An Introduction to the ANAWC

The AAC and Non-AAC Workplace Corpus

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This paper presents an overview of the Augmentative and Alternative Communication (AAC) and Non-AAC Workplace Corpus (ANAWC) (Pickering & Bruce, 2009). The corpus is the first resource of its kind that makes it possible to systematically study the typical language patterns of both AAC users and comparable non-AAC users in the workplace. We discuss the origin of the corpus and give an account of the methodology used for its collection and transcription. We also introduce several publications that demonstrate the novel quantitative and quantiative findings that can be generated on the basis of the corpora. This kind of research will be crucial to guide future developments in AAC development for workplace applications.

Keywords: Augmentative and Alternative Communication, workplace corpus, collection, annotation procedures

1. Introduction

The Augmentative and Alternative Communication (AAC) and Non-Augmentative and Alternative Communication (Non-AAC) Workplace corpus was collected in 2009. Its collection was funded by Georgia State University and the research team was led by Lucy Pickering, Department of Applied Linguistics, Georgia State University and Carrie Bruce, School of Interactive Computing, Georgia Institute of Technology. It was conceived as a specialized corpus focused on the workplace experiences of AAC device users in comparison to their non-AAC using counterparts in similar working environments. It comprises over 200 hours of spoken interaction (approximately one million words) involving eight focal participants and more than 100 interlocutors in seven different workplace

locations. Focal participants comprised four AAC users and four non-AAC users who were provided with an audio-recorder and asked to record their workplace interactions. AAC devices are used by people with complex communication needs who have some form of dysarthria (difficult or unclear articulation) or who are no longer able to speak due to developmental or acquired disorders such as cerebral palsy or motor neurone disease (also known as Amyotrophic Lateral Sclerosis or ALS). The devices are usually portable speech-generating technologies housed in laptops, tablets or smartphones that enable the user to create messages by selecting pictures, letters, words, or sentences and can be accessed using a range of methods such as keyboarding, eye gaze, or switch input. One such device is shown below in Figure 1.

Figure 1. A screenshot of the AAC device "Pathfinder"

There is a common misperception that these devices enable conversations that closely resemble natural speech (think, for example, of watching Professor Steven Hawking speaking at the 2012 Paralympic Games in London). These apparently fluid and efficient instances are usually the result of the speaker using pre-stored messages as opposed to creating real-time spontaneous utterances (Hill, 2001). In fact, devices are quite limited in terms of providing quick access to context-specific language (Bryen et al., 2007). The best devices may still only allow users to express up to 65 words per minute, which is considerably slower

than the average conversational rate of 180 words per minute (Dominowska, 2002; Tönsing & Alant, 2004; Venkatagiri, 1995). This has a negative impact on the effectiveness of communication and can be highly frustrating for AAC users (Beukelman & Mirenda, 1998; Hoag et al., 2004). It presents a particularly significant barrier in the workplace, where AAC users often struggle to meet spoken communication demands (McNaughton & Bryen, 2002.)

Despite developments in natural language processing (NLP), the improvement of prediction rates for workplace contexts is hampered by insufficient evidence regarding what workplace conversation looks like and what vocabulary should be represented (Balandin & Iacono, 1998; Bruce, 2008). Higginbotham et al. (2012) note that as NLP systems are trained on statistical input from very large text corpora in order to create word predictions, rather than on "genre-specific prediction", this can result in a mismatch between predictions and users' needs (Higginbotham et al., 2012:18). Thus, there has been a growing call for more "social validation studies", i.e. studies that focus on identifying core language patterns by investigating language users' experience within the specific context of interest (Bryen, 2008; Graves, 2000). Higginbotham (1990:84) further proposes that AAC research perform comparative studies that include not only AAC participants but which also "employ nondisabled subjects in order to construct performance distributions to which the performance of persons who are communicatively impaired can then be compared".

This project was undertaken to contribute to this area of investigation by providing a comprehensive and rigorous understanding of the typical language patterns of both AAC users and comparable non-AAC users in the workplace. This short paper introduces the ANAWC and includes information regarding its construction and the transcription and annotation schemes that are used. Finally, it briefly discusses current published research derived from the ANAWC and addresses some of the limitations of the corpus.

2.   Existing corpora of spoken workplace English

The ANAWC places itself in the context of spoken workplace corpora of English, but it is unique in terms of its focus on AAC speakers in the United States. Workplace spoken corpora of English are limited in number and rather heterogeneous in terms of word count, type and quantity of workplaces, and countries of data collection. Michael Nelson (2000) built one of the first corpora of workplace discourse, the Business English Corpus (BEC), which is comprised of both spoken and written texts. The spoken portion of the BEC is divided into "Talking about business" and "Speaking to do business", with the latter consisting of

job interviews, meetings, phone calls, etc. Simultaneously, scholars at Victoria University in New Zealand developed the Wellington Language in the Workplace Project (LWP) (see Holmes, 2000; Holmes & Stubbe; Stubbe, 2001), in which 2000 spoken interactions recorded in different New Zealand workplaces by the workers themselves have been collected.

Additional smaller corpora have been collected including the ABOT – American and British Office Talk corpus consisting of "generic stretches of talk" (Koester, 2010:24) from 66 office conversations totaling 34,000 words; and the CONIC (Construction Industry Corpus) collected across multiple countries and including mostly English as a lingua Franca interactions (Handford, 2017). Two much larger corpora are CANBEC – The Cambridge and Nottingham Business English Corpus, which consists of almost one million words of business discourse (Handford, 2010) and the Hong Kong Corpus of Spoken English (HKCSE). The HKCSE comprises four sub-corpora, one of which contains spoken business interactions mainly collected in Hong Kong hotels (Warren, 2004) and includes interactions as varied as job and placement interviews, informal office talk, meetings, and so on, involving both native and non-native English-speaking participants.

Table 1 summarizes the available corpora of spoken English in workplace contexts along with information concerning country of collection, hours of recording and number of words.

3. Collection and transcription of the ANAWC

The following section of the report addresses the process by which the study was set up and how the subsequently collected data was handled.

3.1 Participant recruitment

Due to the specialized nature of the corpus, AAC device users were recruited first, followed by non-AAC users in parallel professional contexts. Participants using AAC devices were recruited through the Center of Assistive Technology and Environmental Access (CATEA) Consumer Network (henceforth 'CCN') and the AAC-Rehabilitation Engineering Research Center, as well as through other organizations that work with individuals who use AAC such as the Pittsburgh Employment Conference, the AAC Institute, and AAC device companies. The CCN, managed by CATEA, is a database of individuals with disabilities who have agreed to be contacted to participate in research and is designed to enable researchers to select specific study criteria to render a list of potential subjects. While the CCN was populated with over 850 people at the time of recruitment,

Table 1. Workplace corpora of spoken English

Corpus name	Abbreviated name	Country	Hours of audio recorded data	Size	Work-places	Reference
American and British Office Talk	ABOT	North America and United Kingdom	30 hours	66 interactions 34,000 words	–	Koester (2006, 2010)
AAC and Non-AAC Workplace Corpus	ANAWC	North America	221 hours	1,069,442 words	7	
Business English Corpus (Speaking to do business section)	"Speaking to do business" of BEC	North America and United Kingdom	–	227,441 words	approx. 10	Nelson (2000)
Cambridge and Nottingham Business English Corpus	CANBEC	Mostly United Kingdom, but also Japan, Ireland and continental Europe	–	920,000 words (250,000 inter-organizational and 670,000 intra)	approx. 26	Handford (2010)
Construction Industry Corpus	CONIC	Singapore, Vietnam, Bangladesh, Hong Kong, Japan and United Kingdom	–	over 35,000 words	–	Handford (2017)
Business sub-corpus of the Hong Kong Corpus of Spoken English	Business sub-corpus of HKCSE	Hong Kong	about 50 hours	500,000 words		Cheng (2004); Warren (2004); Cheng et al. (2005)
Language in the Workplace Project	LWP	New Zealand	–	2,000 interactions	approx. 30	Holmes (2000)

our study criteria (outlined below) were linked to only 12 members who were then contacted via an email recruitment message. This recruitment message was also sent to organizations, device companies, and speech-language pathologists

who specialize in AAC to post on their web pages, listservs, and newsletters. In addition, we recruited through word-of-mouth at the Pittsburgh Employment Conference and other disability-related conferences.

All participants were required to: (i) have a speech and/or language impairment that necessitated use of an AAC device; (ii) be L1 users of English; (iii) interact with other co-workers on a daily basis (as opposed to teleworking from home using only computer-mediated interaction); and (iv) have experience with an AAC device for at least two years and rely primarily on their device for interactions with co-workers (although see later remarks regarding the use of vocalizations by some participants instead). Once the four AAC participants were confirmed, non-AAC users in parallel professional contexts (i.e. performing similar jobs in similar environments) were identified through local contacts. Details regarding the eight focal participants are given in Table 2. The table is organized by paired AAC and Non-AAC participants in each parallel workplace.

3.2   Participants as data collectors

Data collection methods were derived from the Wellington Language in the Workplace Project (LWP) conducted at Victoria University in New Zealand (Holmes, 2000; Stubbe, 2001; Holmes & Stubbe, 2003). We chose to follow the LWP methodology because it incorporates a "participatory approach". Where possible, participatory research locates the power of the research process in the hands of members of the relevant community in order to take account of "local priorities, processes and perspectives" (Cornwall & Jewkes, 1995:1667) and allows for a certain amount of "activeness and choice" in aspects of the project (Rifkin, 1990). In this case, the participants were clear on the goals of the study, and the actual data collection was controlled by them and not by the research team.

Each of the eight participants wore a voice-activated digital audio recorder for one 40-hour work week (five consecutive working days). Participants were asked to: (i) wear an easy-to-see badge that informed other people that they were wearing an audio recording device; (ii) position the microphone and device in such a way that other people could easily see that they were wearing an audio recording device; and (iii) inform all individuals who may not see the badge or recorder, or be able to read the badge, that they were being recorded. Dual consent was obtained from both the participants and their managers in the workplace. The transcriptions have then been anonymized and "cleaned" to take out all direct references to specific people, geographical locations, and specific buisnesses or organizations. Participants had complete control over the recording process: starting and stopping the recording at the beginning and end of each workday, throughout the day, or when requested to do so by an interlocu-

Table 2. Information on participants and data collected in each workplace

Participant[*]	AAC status	Gender	Job	Time using device/ Type of device	Approximate amount of use in total interaction in workplace	Number of words	Recording time hh:mm:ss
Len[**]	AAC	Male	Administrative Assistant	4 years DynaWrite	20%	78,797	28:56:10
Alex	Non-AAC	Male	Administrative Assistant			175,272	29:30:41
Ron	AAC	Male	Parks & Recreation Department Manager	4 years Pathfinder II	80%	9,233	11:26:33
Tony	Non-AAC	Male	Parks & Recreation Department Manager			162,761	44:32:35
Saul	AAC	Male	Director of Information Technology	15 months Vmax	99%	186,853	24:09:56
Katie	Non-AAC	Female	Information Technology Specialist			101,643	34:34:15
Sarah[**]	AAC	Female	Grant Administrator	8 years EZ Keys	20%	106,995	12:10:25
Paula	Non-AAC	Female	Grant Administrator			247,888	35:43:00
Total						**1,069,442**	**221:03:25**

[*] All names of participants have been changed to pseudonyms.
[**] These participants were out-of-state. Data were collected via uploading audio recordings to a MOZY online data collection site.

tor. This, of course, resulted in a variety of recording times among participants as shown in Table 2. Overall, however, our data comprised a wide variety of typical kinds of workplace interactions including meetings, informal office talk (including small talk), workplace telephone talk, conferences calls, and presentations.

3.3   Data retrieval

Each in-state focal participant was assigned an undergraduate research assistant (URA) for the duration of the recording. The assistants' role in the project con-

sisted not only of transcribing the data collected in the places of work, but also ensuring its capture. Each assistant briefly visited the workplace each day to download the audio files in order to avoid accidental erasure. The two remote participants who were located out of state uploaded their audio files at the end of each day of recording to a secure online storage site from which we retrieved the files.

3.4   Transcription procedures

The data were transcribed following an enhanced orthographic transcription scheme based on the T2K-SWAL (TOEFL 2000 Spoken and Written Academic Language) corpus (Biber, 2006) to easily replicate related tagging and data extraction applications provided by tagging and parsing tools such as the *Biber Tagger* (Biber, 1988, 1995, 2006). It was adapted from Friginal (2008, 2009) and included additional interaction-based elements such as notations of pauses and overlaps. Example (1) shows a sample transcription of a partial interaction involving Sarah, one of the AAC device users and her co-workers.

(1)   [overlap] overlapping talk
       [+]   micropause of less than 0.2 seconds
       [0.00]   pause length
       [voc]   vocalization – the AAC speaker is vocalizing
       Mandy: [phone rings twice] [unclear] [0:13] operator [laughs] [unclear] started on [shuffling & thuds] [0:06] and I'll turn the projector back on

       Marissa: let us know before you set that thing on

       Sarah: [voc]

       Marissa: oh okay

       Sarah: [beeps thuds and shuffling] [0:06][voc]

       Marissa: [+] alrighty [0:07] January [+] March [+] [overlap] [unclear] this order [+][overlap] all my minutes

       Sarah: [voc]

       Charly: [+] you go because I I I am so glad you got your stuff in order [+] because my stuff is so scrambled up

       Marissa: well I got all the minutes right here that I [+] I know have been written if we need to put them copies in the other book [+] 2 were originally going to keep the minute book

       Charly: I was working on it then somehow

       Marissa: but I kept it here so we got it

       Charly: [0:03] thank you

       Marissa: you're welcome

Charly: so did you get one of these too?

Marissa: [+] I know I did but I'd like to have another one

Charly: okay

3.5   Corpus cleaning and annotation

Cleaning and checking of the corpus has continued since 2009. All personal identifiers (e.g. names, proper nouns, addresses, phone numbers, etc.) have been replaced by generic proper nouns in the corpus. The transcripts have also been annotated for non-verbal information (such as ambient noises or laughter) and markups such as length of pauses, number of filled pauses, and vocalizations. The ANAWC is completely tagged for part-of-speech (POS) and other semantic categories using the *Biber Tagger* (Biber, 1988, 1995, 2006). POS-tags follow every word or punctuation mark in the text output. This tagger combines computerized dictionaries with the identification of word sequences as instances of a linguistic feature (e.g. noun + *WH*-pronoun and not preceded by the verb *tell* or *say* = "relative clause").

There are over 150 POS-tagged categories in the tagged version of the ANAWC, and each tagged feature was counted and normalized per 1,000 words. Other linguistic features such as type/token ratio, average length of words, total words per focal participant, and *n*-grams were also included. Two sub-corpora were created – one comprising AAC users and one with their non-AAC user counterparts. AAC users produced much less speech (381,878 words) compared to their non-AAC counterparts (687,564 words). This finding was not surprising given the labor-intensive nature of AAC devices (Wisenburn & Higginbotham, 2008). However, the ANAWC transcripts indicate that AAC participants also make more use of vocalizations than had been anticipated. These ranged from short vocal gestures to indicate (dis)agreement or to function as backchannels to much longer routines (see discussion of Bouchard, 2016).

4.   Examples of ANAWC-based research

In this section, we describe three published studies that have derived from the corpus data. These have varied from studies using traditional corpus methods such as POS tagging to more qualitatively oriented studies.

4.1   Linguistic characteristics of AAC and non-AAC discourse

Consonant with our focus on identifying core language patterns that distinguish the language of current AAC device users from that of non-AAC users in the workplace, our initial research examined the overall lexico-grammatical differences between the AAC user and non-AAC user sub-corpora. Friginal et al. (2013) investigated linguistic measures of lexical variety/diversity and show that AAC texts have lower average counts for type-token ratio, length of turns, and word count (per hour/day) compared to their non-AAC counterparts. AAC users, however, use more content words – nouns and verbs, on average (normalized frequencies) in their turns. These key content words are often delivered as a one-word response to a question. In addition, most AAC responses did not feature personal pronouns or private verbs (e.g. *think*, *feel*, *believe*).

Phrasal discourse markers and formulaic sequences in conversation were not common in AAC turns, nor were dysfluencies (e.g. filled pauses and repeats). AAC users also had very limited hedges and stance markers in their turns compared to non-AAC users. In comparison, non-AAC corpus data showed extensive use of communicative features such as discourse markers of participation (e.g. *you know*) and information management (e.g. *okay, well*). These findings support the "trade-off" that AAC users claim they often have to make when faced with communicating in real-time. It simply is not possible to generate the typical interactional features of conversation (i.e. discourse markers) and stay relevant in the real-time of the conversation. A follow-up study was conducted (Friginal et al., 2016) using a multidimensional framework (Biber, 1988; Friginal, 2015) to investigate differences between AAC and non-AAC linguistic patterns in three dimensions: (i) informational vs. involved discourse features; (ii) planned vs. narrative production features; and (iii) managed vs. non-marked information flow. As anticipated from our earlier findings, patterns in AAC user texts mirrored the features of formal, informational language use such as more nominalizations and second person pronouns. In contrast, non-AAC user texts were characterized by more involved and interactional features such as narrative markers (e.g. past tense verbs and third person pronouns) and situation-dependent references. Unlike the typical workplace discourse found in the non-AAC texts, which is interactive and involved, linguistic patterns found in the AAC texts for the most part resembled those found in written corpora, further confirming the limitations of the AAC devices in real-time interaction and offering previously unreported insight into language use in the workplace.

4.2   Mapping small talk in the workplace

Communication is often described as a critical "soft skill" in employment settings (McNaughton & Bryen, 2002) and in addition to lexico-grammatical features, we were also interested in mapping small talk, or non-task related talk in the corpus in order to identify topics and contexts that could potentially be used to train AAC devices. Pearson et al. (2011) and Di Ferrante (2013) examined the categories of small talk topics that appeared in the corpus. Weather, health, family, appearance, professional life, sports, and people known by the participants were frequent topics together with food and drink, technology/mass media, and (extended) greeting routines. An important finding was the way in which small talk can be used to map time and space in the workplace. It included greetings, which mapped the interactions in terms of time (e.g. *good morning* vs. *good bye* or *good night*). It also framed meetings and work tasks and varied in length depending on the relationships between the participants, and also the immediate context (e.g. during lunch time, just before a deadline). Small talk also contributed to mapping space: multiple-participant small talk interactions occurred in open-space offices, whereas one-to-one interactions happened in smaller offices with one or two desks.

Di Ferrante (2013) extracted a sub-corpus of the ANAWC, "Small Talk in the Workplace" (STW), made up of 423 interactions and almost 50,000 words, in which she defines small talk in the workplace through the analysis of multiple variables. With regard to AAC users, she notes that messages are often left unfinished and successful uptake often relied on their coworkers' ability to interpret visual cues or vocalizations due in large part to the fast-paced nature of these interactions (see below). Data from the STW were also analyzed to examine the linguistic strategies used by non-AAC users to build and affirm their positive image amongst their co-workers (Di Ferrante, 2016).

4.3   The use of vocalization by AAC device users in the workplace

As we noted in the beginning of this piece, an ongoing source of frustration for AAC device users is the communication delay that results from having to create real-time utterances rather than using prestored messages. Higginbotham & Caves (2002:55) note that these time delays often exclude augmented speakers from inhabiting the same communication "time stream" as their non-device-using interlocutors. Noting the frequency with which some device users will switch to vocalizations to alleviate this difficulty, Bloch and his associates (Bloch, 2005, 2011; Bloch & Wilkinson, 2009, 2011) investigated strategies used by speakers with dysarthria in everyday conversation in home environments; however, this has not previously

been studied in a workplace environment. This has been investigated in more detail by Bouchard (2016) using the AAC user subcorpus. Bouchard (2016) points out that AAC-user participants in the corpus often work with the same core group of co-workers for at least part of the day, and they have become more familiar with the AAC users' gestures and vocalizations. Three of the four AAC device users in our corpus leveraged this familiarization on a regular basis to attempt to vocalize part or all of their message if they felt that they could make their meaning intelligible (see Example (1) above, for example). Strategies used to increase understandability of vocalizations included guessing and repetition by co-workers and also spelling aloud by the AAC participant, which was a new finding in terms of strategy use. We believe that findings in each of these areas have the potential to help to guide future developments in AAC development for workplace applications.

5.   Conclusions

To our knowledge, the ANAWC is the first corpus of its kind at the intersection between disability studies and workplace discourse and thus offers novel opportunities for research in cross-disciplinary contexts. It provides a unique resource for the study of AAC communication. Its design also makes it possible to investigate the workplace experiences of AAC-users in comparison to their non-AAC user counterparts in parallel professional contexts. A clear limitation of the corpus is a lack of video recordings to supplement the audio record. This was not a viable option as permission is not readily granted for this kind of access due to the often confidential nature of workplace products. We also have limited information with regard to the interlocutors other than the eight focal participants. As our participants interacted with over one hundred people across the corpus, it was simply not possible to retrieve this information. This was essentially a matter of "research economics" (Higginbotham & Bedrosian, 1995:12) as time and financial constraints did not allow us to consult any further with our participants. We also recognize that our final participant pool with regard to AAC users in the workplace was very limited, despite an extensive recruitment drive. We hope that the variety of workplaces that we have captured goes some way to mitigating this limitation. Despite these drawbacks, the corpus is *sui generis* in conception and content, and it affords opportunities for multiple avenues of corpus-based research. It also opens new avenues to guide future developments in AAC development for workplace applications.

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