Augmentative and Alternative Communication Emerging Trends, Opportunities and Innovations.

Introduction to the Special Thematic Session

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Abstract. Augmentative and Alternative Communication (AAC) technologies, training and support have benefitted from significant emerging trends in recent years to cope with the changing environments experienced by many users. The landscape of inclusion, whether it means different forms of digital accessibility, tele-support or more built-in assistive technology in everyday devices, has helped many more individuals with speech and language difficulties communicate effectively. There has also been an increased use of artificial intelligence, including machine learning and natural language processing with improved multilingual automatic speech recognition (ASR) and text to speech, location capturing apps and the Internet of Things being just a few of the technologies providing the world of AAC with a wealth of exciting emerging trends, opportunities and innovations. This special thematic session aims to provide an insight into some of the trends developing across Europe and the wider community.

Keywords: AAC, Augmentative and Alternative Communication, disability, symbols, assistive technology, participatory

1 Introduction

According to the International Telecommunication Union in 2019, 85% of European households had access to the internet, 77.7% had access to a computer, "with mobile cellular subscriptions far in excess of 100 subscriptions per 100 inhabitants in 38 out of 45 countries" [1]. However, these statistics do not highlight the fact that within Europe 25% of the population are disabled and half of these individuals fail to use the internet regularly [2]. This is concerning, as the majority of new technologies available to support functional limitations require online access, even if it is just to download an app or in the case of augmentative and alternative communication (AAC)

speech generating devices (SGDs), chosen symbol sets or voices, vocabularies and links to support. This disparity may be due to a lack of connectivity, digital skills, knowledgeable support or a combination of all three. Its impact on those with complex communication needs (CCN) may prevent access to more affordable and adaptable technologies than have been available in the past. Networked systems also have the potential to give AAC users a voice and independence, using increasingly socially acceptable devices and applications [3].

The fact that AAC devices have become increasingly dependent on some form of internet connection, at some stage, is often based on a need to upload data as well as to download it. An app may need to be downloaded, but it may also need to gather data from the cloud (servers accessed via the Internet). So, for example an accurate GPS tracker can provide location specific vocabularies to aid symbol selection on a communication board or when required, family members, carers or technical staff can access information about the user's device to support any issues that are arising.

Many AAC systems that provide translations, speech to text or text to speech nowadays depend on some form of artificial intelligence (AI) [4]. The machine learning with natural language processing (NLP) usually looks for patterns in the language and aims to provide as accurate an output as possible. English speakers often have an advantage in this area, due in part to large cleaned datasets with good labelling and no accents or diacritics. The range of English speech synthesizers for AAC users is more plentiful compared to some other languages, where acceptable text to speech requires an understanding of the nuances of pronunciation and the different ways diacritics are used, especially if these have been omitted in written text and context becomes important.

There can also be challenges when an AAC user interacts with a device that is using automatic speech recognition, such as a smart speaker within the home environment. The clarity and time taken to speak can have an impact, but it has been shown how these devices not only work with dysarthric speech, but also with messages on SGDs. These tools can provide chances for social engagement, feelings of independence and freedom as well as positive outcomes in terms of daily care [5].

The ideas discussed in this introduction will be presented in more detail under the following three main themes namely: Assessment and Frameworks, Participation and Collaboration and finally Independence, as a series of emerging trends, opportunities and innovations for those involved with Augmentative and Alternative Communication (AAC).

2 Assessment and Frameworks

Over the years many frameworks for the assessment of a potential user's abilities to engage with different types of Assistive Technologies (AT) and AAC have been pro-

posed as well as the frameworks providing support for technology choices. Frameworks can provide a basic conceptional structure for any task, but they have to be adaptable over time as circumstances change. In the world of AT some lean towards a medical model, highlighting functional limitations and others such as The Human, Activities, Assistive Technology (HAAT) model "conceptualizes the consumer, their activities, environment, and assistive technology as an integrated system in which changing one element affects all other elements in the system" [5].

Although AAC users may be introduced to systems that involve the use of technology and HAAT can guide clinical decision making, there are often gaps in the assessment framework that need to be considered when working with those who have autism. The paper titled "AAC for individuals with autism: additional considerations" suggests these gaps mainly relate to the need for constant reviewing of assessed capabilities, motivation and the possibility of "disruptions in sensory processing [that] may produce cascading effects on social and communication development" [6] as well as the need to consider the communication partner's understanding of the individual's sensory needs [7]. In order to address these issues, the authors further suggest the need to adjust existing frameworks, such as the participation model [8] as well as considering the skills of those around the potential AAC user and "provision of sensory processing interventions". They conclude with a note about the need for careful selection of the AAC system itself, which provides an interesting lead into the following paper.

Sacchi et al state that when assessing the functions available on an AAC SGD the framework developed needs to address the "communicative and linguistic functions of the communication software". Feature lists for devices are usually available, but it is rare for the information to contain in depth descriptions of the potential linguistic capabilities of the content provided. There may be mention of the voices used for various languages, different symbol sets and vocabularies available. However, a lack of more in-depth descriptions can become an issue when considering bi-lingual or multilingual situations. Future SGD communication boards may even lack certain dynamic elements in some languages because of the complexities involved resulting in poorer messaging.

As has been suggested in the introduction, many AAC systems are based on the English language, which has a very different grammatical and syntactical structure to some other languages, even those that use Latin as a base, such as Italian and Spanish. Sacchi et al illustrate how important it is to assess the pragmatic, semantic and morpho-syntactic elements within a language and their impact on the generation of fluent messaging. Just as frameworks can be adapted to suit individual abilities, so they can be added to in order to consider spoken and written language differences. In this case it is the adaptation of the 'Graphic Symbol Utterance and Sentence Development Framework' [9] covering the progression from pragmatic symbol use to meaningful semantic levels of symbol combinations onto basic sentences and finally grammatically correct constructions that has been required.

These two papers highlight the importance of evaluating the assessment criteria presented within any framework prior to its use, in order to ensure it is fit for purpose. The components need to be sufficiently open for any adaptation to occur, so that they can support a wide range of skills, tasks, resources, environments (linguistic, social, cultural or physical), expertise and tools at the time of the assessment.

3 Participation and Collaboration

Participatory technology design can have many positives in particular when working in the field of disability but it is not without challenges [11]. It is interesting to see in the paper shared by Clastres-Babou et al that it is the experts working with those who have complex communication needs who are drawn into the user-centered design process. They illustrate how these stakeholders are encouraged to actively demonstrate their expertise and decision making when trialing various features available on an AAC tool. The process shows how changes are made to the application and the addition of a version for the web would eventually be available. By following up with trials using prototypes, stakeholders could further shape the outcome of the software prior to its final release.

Stakeholders may come with many different views about how a product should be designed, but by ensuring decisions were made in a participatory manner with the original development team, it was clear that there was a certain degree of ownership of the outcome. This was seen in the discussions concerning enhanced features and the setting of further goals (such as the introduction of a web version). The participation of stakeholders clearly enabled a co-design process, as has been suggested by other researchers in the past [12].

The rationale behind a collaborative ecosystem for open licenced AAC, has distinct similarities to the participatory approaches already described as will be presented by Draffan and Banes. However, in this case the project design involved the planning of a “sequence of activities that not only produced a meaningful result, but also facilitate small groups working together to achieve common goals” [13]. As there was a common goal at the outset, the combining of very different types of expertise and knowledge meant that the small groups in different localities could co-create projects, technologies, training and support for AAC users.

Nevertheless, projects that involve participation and collaboration can result in task allocation challenges, time management issues and communication mishaps, but the overall impact of sharing ideas, innovating designs and providing successfully inclusive outcomes can produce life long changes for those who benefit from the results as has been demonstrated in these papers.

4 Independence

The final three papers all present users with the chance of independence, despite using very different technologies. They depend on different forms of AI but are linked through communication, whether via the use of symbols or voice. The devices used are those available to the public, such as mobile phones and smart speakers, but the innovations provide specific support for those with speech and language difficulties.

Ahn et al have suggested a location and situation based AAC service that could offer the potential user with the symbols relevant to a place visited and commonly used circumstances, such as choosing a menu and paying. GPS tracking and map services make it possible for a user to choose locations that are then linked to a recommender system that predicts suitable symbols for secondary or sub communication boards.

One of the issues for many AAC users is not having a wide range of specific vocabularies to hand, or as subsidiary boards linked to a general core board or home board on their device. So, to have the potential to make it possible to offer automated selections based on context and frequency of use, could not only increase independence, but also be a time saver if the AAC user is a skilled user.

However, being able to control devices when AAC users have co-occurring physical disabilities is a challenge that can require assistance. So, an alternative to human help could be a positive move towards increased independence. This appears to be happening in part by the use of the Internet of Things (IoT) using sensors, the internet and smart speakers. Ryu et al suggest that linking these systems as part of an interconnected service, allows users to listen to their favourite music, turn lights on and off, answer a phone and carry out many other tasks, thus "enhancing their quality of life and self-esteem".

Once again issues can arise, in this case with ASR systems failing to work with spoken language that is not enunciated clearly or at a regular pace. It appears that the datasets for atypical speech such as dysarthria are limited. This means that there is insufficient training data to enhance accuracy and the problem may be exacerbated when the language in not English, as discussed by Madina et al. In this case the choice for those with poor articulation is not to turn to the use of AAC, but rather to work with speaker-adaptive systems that allow for personalization in order to achieve independence of use and take control of devices via their own spoken commands.

5 Discussion and Conclusion

The thread following through all the papers moving from assessment to participation and independence allows us to believe that we can help to provide improved strategies for AAC users and those with speech and language difficulties, by introducing tech-

nological solutions to enhance engagement with society. Nevertheless, challenges remain with the way artificial intelligence supports the process, often due to a lack of data that can be used for training algorithms. Time will tell whether different types of generative models and deep learning will produce better results for a minority population. Nevertheless, there is no doubt that over the last ten years there have been many interesting AAC trends emerging, providing increased opportunities and innovations to support users with speech, language and literacy difficulties.

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