Use of artificial intelligence (AI) in augmentative and alternative communication (AAC)

Griffiths, Tom; Slaughter, Rohan; Waller, Annalu

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Use of Artificial Intelligence (AI) in Augmentative and Alternative Communication (AAC): Community Consultation on Risks, Benefits and the Need for a Code of Practice

Abstract

Purpose – This paper reports on a workshop discussing the views of the augmentative and alternative communication (AAC) community on the opportunities and risks posed by the integration of artificial intelligence (AI) into voice output communication aid systems. The views of the community on whether a Code of Practice was needed for the use of this new technology were also sought.

Design/Methodology/Approach – This was an explorative, qualitative study in which members of the AAC community attending a session at a UK national conference were invited to discuss the topic, responding to structured questions from the research team. The use of AI for both novel language generation and rate enhancement was discussed within the session.

Findings – Many potential opportunities and benefits of AI to AAC users were discussed by the group. Risks associated with new and existing biases in AI language models were raised, as was the need to ensure that outputs generated by AI were authentically authored by users. Whilst there was broad support for the idea of a Code of Practice, questions were posed about how it would be designed and what it should contain.

Originality – This study presents a unique insight into the views of the AAC community on the benefits and risks of incorporating AI into AAC systems. The views of the community on the need for a Code of Practice may support how the field moves forward with this complex technology.

Keywords – Augmentative and Alternative Communication (AAC), Artificial Intelligence (AI), Qualitative Research

Paper Type – Research Paper

Introduction

Augmentative and alternative communication (AAC) is a general term for strategies, tools, devices and techniques that may supplement or substitute speech for individuals with communication disabilities (Griffiths *et al.*, 2019). Amongst these tools are a range of "high-tech" or "powered" systems, often collectively referred to as voice output communication aids (VOCAs), which produce synthesised speech output based on letters, words or graphic symbols selected by the user (Baxter *et al.*, 2012).

Individuals who make use of VOCAs are a heterogeneous group, with a range of barriers and facilitators to their effective communication. The range of available AAC systems is equally broad, with no one system suitable for all, and a careful process of assessment, feature matching and trial needed to identify a system that best fits the needs of an individual (Gosnell, Costello and Shane, 2011; Griffiths *et al.*, 2019; Murray *et al.*, 2020). Valencia and colleagues (2023) propose that, despite this variability, there are certain "general challenges" that impact large numbers of users. One such challenge is the speed at which VOCA users can communicate, which is often at a significantly slower rate than their speaking conversation partners (Judge and Townend, 2013; Garcia, de Oliveira and de Matos, 2014; Koester and Arthanat, 2018). This is seen by many as a key barrier to the social participation of AAC users (Baxter *et al.*, 2012; Seale, Bisantz and Higginbotham, 2020). Allied to this, the usability of AAC systems can be impacted upon by their ability to support the user to communicate flexibly, and to articulate their thoughts, tell stories and relay information in a way that is authentic and individualised, whilst preferably requiring as little physical and cognitive effort as possible (Waller, 2019).

The recent growth in awareness and availability of general-purpose artificial intelligence (AI) based on large language models (LLMs) has been a disruptor for many technological and creative fields. The ability to complete or compose sentences from minimal prompt information (Brown *et al.*, 2020) has resulted in systems such as ChatGPT (OpenAI, 2023), which can generate output that, whilst different in style and linguistic structure, is rated of equal or higher quality than human-written text (Herbold *et al.*, 2023), although it remains challenging for AI to produce outputs that are considered interesting, coherent or engaging in conversation or retelling of events (Callan and Foster, 2023). Within the field of AAC, it has been recognised (Sennott *et al.*, 2019; Konadl *et al.*, 2023; Valencia *et al.*, 2023) that the technology has great potential to improve the usability, flexibility and efficiency of AAC systems and devices, potentially offering a method to increase output rates through more efficient prediction or through making systems context-aware (taking inputs from cameras, GPS locators, microphones etc.) so that the options presented to the user are

more relevant to their requirements. Indeed, prototype systems have already demonstrated the utility of integrating AI into AAC systems (Shen *et al.*, 2022).

The rapid growth in the functionality and availability of AI has also led many to express concerns about how it might be used or misused. The costs associated with both using and supporting the technology, particularly at the speeds required for conversational interaction, may be cost prohibitive for some and could lead to a two-tier scenario which would disadvantage some users. Whilst many conversational AI systems are available freely online to individual end users, there are costs associated with the integration of the technology into new or existing systems. Access to faster processing, which would conceivably be needed to fully realise the benefits of increase output rates, requires the use of specific APIs, which carries a cost implication for users or suppliers (Campos, 2023). Whilst the volume of text generation that would be needed for an individual AAC user is highly variable, providing access “at scale” will have a cost implication and suppliers will need to factor in consideration of such costs to their pricing structure, and mitigate against the risk that costs may increase as the AI market landscape evolves. Equally, use of commercially available systems may present the risk that these systems could be withdrawn or that changes in legislation, regulation or new legal precedent could limit their functionality, potentially leaving users "stranded” if technology they are using is altered or no longer available. Whilst complete withdrawal of such technologies currently appears unlikely, even small changes in functionality related to the processing of private or sensitive data could have an impact on their usefulness in generating novel utterances for individual users. The development and training of individualised models or of models developed purposefully for certain manufacturers is one way to potentially mitigate this risk, however such processes are time and cost-intensive. In April 2024, the European Commission released the final draft of the *Artificial Intelligence Act* (European Commission, 2021), a regulatory framework for providers and users of AI, many of the current AI systems may need to change or adapt their functionality, potentially impacting users if services are withdrawn after being embedded into other software. Recent concern around copyright infringement by AI firms, for example, has resulted in an increasing pressure for AI to be subject to regulation that advocates responsible development, whilst not infringing the rights of content producers (Vallance, 2023). Data privacy and security are also areas of concern for users, with the long-running debate about data logging and sharing being reignited by the advent of these technologies (Cross and Segalman, 2016). In the previous instances of this debate user concern has focussed on individual privacy, with a perceived potential for AAC service providers or companies to be able to access user utterances (Blackstone, Higginbotham and Williams, 2002). In LLM systems, who has access to the data is far more complex, with a chain of entities potentially involved in

accessing, processing and utilising this data for various purposes, in a similar way to how advertising cookies and related technologies operate. Telemetry from AI systems is generated and shared with partner organisations in a similar way to that in which advertising cookies enable many vendors to access data that is generated by a user's visiting a website. Due to the chain of entities involved in web-based advertising systems, and in the use of services such as ChatGPT (OpenAI, 2023), it is often difficult for users to know who has access to their data.

It is with this balance of risk and opportunity in mind that this study was designed. Whilst it is understood that many AAC developers and suppliers are actively exploring the integration of AI tools into existing and novel AAC systems, the voice of AAC users and those supporting the technology has not yet been widely explored in the research literature. The study therefore proposes the following research questions:

- What does the UK AAC community perceive to be the benefits and risks of the use of AI in AAC systems?
- What safeguards may be needed?
- Does the UK AAC Community perceive there to be a need for a Code of Practice for those planning to integrate AI into AAC systems, and if so, what should such a Code contain?

Methods

Ethical Approval

The study received ethical approval from the local ethics review committee within the School of Science and Engineering at University of Dundee (Approval Ref: UOD-SSREC-Staff-2022-002).

Participants

Participants in the focus group were delegates at the *Communication Matters International AAC Conference* held at University of Leeds from 10-12 September 2023, who attended a workshop session chaired by the authors entitled "Towards a code of practice to support the use of AI (artificial intelligence) in AAC". As such, participants represent an opportunity sample of delegates at an AAC conference that chose to attend the advertised session. Delegates at the conference were considered to be suitable participants for this study, since the conference is the principal event for AAC researchers, clinicians at all career stages and people who use AAC in the UK. It could therefore be assumed that conference delegates would have an active interest in the field and that their

attendance at the workshop would signal an interest in the topic. No minimum or maximum number of participants was sought by the research team, since the research was exploratory, and the intent was to discuss whether a code of practice for AI in AAC would be helpful and to generate ideas on indicative content if so. The session was not intended to develop or generate a new theory, hence there was no need to achieve any theoretical target for data saturation (Varpio *et al.*, 2017).

A total of 35 participants attended the session, which included two AAC users. Each participant was given an information sheet and signed a consent form prior to or during the workshop session. The professional background or reasons for attending the workshop were not collected, although it was noted that there were AAC users and family members in attendance, as well as developers clinicians and educators. Prior to the session, an attendee asked for a show of hands to indicate who had used ChatGPT, most of those present raised their hands.

Materials and Data Collection

The workshop was held in a theatre, with delegates seated in the audience and the researchers chairing from the stage. The session was recorded using the room microphones, connected via the sound desk to an instance of *Microsoft Teams*, which was used to record the session and produce preliminary transcripts. A backup recording was taken using a mobile phone microphone angled towards the audience. The session lasted 45 minutes. The researchers gave a short introduction to the workshop, outlining the terminology and assumptions made to ensure that the discussion was both accessible and bounded.

The discussion was framed by the research team as being timely, considering the recent rapid growth in large language models (LLM) such as ChatGPT (OpenAI, 2023), Bard (Google, 2023) and Copilot (Microsoft, 2023) and that the increased public awareness of such systems corresponded with many AAC developers looking to integrate the technology into their systems. The research team proposed that whilst this is not an entirely new technology, perhaps the way it is being applied has changed. The research team affirmed that the output of the workshop would be used to inform what the team will do next and possibly what others may do next. The research team shared that, based on their experience, current writing about AI in AAC is largely speculating on its potential, with little exploration of its use, leading the research team to conclude that the use of AI in AAC is under-researched.

The research team described that the intention of the workshop was to focus on the use of AI *by, with or for AAC users* with a view to increasing text input speed or and richness of output. The discussion was therefore organised around two potential uses for AI:

Acceleration

Rate enhancement for prediction or retrieval:

- Increasing the speed of word, sentence and phrase construction
- Use of word prediction engines
- Retrieval, contextually based on things that have been said before

Generation

Linguistic enhancement, based on expansion from limited inputs:

- Augments or elaborates on the smaller inputs that the user creates
- Can also use environmental data:
    - Where the user is - geolocation
    - What the device sees - machine learning real time analysis of a camera input

Other uses of AI such as enabling people with disabilities to generate images or videos from written prompts were therefore out of scope for this discussion. The remainder of the workshop consisted of group discussion of five prompt questions, each of which was introduced by the researchers and projected on the screen for the duration of the discussion. The prompt questions used were:

1. What are the opportunities for AI to support AAC users?
2. How might you see these opportunities being realised?
3. What do you see as the risks for the use of AI to support AAC users?
4. How would you propose mitigation of the risks?
5. Do you think a code of practice is helpful, and if so, what should it contain?

Participants raised their hands to signal a wish to contribute, with the researchers selecting contributors in order. The researchers made attempts to balance the contributions of individuals, so that no one contributor or group of contributors dominated the discussion. Whilst the researchers made active attempts to elicit responses from the AAC users in the room, by providing extra time and checking with them after each question, there were no contributions from either of the AAC

users who attended the session. Participants were invited to email the authors with any additional comments following the session, and one email response was received from one of the AAC users who attended.

Data Analysis

Data were analysed using a coding system based on the principles of content analysis (Silverman, 2020). The focus group recordings were initially transcribed automatically using the built-in transcription facility within *Microsoft Teams*. These transcripts were then reviewed and corrected by the second author, using the mobile phone backup recording as a reference to verify any inaudible or incorrectly transcribed sections. This review also served to better familiarise the second author with the data. Preliminary coding followed, again by the second author, resulting in the generation of 24 individual codes. Examples of each code were then presented to the first author for review. Three sessions of code review between the first and second author then took place, during which the coding template was reviewed and refined, resulting in a final template of 12 main codes. Because of the high level of consensus on the coding between the two authors, subsequent coding was not undertaken.

Findings

Findings are presented as descriptive interpretations of each code. A full list of the codes and the sub-codes under each is presented in Table 1. Direct quotes from participants have been included to provide an indication of the content of each code.

[Table 1 APPROXIMATELY HERE]

Bias

Bias in AI systems was the most frequently raised topic, with 11 instances identified. Participants expressed concerns about the inherent, coded biases known to be present in existing AI systems, and how these might result in homogeneous output for AAC users. Several users viewed this through the lens of ableism, with AI posing a risk to the individuality of users if not properly implemented.

> *Could this actually end up having some kind of ableness slant, which tries to shift the culture of AAC and the uniqueness about why people communicate […] we really need to retain that and grow this culture and identity that we've got with non normative voices. So it's definitely an amazing tool, but it could end up being some kind of ableist [tool to] get everybody to talk in that societal norm.*

The group foregrounded ideas that might address this challenge, including the use of AAC users' data to train AI models specifically for use in AAC systems. This was proposed as a way to reduce algorithmic or ableist bias. Replacing generic training data in an AI model that is to be used in AAC systems with AAC users' data means that predictions or generation will be based on what AAC users are saying rather than what the general population might say. A participant, who identified themselves as an AAC developer, discussed the difficulty resulting from the small sample size due to the relatively small number of AAC users, and the challenges of enabling commercial companies to pool their data to realise this solution. How this is done, and by whom, was also the subject of discussion, with concern expressed around centralising the data collection on the AAC services.

Another method proposed to avoid coded bias was to enable users to adjust settings in the AAC system which alter the output of the AI model to emphasise a given style, such as making the generated text more playful.

> *"Thinking about AI as being playful rather than [a] tool? Because I think […] it being a tool gives it a really rigid black box structure that people don't know what it does, and they can't change the settings, if you could actually allow people [to manipulate the output it] takes them in different ways, [which] aren't just about any goal fixing but much more about playful exploration."*

One participant emphasised the need to be aware that biases already exist in AAC systems, as they have in the past been designed and developed with minimal user consultation. The resulting concern was that the use of AI models could "amplify" such biases even further.

Ownership

Participants identified concerns related to a sense of ownership of the output of AAC systems making use of AI models, with eight occurrences of this code identified. Three instances were directly related to ensuring the identity, voice or words produced were authentically those of the user.

> *"[ChatGPT] comes back in not my style of writing. It could very easily generate text but whether it matches the persons way of writing, identity?"*

Two participants identified concerns around authorship and specifically cited the need to avoid the outputs of AI being misattributed to users. Parallels were drawn with the discredited technique facilitated communication where authorship of output is attributed to the user but overwhelmingly found to represent the thoughts of a facilitator (Schlosser *et al.*, 2014). Participants expressed

concerns that AI generated outputs could be perceived as a representation of a user's thoughts or abilities, whereas this might not in fact be the case:

> *"So I think there is a risk related to authorship: the obvious thing is who owns the words that are coming out of any device. That is a risk with generative AI full stop. [We] need to grasp the meaty issue of what authorship is [now, because this] is a substantively different risk, but also it is a substantially better opportunity. It feels like we could run away from that conversation again a bit, but [...] I think if we ignore the role of AI, potentially it will be like facilitated communication, or for what it means in terms of authorship."*

Participants proposed that one possible solution to this might be for users to have the option to turn off the AI functionality altogether.

Moving the Field Forwards

This code groups together instances where participants identified a perceived need for development that could advance the integration of AI existing or novel AAC systems. A single participant identified that avoiding commercially driven segregation of data would be positive.

> *"[Getting] suppliers involved so that they are all giving data to the same project. Because where I work it is quite difficult, sometimes the suppliers are very segmented, so if you were looking at AAC as a whole, trying to collect and combine everybody's data [in] one place so we can get the best idea of what we are trying to create."*

One participant identified that there was an imperative for AAC users to use AI, asserting that this was their right, as the general population have access. It was suggested that managing expectations of communication partners around the potential for AI was important:

> *"Are people going to become more impatient? Could it emphasise more of that? Sort of bad listening from people?"*

A subtheme was identified of ensuring data protection, with a discussion around the acceptance of AI listening to conversations or using camera input within a school setting being unacceptable for data protection compliance.

> *"I think there's a pretty large area [...] of privacy and data risks if you're taking in those contextual cues to use: that means using cameras and video recording.*

Taking a school environment, I don't know how well that would go down with people, being recorded all the time […] would be a major barrier to getting it through."

Two participants proposed that further research was needed. In recognition of the early stage of existing work in the field, smaller scale studies were suggested:

"Opportunities might be realised through single case studies where people can consent to us getting inside that box [to understand] how they do generate things because […] AI can offer us an insight into what language hasn't been learned yet and what opportunities there are for learning by what is or isn't being routed or accessed."

Participants also called for the community to propose work that would inform evidence-based government policy or legislation.

Explainable AI

Six instances where participants identified the need for transparency of how algorithms or AI models worked were coded.

"I think we need to know more about what the algorithms (for want of a better term) are doing for generation. [..] because if we don't know that, you don't know […] the bias [that] is going into this into the data."

"We want to be able to know how the systems [are] created and understand it, and I think transparency [is how] you do that."

The transparency of how the models work was contextualised as users being able to see inside the black box: a metaphor used to represent the hidden mechanisms by which language output is generated. Having models presented in an accessible or understandable way was proposed as an important step to acceptance of the technology.

"[We need to] find a way of explaining what's going on in the black box in accessible ways, […] at whatever level: [supporting] understanding of what's happening."

The idea that increased transparency would support social acceptance of AI equipped AAC systems was also included in the discussion.

Development of Code of Practice

Three participants commented on what the content of any proposed code of practice should be. One participant asserted that a code of practice would be unhelpful, as it would be too long if it had to cover all possible uses of AI.

> *"[I] currently stand on the side of not thinking that the Code of Practice is helpful. But that's only because I think everybody would have a different idea of what they're thinking the outcomes of integrated AI is in their line of work. So unless it's like a 12,000-page document I don't think currently, it's super helpful to have the one code, but I do think everybody should be taking it away and having those discussions in their teams […] and then later all those could be compiled."*

A single participant indicated that a code of practice must be positive and allow exploration.

> *"The implementation of AI at the moment is very immature, it is in that phase where we don't really know where it is going to go, there are so many open doors out there, which ones are you going to walk through? I think the initial Code of Practice needs to allow that flexibility, so I think it's got to focus on the exploration and […] value, rather than the mechanics of what we can't do: "Don't do this". [It] needs to be a positive Code of Practice rather than a restrictive Code of Practice."*

One participant proposed that a Code of Practice should be simple in order for it to be utilised, and went on to consider its ownership, identifying support for AAC users to own the code of practice as a crucial part of development:

> *"I think it needs to be very simple so that services can implement it really, really, clearly and develop their own policies around it […] I think it needs to be values driven. I really think it needs to be created by AAC users, by the people who are going to use it."*

Ownership of the Code of Practice was raised three times, with questions asked about who would potentially manage its operation.

> *"You need to agree who [owns] the code of practice, or who is going adopt [it]. It is a good idea that everyone contributes […] it needs to be adopted as a code of practice, as otherwise you have got potential for it to not be adopted [by others not involved in its creation]"*

Speed / Rate Enhancement

Rate enhancement was identified five times, with two of these instances linked to reducing the effort required for AAC users to create their intended message.

> *"For me it's about […] the hope that reducing the effort that people need to put in, especially if we are talking about [contextually aware systems] so that it creates much quicker opportunities for commenting and choice making and context for asking questions about the environment and can generate context-based language cues rather than just have to do it from the [vocabulary options already available in the system]."*

Risk Management

Risk management was identified on three occasions by participants. One of these occasions focussed on how to control for uncertainty brought about by the rapid pace at which the technology is developing:

> *"Once [AI technology is] on the shelf, it's already obsolete. So what's the next phase of AI? And do we know what's coming? How do we identify what the risks are? Not very helpful set of questions, but I'm really struggling to come up with how [to] mitigate for things that I know now, but [also] things that might be coming that we don't yet understand?"*

One participant considered developing an AI specific risk assessment process and another participant considered how to support users to take limited risks.

> *"Not really knowing how to mitigate the risks, how do we balance not trying to constrain it too much so that people can explore the potential, whilst also looking at what the potential risks are and not unwittingly making it too risky?"*

Other Uses for AI

Two alternative uses for AI beyond rate enhancement and linguistic enhancement of AAC systems were proposed by participants. Two instances were identified where participants discussed using AI to support automatic symbolisation of a conversation to support understanding.

> *"I'm wondering if it's an opportunity [to] open up a learning system, rather than just passively being taught? If AI can automatically generate [symbol*

translations] in Blissymbolics, for example, it would be a lovely learning tool to learn naturally."

One instance where an AI system could be used to provide analytics to support planning an intervention was also identified.

Training / Competency

Three instances of participants discussing training in AI for members of the AAC workforce were surfaced. One of these instances identified the need to train the general workforce:

"Within a school there can be the people who can be very technophobic, who are providing […] support for AAC users and actually that "hearts and minds" work is gonna be really, really important quickly. This stuff is really long term, like having the pandemic, being online […]. Some of our staff members are still really, really stressed about being in [Microsoft Teams] meetings […] Not all of our staff members have access to computers because they are doing a hands-on role throughout the day and they're going to build barriers [to the use of AI]. We are asking people to support with the use of generative tools, and they have very little opportunity to do it outside of when they're expected to support an AAC user"

Two instances were identified where participants proposed the need for technology specialists to be trained to support AAC systems that include AI, rather than the support and implementation of the technology defaulting to existing job roles:

"What we're going to need is a network of people who have enough knowledge to help through these "hearts and minds" barriers and understand what's happening with the AI […] I'm wondering, will there really be [a], computer on every desk, assistive technologists, clinical scientists in every team? Because otherwise it's gonna fall to speech therapy staff, [left] to struggle with their 'Radio 4' knowledge of AI. Well that's the anxiety."

"If all tertiary centres all had AI or technology specialists who weren't just assistive tech OT's, but specifically around managing issues like […] creating spaces around using AI, [making] it part of the structure of the teams and not just an adjunct that is brought in where we have a couple of hours spare."

Linguistic Enhancement

There were three instances of participants identifying linguistic enhancement, specifically about improving vocabulary selection:

> *"[…] this gives us an opportunity to put some ideas together and [much more quickly] create the bulk of the text based on [the user's] ideas."*

> *"[…] I wonder if you can use AI to start forming an evolving instead of static communication [system]?"*

> *"[…] One of the issues we have is that a lot of the AAC contains very basic language and finding a way to actually enrich the language [For example] If she uses the word, great, but [what if] she wants a word that is more descriptive?"*

Financial Cost / Exclusion

The potential for increased costs was identified by two participants, linked to the potential for users to be excluded from accessing certain AAC systems that make use of AI due to the increased financial cost.

Standards and Interoperability

One participant proposed that the field of AAC has an opportunity to inform or contribute to the development of standards that encourage interoperability between systems, or which limit the functionality of AI tools. This was linked by the group to how any such standards might later be imposed through the enactment of policy or legislation. An AAC user who emailed the research team following the session highlighted the risks of generic legislation negatively impacting AAC users unintentionally through a lack of awareness in policymakers and legislators:

> *"Most of the British population and the government don't actually know what AAC is, so I would make a suggestion that [Communication Matters and the research team] create a letter that each AAC user, parent, etc., can download and send to their MP, to inform them of the crucial use of AI, in the AAC field."*

It was felt that contributing to any such development at an early stage would ensure that the views of the AAC community were integrated into broader, more general standards.

Discussion and Implications

This study provides some insight into how the UK AAC community perceives the risks and benefits of AI for rate enhancement and novel language generation. The study also provides a starting point for discussions about whether a Code of Practice is something that the community considers helpful, and the potential content of any such Code. The following discussion is centres on each of the research questions in turn, highlighting the findings of the study alongside the implications of these for the for the field of AAC. The potential value contributions of including AI in AAC systems are presented alongside the perceived risks and benefits for users highlighted by participants.

What does the UK AAC community perceive to be the benefits and risks of the use of AI in AAC systems?

Workshop participants identified that there are potential benefits to using AI in supporting AAC users to increase their rates of word or phrase construction. The research literature already contains examples of considerable improvements in output rates when AI tools are applied to the task of reducing the number of selections required to produce words and sentences (Farzana *et al.*, 2021; Shen *et al.*, 2022) and the similarity of this application of AI to existing AAC word prediction and phrase generation functionality may explain the group's focus on this area. The perceived gains were balanced with concerns about the need to ensure AAC users retained authentic ownership of the output generated by AI systems. Ensuring that AAC outputs accurately represent the thoughts and intentions of users is a long-standing discussion in the field of AAC. The advent of AI that can generate extensive and potentially complex output from relatively minimal prompting is an extension of this discussion, although the concept itself and the concerns about "putting words in users mouths" are not in themselves new: Waller (2019) documents that similar concerns were raised about word prediction when it first appeared in the 1990s. As the technology found mainstream adoption, these concerns receded and the integration of word prediction into text-based AAC systems is now commonplace. Mechanisms to ensure users' ownership of the output were considered important by the group, to avoid similar authorship concerns to those linked to discredited approaches such as facilitated communication.

The risk that AI generated output is subject to a range of biases was discussed extensively by participants. Where large language models are trained on data typically generated by non-disabled sources, there is a risk that outputs generated for AAC users could unwittingly carry an ableist "slant". Concerns about the biases which appear "baked in" to existing applications of AI are well

documented (Akter *et al.*, 2022), and it has been reported that ableist bias is amongst those most amplified by AI systems involved in employee screening, for example (Moss, 2021). For AAC users in particular, there exists a risk that use of AI language generation tools may result in the erosion of the unique characteristics of an individual's utterances and outputs, since AI functions by being biased against anything outside the average, or anything that presents as an outlier – potentially correcting as "wrong" something that an AAC user may have intentionally constructed. It was proposed that, by using AAC users data to train AI models specifically for AAC systems, the ableist bias inherent in existing large language models might be addressed. Curation of such datasets is complicated and time consuming, but fits with the increasing awareness of a need for human-centric AI – where human input is used "collaboratively" with AI models to consciously mitigate against biases (Harfouche, Quinio and Bugiotti, 2023).

What safeguards may be needed?

The need for comprehensive risk assessment around the use of AI was proposed by some participants in the group, although there were also expressions of the need for AAC users to be able to explore or "play" with the technology. This reinforces the need for proportional risk mitigations that are not unfairly punitive to people with communication disabilities who, participants agreed, should be supported to explore this technology in the same ways as their non-disabled peers.

Participants expressed the importance that AI tools were understood by those using them, and by those charged with implementing them. In the broader literature, this relates to the concept of "Explainable AI" (XAI): the practice of finding human-understandable justifications for an AI system's behaviour (Adadi and Berrada, 2018; The Royal Society, 2019). Two distinct facets of this discussion emerged in this research. Firstly, multiple participants shared concerns about the "black box" nature of many AI systems, feeling that not knowing or fully understanding how they worked made the risks harder to assess and control. Of specific relevance to the AAC community, participants stressed the need for users to be presented with information at an appropriate level to their understanding, allowing them to make informed decisions about the use of AI technology. Secondly, there were expressions of concern about how the existing workforce may be expected to support this technology. Several authors (Ehsan *et al.*, 2023) have highlighted the socio-technical gap created by AI systems, characterised by Ackerman as "the divide between what we know we must support socially and what we can support technically" (Ackerman, 2000, p.180). This gap is exacerbated in AAC, with participants in this study highlighting an already existing skills gap in the field: some staff charged with supporting assistive technology and AAC may not have appropriate or adequate training opportunities, which is again reflected in the broader literature (Anderson,

Balandin and Stancliffe, 2016; Wallis, Bloch and Clarke, 2017; Karlsson, Johnston and Barker, 2018; Edyburn, 2020). The advent of a complex technology such as AI, and the risks that are perceived to accompany it, was felt to underline the need for technology specialists with specific skills, competencies and training (Slaughter, Waller and Griffiths, 2023). Participants in the present study felt it was important that the support of this technology did not simply default to existing staff groups who may not have the expertise to properly and safely support it, and who may already have overloaded work schedules. Training and upskilling of the general workforce was also proposed as an important component in safely and effectively implementing AI technology.

Participants spoke to the need for any use of AI to comply with existing legislation such as data protection, and it was acknowledged that any work around AI in AAC systems will be subject to future government AI policy or legislation. Concerns around how systems which gather context data (video and audio recording, GPS location etc.) could be managed without breaching the privacy of AAC users and communication partners were raised during the session. Although context-aware AAC systems have been proposed in the existing literature (Kristensson *et al.*, 2020), Valencia and colleagues (2023) reported on the concerns of AAC users about where their speech output was going, and with whom it was being shared. Participants in this study identified that proactive engagement at the policy level was desirable to ensure the AAC community's expertise and experience is embedded in any future regulation, legislation or new legal precedent.

Does the UK AAC Community perceive there to be a need for a Code of Practice for those planning to integrate AI into AAC systems, and what should such a Code contain if so?

Participants in this study generally welcomed the idea of creating a Code of Practice around the adoption of AI in AAC systems. This work used an opportunity sample of participants, however it is considered that this was appropriate to answer the research questions, given the high information power of the participants (Malterud, Siersma and Guassora, 2016) – with those attending the session having extensive knowledge and experience in the subject area.

Some participants queried the practicalities of collating such a document, citing the many different applications and contexts in which AI could be used to support AAC users and the rapid pace of change in the technology. Concerns were expressed that a Code of Practice would either be too specific, or would be immediately out of date, with one participant concerned that it would be impossible to know what AI technology would look like in even the relatively near future. Perhaps

because of this, there was comparatively little discussion within the group of the potential content of a Code of Practice. Some participants argued for a Code that was relatively simple, more similar perhaps to a set of guiding principles. Others felt that the complexity of the technology should result in a more in-depth framework with sufficient nuance to acknowledge the multitudinous uses of AI in AAC technology. This is similar to the approach taken by the G7 and the European Commission in the *International Code of Conduct for Organizations Developing Advanced AI Systems*, which sets out suggested actions for organisations to take "in a manner that is commensurate to the risks" (European Commission, 2023, p.2). It was proposed that a Code of Practice for AI in AAC should be framed positively, highlighting the potential of AI to add value, rather than limiting its use and creating barriers to AAC users exploring the technology.

It was identified that the development and ownership of any code may be linked to whether it is accepted and how it is adopted. A Code of Practice developed by professionals and then imposed "top-down" would, it was felt, not be effective. Rather, it was proposed that AAC users should "own" the Code of Practice, or should be actively involved in leading its development.

The findings from this part of the study support the exploration of developing a Code of Practice, as well as identifying some potential content and how any code might be introduced and managed.

Conclusion

This work suggests that the UK AAC community sees the potential for AI to be used for both rate and linguistic enhancement in AAC systems, balanced against a strong desire to ensure that such systems do not propagate or further entrench existing biases. It was strongly identified that AAC users must have authorship and ownership of the output of AAC systems that include AI. Methods to address these concerns included the use of AAC users data to train AI models and enabling users to switch off AI tools altogether. Ensuring transparency through explainable AI was also proposed as a way of improving the social acceptance of the technology. Training of both the general and specialist technology workforce was proposed to support the integration and use of AI technology in AAC systems. The community is open to further research and sees this as being helpful in supporting future evidence-based AI policy making.

The present study does have some limitations, which the authors propose should be addressed through future work. The participants in this research constitute an opportunity sample, being delegates attending a conference who chose to attend the advertised session. More targeted recruitment through purposive sampling should be considered for any further work in this area, to

ensure that the views of all stakeholder groups are represented. In particular, although two AAC users attended the session neither contributed to the discussion at the time, and only one contacted the research team subsequently. This means the crucial voice of the AAC user is still unexplored in this discussion – something that was proposed as an issue with current AAC devices by some members of the group. It is suggested that further sessions run specifically for AAC users would facilitate the exploration of this topic by adding the opinions of this most important stakeholder group. The session was time-limited by its position within the conference schedule and the authors acknowledge that this study represents the start of a conversation; a way to give an overview of the opinions of the AAC community, rather than a comprehensive overview of attitudes in the field. Further consultation through focus groups and surveys should be conducted to provide more in-depth understanding of the attitudes in this sector, or the differences in attitude between stakeholder groups. In particular, the study has identified a feeling that a Code of Practice may be needed to support the integration of AI into AAC systems, but it is clear that there is further work to be done to identify content of such a Code, as well as discussing the stakeholder groups who should contribute to its ownership and maintenance.

References

Ackerman, M.S. (2000) 'The Intellectual Challenge of CSCW: The Gap Between Social Requirements and Technical Feasibility', *Human–Computer Interaction*, 15(2–3), pp. 179–203. Available at: https://doi.org/10.1207/S15327051HCI1523_5.

Adadi, A. and Berrada, M. (2018) 'Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI)', *IEEE Access*, 6, pp. 52138–52160. Available at: https://doi.org/10.1109/ACCESS.2018.2870052.

Akter, S. *et al.* (2022) 'Algorithmic bias in machine learning-based marketing models', *Journal of Business Research*, 144, pp. 201–216. Available at: https://doi.org/10.1016/j.jbusres.2022.01.083.

Anderson, K.L., Balandin, S. and Stancliffe, R.J. (2016) '"It's got to be more than that". Parents and speech-language pathologists discuss training content for families with a new speech generating device', *Disability and Rehabilitation: Assistive Technology*, 11(5), pp. 375–384. Available at: https://doi.org/10.3109/17483107.2014.967314.

Baxter, S. *et al.* (2012) 'Barriers and facilitators to the use of high-technology augmentative and alternative communication devices: a systematic review and qualitative synthesis: AAC barriers and facilitators review', *International Journal of Language & Communication Disorders*, 47(2), pp. 115–129. Available at: https://doi.org/10.1111/j.1460-6984.2011.00090.x.

Blackstone, S.W., Higginbotham, D.J. and Williams, A.W. (2002) 'Privacy in the Information Age: Unique Issues for AAC Users', *The ASHA Leader*, 7(20), pp. 1–13. Available at: https://doi.org/10.1044/leader.FTR1.07202002.1.

Brown, T.B. *et al.* (2020) 'Language Models are Few-Shot Learners'. arXiv. Available at: https://doi.org/10.48550/ARXIV.2005.14165.

Callan, D. and Foster, J. (2023) 'How interesting and coherent are the stories generated by a large-scale neural language model? Comparing human and automatic evaluations of machine-generated text', *Expert Systems*, 40(6), p. e13292. Available at: https://doi.org/10.1111/exsy.13292.

Campos, I. (2023) 'OpenAI API Pricing in Words per Dollar', *Sopmac Labs*, 22 January. Available at: https://medium.com/sopmac-labs/openai-api-pricing-in-words-per-dollar-9eeac857aee7 (Accessed: 25 January 2024).

Cross, R.T. and Segalman, B. (2016) 'The Realize Language System: An Online SGD Data Log Analysis Tool', *Assistive Technology Outcomes and Benefits*, 10(1), pp. 74–93.

Edyburn, D.L. (2020) *Rapid literature review on assistive technology in education: Research report*. Research Report DFERPPU/2019/038. Department for Education.

Ehsan, U. *et al.* (2023) 'Charting the Sociotechnical Gap in Explainable AI: A Framework to Address the Gap in XAI', *Proceedings of the ACM on Human-Computer Interaction*, 7(CSCW1), pp. 1–32. Available at: https://doi.org/10.1145/3579467.

European Commission (2021) *Proposal for a Regulation of the European Parliament and of the Council laying down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts*, *2021/0106/COD*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206 (Accessed: 25 January 2024).

European Commission (2023) 'Hiroshima Process International Code of Conduct for Organizations Developing Advanced AI Systems'. European Commission.

Farzana, W. *et al.* (2021) 'Technological Evolvement in AAC Modalities to Foster Communications of Verbally Challenged ASD Children: A Systematic Review', *IEEE access*, pp. 1–1.

Garcia, L., de Oliveira, L. and de Matos, D. (2014) 'Word and Sentence Prediction: Using the best of the two worlds to assist AAC users', *Technology and Disability*, 26(2–3), pp. 79–91. Available at: https://doi.org/10.3233/TAD-140406.

Google (2023) 'Bard'. Available at: https://bard.google.com/chat.

Gosnell, J., Costello, J. and Shane, H. (2011) 'Using a Clinical Approach To Answer "What Communication Apps Should We Use?"', *Perspectives on Augmentative and Alternative Communication*, 20(3), pp. 87–96. Available at: https://doi.org/10.1044/aac20.3.87.

Griffiths, T. *et al.* (2019) 'Alternative and Augmentative Communication', in *Handbook of Electronic Assistive Technology*. Elsevier, pp. 181–213. Available at: https://doi.org/10.1016/B978-0-12-812487-1.00007-7.

Harfouche, A., Quinio, B. and Bugiotti, F. (2023) 'Human-Centric AI to Mitigate AI Biases: The Advent of Augmented Intelligence', *Journal of Global Information Management*, 31(5), pp. 1–23. Available at: https://doi.org/10.4018/JGIM.331755.

Herbold, S. *et al.* (2023) 'A large-scale comparison of human-written versus ChatGPT-generated essays', *Scientific Reports*, 13(1), p. 18617. Available at: https://doi.org/10.1038/s41598-023-45644-9.

Judge, S. and Townend, G. (2013) 'Perceptions of the design of voice output communication aids', *International Journal of Language & Communication Disorders*, 48(4), pp. 366–381. Available at: https://doi.org/10.1111/1460-6984.12012.

Karlsson, P., Johnston, C. and Barker, K. (2018) 'Influences on students' assistive technology use at school: the views of classroom teachers, allied health professionals, students with cerebral palsy and their parents', *Disability and Rehabilitation: Assistive Technology*, 13(8), pp. 763–771. Available at: https://doi.org/10.1080/17483107.2017.1373307.

Koester, H.H. and Arthanat, S. (2018) 'Text entry rate of access interfaces used by people with physical disabilities: A systematic review', *Assistive Technology*, 30(3), pp. 151–163. Available at: https://doi.org/10.1080/10400435.2017.1291544.

Konadl, D. *et al.* (2023) 'Artificial Intelligence in Augmentative and Alternative Communication Systems - A Literature-Based Assessment and Implications of Different Conversation Phases and Contexts', in *ECIS2023 Research Papers*. *31st European Conference on Information Systems (ECIS)*, Kristiansand, Norway: Association for Information Systems, pp. 1–18. Available at: https://aisel.aisnet.org/ecis2023_rp/309 (Accessed: 16 November 2023).

Kristensson, P.O. *et al.* (2020) 'A Design Engineering Approach for Quantitatively Exploring Context-Aware Sentence Retrieval for Nonspeaking Individuals with Motor Disabilities', in *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. *CHI '20: CHI Conference on Human Factors in Computing Systems*, Honolulu HI USA: ACM, pp. 1–11. Available at: https://doi.org/10.1145/3313831.3376525.

Malterud, K., Siersma, V.D. and Guassora, A.D. (2016) 'Sample Size in Qualitative Interview Studies: Guided by Information Power', *Qualitative Health Research*, 26(13), pp. 1753–1760. Available at: https://doi.org/10.1177/1049732315617444.

Microsoft (2023) 'Copilot'. Available at: https://copilot.microsoft.com/.

Moss, H. (2021) 'Screened Out Onscreen: Disability Discrimination, Hiring Bias, and Artificial Intelligence', *Denver Law Review*, 98. Available at: https://doi.org/10.2139/ssrn.3906300.

Murray, J. *et al.* (2020) 'The decision-making process in recommending electronic communication aids for children and young people who are non-speaking: the I-ASC mixed-methods study', *Health Services and Delivery Research*, 8(45), pp. 1–158. Available at: https://doi.org/10.3310/hsdr08450.

OpenAI (2023) 'ChatGPT'. Available at: https://chat.openai.com/.

Schlosser, R.W. *et al.* (2014) 'Facilitated Communication and Authorship: A Systematic Review', *Augmentative and Alternative Communication*, 30(4), pp. 359–368. Available at: https://doi.org/10.3109/07434618.2014.971490.

Seale, J.M., Bisantz, A.M. and Higginbotham, J. (2020) 'Interaction symmetry: Assessing augmented speaker and oral speaker performances across four tasks', *Augmentative and Alternative Communication*, 36(2), pp. 82–94. Available at: https://doi.org/10.1080/07434618.2020.1782987.

Sennott, S.C. *et al.* (2019) 'AAC and Artificial Intelligence (AI)', *Topics in Language Disorders*, 39(4), pp. 389–403.

Shen, J. *et al.* (2022) 'KWickChat: A Multi-Turn Dialogue System for AAC Using Context-Aware Sentence Generation by Bag-of-Keywords', in *27th International Conference on Intelligent User Interfaces. IUI '22: 27th International Conference on Intelligent User Interfaces*, Helsinki Finland: ACM, pp. 853–867. Available at: https://doi.org/10.1145/3490099.3511145.

Silverman, D. (2020) *Interpreting Qualitative Data*. 6th edn. Los Angeles London New Delhi Singapore Washington, DC Melbourne: SAGE.

Slaughter, R., Waller, A. and Griffiths, T. (2023) 'MSc Educational Assistive Technology: Training an Emergent Professional Group', in D. Archambault and G. Kouroupetroglou (eds) *Assistive Technology: Shaping a Sustainable and Inclusive World*. *17th International Conference of the Association for the Advancement of Assistive Technology in Europe*, Paris, France: IOS Press, pp. 461–468. Available at: https://doi.org/10.3233/SHTI230661.

The Royal Society (2019) *Explainable AI: The Basics*. Policy Briefing DES6051. The Royal Society, p. 32. Available at: https://royalsociety.org/-/media/policy/projects/explainable-ai/AI-and-interpretability-policy-briefing.pdf (Accessed: 25 January 2024).

Valencia, S. *et al.* (2023) '``The less I type, the better'': How AI Language Models can Enhance or Impede Communication for AAC Users', in *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. *CHI '23: CHI Conference on Human Factors in Computing Systems*, Hamburg Germany: ACM Press. Available at: https://dl.acm.org/doi/10.1145/3544548.3581560 (Accessed: 20 April 2023).

Vallance, P. (2023) 'Pro-innovation Regulation of Technologies Review – Digital Technologies'. UK Government. Available at: https://assets.publishing.service.gov.uk/media/64118f0f8fa8f555779ab001/Pro-innovation_Regulation_of_Technologies_Review_-_Digital_Technologies_report.pdf (Accessed: 25 January 2024).

Varpio, L. *et al.* (2017) 'Shedding the cobra effect: problematising thematic emergence, triangulation, saturation and member checking', *Medical Education*, 51(1), pp. 40–50. Available at: https://doi.org/10.1111/medu.13124.

Waller, A. (2019) 'Telling Tales: Unlocking the Potential of AAC Technologies', *International Journal of Language & Communication Disorders*, 54(2), pp. 159–169. Available at: https://doi.org/10.1111/1460-6984.12449.

Wallis, S., Bloch, S. and Clarke, M. (2017) 'Augmentative and alternative communication (AAC) training provision for professionals in England', *Journal of Enabling Technologies*, 11(3), pp. 101–112. Available at: https://doi.org/10.1108/JET-10-2016-0023.

Table 1 - Themes and subthemes identified during transcript analysis

Main Code (Instance)	***Subcodes (Instance)***	***Description***
Bias (11)	Algorithmic bias addressed by using AAC users data to train the model (7) Other ableist / coded bias (4) Recognising where the bias already exists in AAC and AAC development. (1) Allows users to experiment with user adjustment the settings / Avoiding coded bias by enabling settings to be changed (by the users). (2) Homogenisation of the AAC users voice due to models being trained using ableist data? (1)	Related to ways in which AI is perceived to be enforcing ableist or other biases, and proposed solutions to address this concern.
Ownership (8)	Ensuring ownership (4) Authorship (2) Homogenisation (1) Control (1)	Related to ensuring the output from any AAC system is authentically the user's voice.
Moving the field forwards (7)	Identifying good practice (1) Avoiding commercial segmentation (1) Right to use (1) Managing communication partner expectations (1) Data protection (1) Building the evidence base (2)	Perceptions of what actions are required by the community to responsibly advance the use of AI in AAC systems.
Explainable AI (6)	-	Calls for transparency in how AI models are developed, described and used to ensure that all stakeholders can make informed decisions about if and when to use a given AI.
Development of Code of practice (6)	Content (3) Ownership (3)	Suggestions on the development, positioning and content of a code of practice and the ownership thereof.
Speed / rate enhancement (5)	Rate enhancement (3) Reduced effort (2)	Comments on the use of AI to support rate enhancement, including prediction and retrieval methods.
Risk Management (3)	Uncertainty (1) AI Specific risk assessment (1) Supporting users to take informed risks (1)	Related to the management of risks associated with AI.

Other uses for AI (3)	Automatic symbolisation (2) Data analytics supporting intervention (1)	Alternative uses for AI suggested by participants, beyond rate and linguistic enhancement.
Training / competency (3)	Specialist (2) General (1)	Identification of the need for training focused on AI
Linguistic enhancement (3)	-	Comments on the use of AI to support linguistic enhancement, including generation and expansion from a limited prompt.
Standards and interoperability (3)	-	Related to implementing standards, regulation and legislation to support interoperability.
Financial cost / exclusion concern (2)	-	Related to the cost of AI, and the potential for these costs to lead to financial exclusion.