linguistics) as well as translation studies. Otherwise, avatars will remain gimmicks.
17. The principle *Nothing about us without us* also applies to the field of sign language avatars. Therefore, the deaf sign language users' perspective (not the perspective of them) should always be central in public relations, in business communication and in marketing.
18. Last but not least, the UN Convention on the Rights of Persons with Disabilities demands of State Parties that they take "appropriate measures" which include "professional sign language interpreters, to facilitate accessibility to buildings and other facilities open to the public". Furthermore, State Parties are required to guarantee the right to freedom of expression and opinion, including the freedom to seek, receive and impart information by "recognizing and promoting the use of sign languages".¹⁰
19. The cost issue must not be the only or the most important decision criterion. Desirable accessibility is a matter of quality; decisions can be taken pragmatically, but still with

¹⁰ UN Convention on the Rights of Persons with Disabilities, art. 9 (2e) and art. 21 (e). See <https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html> (August 30, 2021)

regard to quality. If an offer is "cheaper" but is neither acceptable for, nor desired by deaf sign language users, then cost saving was prioritized over human/citizens' rights and true accessibility.¹¹

20. When public funds are awarded to the development or deployment of signing avatars, the recommendations compiled in this Best Practice Protocol should be followed.

Situational Appropriateness

21. Sign language avatars do not fit everywhere and anywhere. Deaf people themselves should make the informed decision when and where avatars can be deployed (examples of such areas; see above, chapter IV). Here, many factors should be taken into account, such as target group, topic, desired effect etc.
22. From the perspective of deaf viewers, avatars have not (yet) arrived at a point where they can relate complex topics and not every length of text can be adequately represented.
23. Best use of avatars is where the content allows it and where there is no live communication, no two-way communication and no dialogue.¹²
24. There are two crucial aspects in deciding whether avatars should be deployed: 1) the sensitivity of the respective topic, and 2) the potential for danger. Content that demands a linguistically impeccable quality and excellent translation because misunderstandings could lead to big disadvantages or even dangerous situations, should not be presented by avatars. In emergency situations, only ever human interpreters should be called to action.
25. It would be worth considering that avatars should only ever be deployed when hearing people are confronted with computer voices. In all cases where hearing people are informed by human voices or real speakers, deaf people should also be informed by human interpreters.
26. It would contribute to more confidence in avatars if the employees or those responsible for it did not remain anonymous but were disclosed, e.g., on the website of the avatar manufacturer.
27. Many deaf people who are multilingual and have a high level of linguistic competencies distrust avatars. This is to be kept in mind when it comes to content that aims at gaining the trust of deaf viewers or convince them of something.

¹¹ Remark: The issue of cost has both a short-term and a long-term aspect to it.

¹² Unless sign language recognition of the highest quality is available for a live dialogue. This is currently not the case.

28. Many deaf viewers miss emotion and charisma in avatars. It is also difficult to imagine that irony and nuances can be transmitted by an avatar. All this should be taken into account when deciding whether to have an avatar or a human interpreter sign a specific content.
29. Interdisciplinary research on avatars and their ramifications should be conducted continuously. It would be desirable to conduct longitudinal studies and research that is not assigned by avatar companies.

Social Aspects

30. Avatars should only be deployed when they are a useful and appropriate addition to human interpreters.
31. Avatars must not contribute to the social isolation of deaf people (who have a limited choice of communication partners anyways).
32. Deaf people should not be "obliged" to spend even more time in front of a screen instead of having real, live interactions. Self-determination and free choice of interpreters are of high value and should not be taken from deaf people.

Aesthetic Aspects

33. For any given situation, it must be newly evaluated whether a specific topic can be adequately represented by an avatar, a character that is perceived to be highly artificial.
34. Depending on the situation and the video, it must be considered if the animated avatar figure should be free-standing or better placed in picture-in-picture. Similarly, the sizing of the avatar should guarantee ease of intelligibility.
35. It is important to consider when it is desirable for a sign language to be represented by a human and when it makes no real difference if an animated, artificial avatar does so. Thus, the effect of avatars on society should be taken into account.

VIII. Conclusions

Deaf and hearing participants in our focus groups were very critical towards sign language avatars, but not categorically opposed to them. If deployed adequately, avatars can be a purposeful supplement to human sign language interpreters and thus offer freedom of choice.

Most sign languages of the world have a fragile legal status and suffer societal invisibility. Their power and indispensable role are continuously doubted. Complete linguistic accessibility is achieved when a natural, high-quality, fully fledged sign language is used. Avatars should not be presented, seen or marketed as a "solution" to the "communication problems" of deaf sign language users. Their value is in added entertainment.

Deploying sign language avatars must not create disadvantages for deaf people. Sign language avatars should be deployed responsibly in the interests of deaf sign language users. Currently, sign language avatars are by no means an adequate replacement for human interpreters. As long as comprehensibility of avatars does not match those of human interpreters, avatars should only be used in conjunction with captioning.

The long-term effects of sign language avatars should be kept in mind; for example, when animations of poor linguistic quality are publicly accessible for language learners. Or the role of avatars with respect to dialects and register of a specific sign language.

Should avatars (in comparison with human interpreters) actually be cheaper, the saved funds should be invested in much needed interpreter services in live situations and interactions.

Avatars are perceived as "anonymous". On the one hand, this constitutes a disadvantage because there is little trust in the quality of their translations, and it remains completely opaque for the viewer who can be held accountable in case of a problem with the translation. On the other hand, the avatars' anonymity and neutrality is regarded as a potential advantage, because - in contrast to interpreters - it has no emotions and there are no shared experiences. This is especially relevant in small countries and when there is a great scarceness or even a complete lack of interpreters.

It would be desirable that sign language avatar technology was freely available to everyone as an application (such as Google Translate or other free computer assisted translation tools). Hence, deaf people could use avatars independently and self-determinedly in those situations they find appropriate (and would even supply the app with information that is relevant for future users).

*Deaf Lead*¹³ is a desirable principle for any services or products specifically catering to deaf people. In any case, deaf and hearing colleagues must be especially trained and qualified for that task, ideally with a degree from an academic institution.

Interdisciplinary research should accompany the entire process of development and deployment of avatars for sign languages.

¹³ Deaf people should lead any and all measures that have an effect on the lives of deaf people or deaf communities.