



# Linguistic characteristics of AAC discourse in the workplace

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## Abstract

This study examines linguistic co-occurrence patterns in the discourse of individuals with communication impairments who use augmentative and alternative communication (AAC) devices in the workplace by comparing them to those of non-AAC users in similar job settings. A typical workweek ( $\approx$  40 hours) per focal participant (four AAC; four non-AAC) was recorded and transcribed to create a specialized corpus of workplace discourse of approximately 464,000 words at the time of this analysis. A multidimensional analysis of co-occurrence patterns along functional linguistic dimensions, following Biber (1988, 1995) [*Variation across Speech and Writing*. Cambridge: Cambridge University Press; *Dimensions of Register Variation: A Cross-Linguistic Perspective*. Cambridge: Cambridge University Press], reveals differences in the macro discourse characteristics of AAC vis-a-vis non-AAC texts. Results indicate that AAC texts make use of more informational, non-narrative, and explicit textual features of discourse than their non-AAC

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counterparts. Implications to improve the capabilities of AAC devices to produce speech that matches baseline expectations of co-workers in the workplace are discussed.

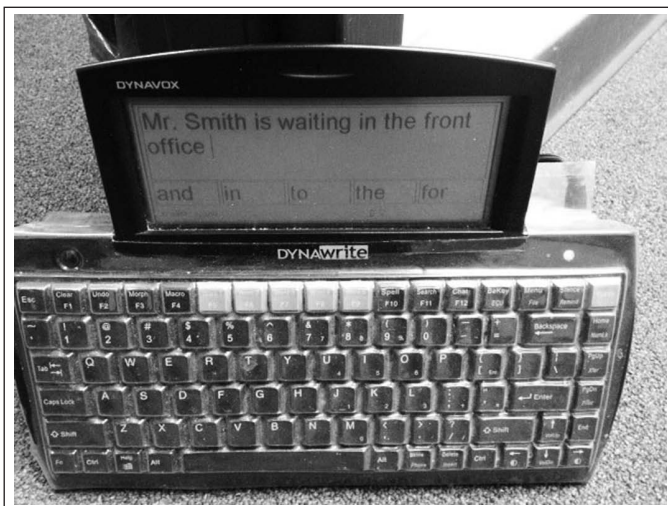
### Keywords

Augmentative and alternative communication devices, communication impairments, corpus linguistics, discourse analysis, multidimensional analysis, workplace discourse

### Introduction

Individuals with severe communication impairments have significant difficulty joining the workforce, with an employment rate that is well below the national average and possibly the lowest among all groups of persons with disabilities (Bryen et al., 2006; McNaughton et al., 2012). For those potential workers who are unable to communicate using their natural speech, augmentative and alternative communication (AAC) may offer a strategy for enabling them to interact with others. AAC can take various forms including sign language, spelling boards, and electronic devices to carry out the verbal and written tasks necessary to participate in workplace communication. The most advanced type of AAC is a speech-generating device that enables a person to formulate messages by selecting pictures, letters, words, or sentences (see Figure 1). These AAC devices are generally portable technologies such as laptops, tablets, or smartphones and can be accessed using a range of methods such as touch, eye gaze, or switch input. The sophisticated features of AAC devices are presumed to facilitate interaction and promote fuller participation for users in work settings. However, while there have been major improvements in AAC technologies over the years, devices are often limited in terms of providing quick access to context-specific language, particularly in workplaces (Bryen et al., 2007).

Although AAC devices have existed for over 50 years, there continues to be a significant gap between the capabilities of natural speech and these devices (Rehabilitation



**Figure 1.** Sample AAC component system DynaWrite/Dynavox keyboard and screen options.

Engineering Research Center on Technology Transfer, 2001). One of the most commonly cited challenges with using an AAC system is slow communication rate (8–12 mean and 65 maximum words per minute (wpm)) compared to the average speaking conversational rate of 180 wpm (Dominowska, 2002; Tönsing and Alant, 2004; Venkatagiri, 1995). While slow communication rate has a negative impact on communication effectiveness and can be highly frustrating for AAC users in general (Beukelman and Miranda, 1998; Hoag et al., 2004), it presents a more significant barrier in the workplace where efficient communication interactions are often a necessity. The slow communication rate of a device user generally results from a lack of pre-stored messages that are relevant to workplace contexts (Balandin and Iacono, 1998; Hill and Chapple, 2007). These pre-stored messages could be phrases or entire sentences that a user could select to take their turn in conversation. While pre-stored messages can be manually customized for a specific user or context, such efforts can be extremely labor intensive (Hill and Chapple, 2007).

Consequently, an AAC device user attempting to produce a workplace-relevant message may have to rely on spontaneous novel utterance generation (SNUG) which provides the broadest access to contextual vocabulary through the construction of messages through letters, individual words, sequences of words/terms that typically co-occur (e.g. bank account) and commonly used phrases (Hill, 2001). Although SNUG allows users to customize their messages, efficiency is dictated by the user's selection speed which is impacted by their visual, auditory, and/or motor skills. The slower communication turns taken by AAC device users can create an imbalance in conversational equity (e.g. lower initiation rates and/or fewer conversational turns), which can negatively impact an interlocutor's attitude toward device users (Hoag et al., 2004). As a result, workers using AAC are less likely to have their communication needs met by their device and are therefore unable to fully participate in the workplace.

### *Previous studies of AAC workplace discourse*

Beyond the perceived limitations of AAC devices for workplace communication, little is known about the linguistic features of discourse used in job situations by AAC users and how AAC-based discourse differs from that of non-AAC discourse in comparable work contexts. Studies on AAC users in the workplace have been conducted, although they have focused, for the most part, on speech, pragmatic, and interactional topics, mostly through case studies, ethnographic reporting of behavioral or interactional norms, and analyses of conversation (e.g. wait times, question/answer turns). For example, Balandin and Iacono (1998, 1999) and Tönsing and Alant (2004) compared work break discussions with interlocutors around an AAC user, and they found that conversation topics demonstrated little variation regardless of whether they involved an AAC user or not. Speech production and wait times have become problematic issues for AAC users and their interlocutors. The devices certainly take more time to produce utterances, creating consistent gaps and pauses in interactions (Wisernburn and Higginbotham, 2008). Simpson et al. (2000) reported that, due to the degree of effort required for speech production, AAC users often do not make use of 'initiators' (e.g. salutations, markers indicating topic introduction and maintenance, topic shifts) in interactions. Most AAC users also avoid or control small talk and narratives focusing on events not directly related to work. Furthermore, Bloch (2011) notes that when non-AAC users try to anticipate the

completion of AAC users' utterances in progress, they often fail in understanding AAC users' intended topic shift, word selection, or even the end point of an utterance.

### *Collection and analysis of workplace corpora*

Over the years, large-scale, longitudinal studies that also include the collection of workplace corpora have been conducted (e.g. Bargiela-Chiappini and Harris, 1997; Handford, 2010; Warren, 2004). Audio and video recordings and transcriptions of general workplace interactions have been used to identify the characteristics of effective communication or diagnose potential causes of miscommunication. The Wellington Language in the Workplace Project (LWP) at Victoria University of Wellington, New Zealand (Holmes, 2000; Stubbe, 2001) has collected approximately 1500 interactions from 362 people in 20 different workplace settings. The LWP did not include AAC users, but some of their interactions involve workers with intellectual disabilities which might be comparable to some types of interactional exchanges in AAC-based contexts, especially with regard to the way interlocutors react and respond to these workers. For example, Holmes (2003) and Holmes and Fillary (2000) followed workers with intellectual disabilities in order to investigate their participation in small talk (i.e. discussion of topics that are unconnected with workplace tasks) and their use of formulaic responses with co-workers. These studies reported that workers with intellectual disabilities tend not to engage in social talk and often give short, monosyllabic answers when they are solicited to participate in social interactions.

It is clear that AAC device users in the workplace are typically different from workers with intellectual disabilities. While there are some workers with intellectual impairments who benefit from AAC, few would rely on a speech-generating device for extended and linguistically sophisticated conversational interactions. Workers requiring AAC devices for more complex conversational needs generally have little to no intellectual impairment and likely are fully aware of the importance and functions of social talk; however, their devices may not be 'augmented' enough to allow them to interact more efficiently. The overlap between these two groups of workers is seen in how to effectively support them in order to achieve successful interaction at work. Unlike workers who demonstrate language difficulties due to intellectual disability, AAC device users with complex communication needs can be further assisted by research-informed technology that will allow them to appropriately access and utilize the sociolinguistic and pragmatic competence that they possess. Detailed descriptions and comparisons of the characteristic linguistic features of AAC vis-a-vis non-AAC workplace discourse in very similar contexts can provide the data needed to develop and advance the technology that will maximize AAC device users' successful participation in communicative exchanges.

### *The focus of this article*

This article examines linguistic co-occurrence patterns in the workplace discourse of AAC users compared to those of their non-AAC, job-equivalent counterparts through a corpus-based, multidimensional approach to discourse analysis (Biber, 1988, 1995). As part of an ongoing set of studies analyzing AAC and non-AAC workplace texts, the

present study combines macro- and microscopic approaches to the nature of linguistic co-occurrence patterns from corpora. First, a comparison of AAC and non-AAC sub-corpora is conducted along the functional linguistic dimensions previously identified by Biber (1988, 1995). Linguistic patterns and trends within dimensions are analyzed further to identify contributing factors and features characterizing these two groups of workplace interactions. In contrast to non-AAC spoken workplace discourse, the linguistic co-occurrence patterns of AAC texts potentially take on more features of formal, informational language (e.g. less involved or less personal, non-narrative, and more explicit) similar to most written texts. This is due to the actual message formulation processes enabled by AAC devices. Linguistically, these dimensions are defined by the high co-occurrence of nouns, prepositions, and nominalizations, while features such as past tense verbs, personal pronouns, and emphatics are limited. A qualitative analysis of these interactions with text samples from the corpus will show whether or not AAC discourse can be clearly differentiated from non-AAC discourse along textual and functional domains.

### **Developing a specialized corpus of spoken discourse**

The AAC and Non-AAC Workplace Corpus (ANAWC) (Pickering and Bruce, 2009) used in this study was collected in workplace settings in the US in the spring of 2009. It features over 220 hours of spoken interaction involving eight focal participants and more than 100 interlocutors in seven different work locations. The specialized nature of this type of spoken corpora requires well-defined procedures for recording and transcribing interactions. The ANAWC was collected based on procedures similar to those used in the LWP (Holmes, 2000, 2009). Participant-controlled speech samples were gathered over five consecutive work days to ensure a wide range of routine and novel topics. Interactions were captured via wearable digital voice recorders.

Audio transcriptions for the ANAWC and similar corpora require an incredible amount of time, an average of six hours per minute, and even longer for ‘cleaned’ transcriptions (Chafe et al., 1991). Audio recordings were transcribed into machine-readable text files by a team of trained transcriptionists following an orthographic transcription scheme based largely on the T2K-SWAL (Test of English as a Foreign Language (TOEFL) 2000 Spoken and Written Academic Language) corpus (Biber, 2006). Transcribed texts were subjected to random accuracy checks to promote reliability of transcription, and all personal identifiers (e.g. names, proper nouns, addresses, phone numbers, etc.) were meticulously replaced by generic proper nouns in the corpus. The transcripts were also partly annotated for non-verbal markers and other markups (e.g. length of pauses, number of filled pauses). In addition, this corpus will be further annotated for multi-modal elements such as laughter, gestures, overlaps, and proximity information.

The main corpus considered for the present study comprises approximately 464,000 words containing two sub-corpora – one with AAC users in the workplace (214,619 words) and one from their non-AAC counterparts (249,503 words). These sub-corpora represent interactions of eight focal participants and their various interlocutors across a typical ( $\approx$  40-hour) workweek. The criteria for AAC user participation consisted of a) native English speaker background, b) employment in a workplace setting, and c) opportunities for daily interaction with co-workers and/or other interlocutors. The four AAC

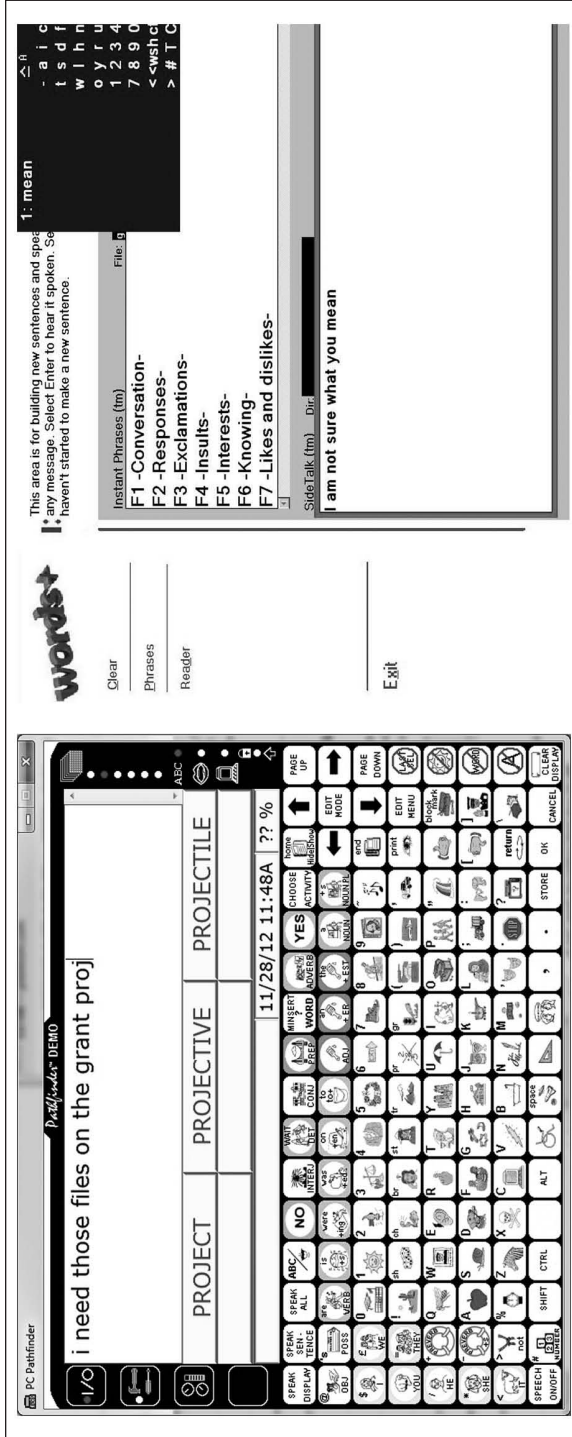


Figure 2. Screenshots of two AAC devices used by participants in this study: Pathfinder (left) and EZ Keys (right).

participants were recruited through the Georgia Institute of Technology Center for Assistive Technology and Environmental Access (CATEA) Consumer Network. Research consent and job descriptions were obtained from each AAC participant, informing the basis for the selection of the four non-AAC participants in comparable job situations. Table 1 provides biographical information for each participant.

## Corpus analysis of AAC discourse in the workplace

### *Linguistic tagging and analysis*

The ANAWC was tagged for part-of-speech (e.g. nouns, prepositions, past tense verbs, etc.) and additional semantic categories (e.g. semantic categories of verbs: private verbs, suasive verbs, communication verbs) using the Biber tagger (Biber, 2006). The Biber tagger was designed to incorporate a large number of linguistic features and return an output that can easily be processed for automatic tag-counting and norming. Grieve et al. (2009) reported that the Biber tagger has a 94% accuracy rate for formal written registers. Every tagged feature was counted and normalized per 1000 words and inputted on a spreadsheet. Other linguistic features such as type-token ratio, average length of words, total words per target participant, and various n-grams were also included on the spreadsheet.

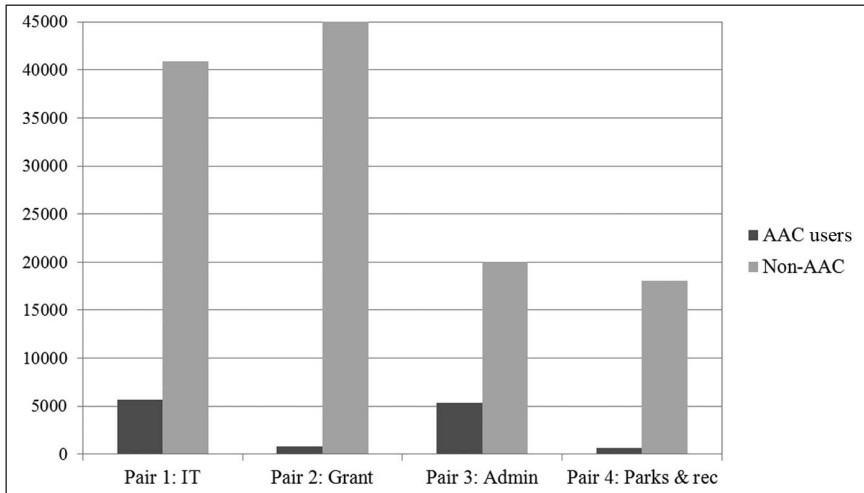
As shown in Figure 3, AAC users produce far less speech as measured by number of words (a range of 614 to 5676 words) than their job-similar counterparts (a range of 18,057 to 45,312 words) in a typical workweek. This finding is not at all surprising, given reports of the labor-intensive nature of SNUG (Hill, 2001) and the limitations of pre-programmed pages (Wisburn and Higginbotham, 2008). However, ANAWC transcripts indicate that AAC participants make use of vocalizations (transcribed in the corpus as ‘voc’), not counted as actual words, which often substitute for linguistic responses or backchannels in interactions. It is interesting to note that there was no major difference between the total word counts of interlocutors (i.e. co-workers) in the two sub-corpora.

**Table 1.** Participant information.

Participant <sup>a</sup>	Age range	Gender	AAC status	Job description
Saul	46–55	M	AAC	IT specialist
Katie	46–55	F	Non-AAC	IT specialist
Sarah	36–45	F	AAC	Grant administrator
Paula	56–65	F	Non-AAC	Grant administrator
Ron	36–45	M	AAC	Parks & recreation manager
Tony	56–65	M	Non-AAC	Parks & recreation manager
Len	46–55	M	AAC	Administrative assistant
Alex	n/a	M	Non-AAC	Administrative assistant

<sup>a</sup>All participant names have been replaced with pseudonyms.





**Figure 3.** Word count of sub-corpora by work context and pair.

### *Multidimensional analysis*

Multidimensional analysis was developed by Biber (1988, 1995) to identify underlying functional dimensions of a wide range of spoken and written registers of English. This approach to linguistic variation stresses that systematic linguistic differences occur within a corpus because speakers or writers make lexical and grammatical choices appropriate to the register in which they are speaking or writing (Biber and Conrad, 2001; Friginal and Hardy, 2012). For example, the functional description of texts as ‘informal’ or ‘formal’ does not capture the broad multidimensional variation existing internally in these texts based on the unique patterning of linguistic features that are not typically seen in manual analyses. By establishing these co-occurring patterns in the corpus, one can then analyze individual and groups of texts to better understand the core structural and functional characteristics of a given genre of discourse.

Biber (1988) identified a total of six functional dimensions of spoken and written English from 23 sub-registers of the London-Oslo-Bergen Corpus (written texts) and London-Lund Corpus (spoken texts). These six dimensions are: 1) involved versus informational production, 2) narrative versus non-narrative concerns, 3) explicit versus situation-dependent reference, 4) overt expression of persuasion, 5) abstract versus non-abstract information, and (6) online informational elaboration. The linguistic compositions of these dimensions are shown in Table 2. These dimensions have established the linguistic differences between spoken and written texts. For example, most written texts have informational production focus (i.e. high co-occurrence of nouns, prepositions, and attributive adjectives) while spoken texts are produced with involved and personal features of discourse (i.e. characterized by extensive use of private and past tense verbs, *that*-deletions, and general emphatics). These features are in complementary distribution and can be used as the basis of register comparison across a dimensional scale.



**Table 2.** Textual dimensions and factor loadings (Biber, 1988).

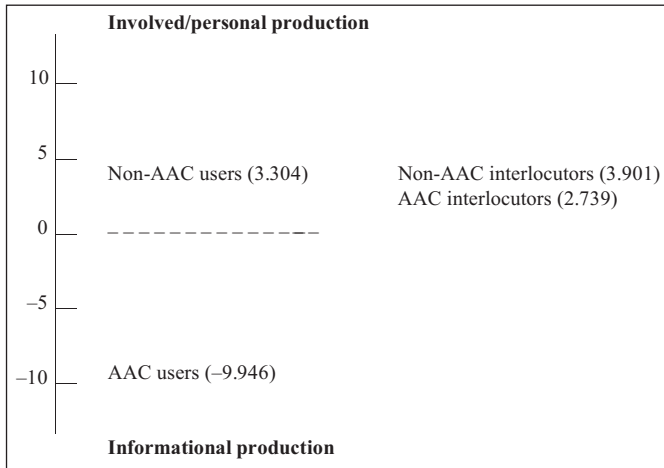
Dimension	Loading	Features
1. Involved vs informational production	Positive	Private verbs, <i>that</i> -deletion, contractions, present tense verbs, second-person pronouns, verb <i>do</i> , demonstrative pronouns, emphatics, first-person pronouns, pronoun <i>it</i> , verb <i>be</i> , subordinating conjunctions, discourse particles, nominal pronouns, adverbials/hedges, amplifiers, WH questions, possibility modals coordinating conjunctions, WH clauses, stranded prepositions
	Negative	Nouns, prepositions, attributive adjectives
2. Narrative vs non-narrative concerns	Positive	Past tense verbs, third-person pronouns (except <i>it</i> ), perfect aspect verbs, public verbs
	Negative	∅
3. Explicit vs situation-dependent reference	Positive	WH pronouns, relative clauses, coordinating conjunctions, nominalizations, adverbs of time and place
	Negative	∅
4. Overt expression of persuasion	Positive	Infinitives, modals of prediction, suasive verbs, subordinating conditional conjunctions, modals of necessity, adverbs within auxiliaries
	Negative	∅
5. Online informational elaboration	Positive	Conjuncts, agentless passive verbs, passive verbs + <i>by</i> , passive postnominal modifiers, subordinating conjunctions
	Negative	∅

A comparison of AAC and non-AAC texts across the first three dimensions from Biber (1988) is presented in the Results section below. Data were obtained by computing an average ‘dimension’ score based on the co-occurring linguistic features per dimension from four groups of speakers: 1) AAC users, 2) non-AAC users, 3) all co-workers of AAC users (collected into one sub-corpus), and 4) all co-workers of non-AAC users (also collected into one sub-corpus). See Biber (1988) and Biber and Conrad (2001) for detailed instructions and procedures for running a multidimensional analysis or computing dimension scores.

## Results

### *Involved versus informational production*

Biber’s (1988) Dimension 1 distinguishes discourse production primarily between spoken and written texts. Positively co-occurring features (e.g. private verbs, *that*-deletion, contractions, present tense verbs, second-person pronouns, verb *do*, demonstrative pronouns, emphatics, first-person pronouns, etc.) represent spoken texts, while negative features (e.g. nouns, prepositions, attributive adjectives) represent written texts. As noted earlier, these two groups of features are in complementary distribution. A comparison of speaker groups (Figure 4) in the ANAWC shows that texts produced by AAC users averaged on the negative side of the dimension (Dimension Score = -9.946) compared to the



**Figure 4.** Comparative scale for involved/personal production versus informational production.

other speaker groups in the corpus. Workplace interactions with non-AAC users and their interlocutors and spoken texts produced by co-workers of AAC users all averaged on the positive side of Dimension 1. Speakers who do not rely on AAC devices maintain a consistent use of personal pronouns and private verbs in producing ego-centric sequences (e.g. *I think, I believe*), informal features of speech (*that*-deletion, contractions), and emphasis on ‘listener-directed’ talk (through second-person pronouns).

In contrast, AAC users often drop involved and personal production features as they type using their component systems and focus more on noun and noun phrases in their responses to questions. There are limited AAC user-initiated topics and very few narratives and responses to small talk (Di Ferrante, 2012). Most AAC responses do not feature personal pronouns and private verbs, although overall, AAC users had more normalized counts for all verbs than non-AAC users (Figure 6). In the text excerpt below, AAC user ‘Ron’ was communicating with a co-worker by providing short nominal responses (e.g. *city, address, truck*). Ron used vocalizations and non-verbal responses in complementing his speech-generated utterances. The co-worker appeared to follow completely Ron’s turns and was able to introduce topic shifts that were not directly related to their primary conversational task. The excerpt suggests that Ron is able to successfully provide direct responses or information needed by the co-worker. However, the co-worker’s several clarifications and questions in this short excerpt were clearly triggered by Ron’s limited speech production.

Text excerpt 1: AAC user Ron

AAC-Ron: **City**

Co-worker: He wants me to do the epic route power out tomorrow morning

AAC-Ron: And

Co-worker: They’ve got a bit swim meet he wants me to get up at three and check if it’s snowing go in at four coz the rest of the crew comes in at six on Saturday so I’m gonna get a jump on it

- AAC-Ron: And  
 Co-worker: No just street address will be fine  
 AAC-Ron: **Address**  
 Co-worker: But it's a good thing you asked. I'm listening where is this going in? On the side?  
 On the bottom? You got these upside down sir  
 AAC-Ron: **Right address**  
 Co-worker: You bragging, I'm leading  
 AAC-Ron: [voc]  
 Co-worker: I getting ornery but  
 AAC-Ron: Right  
 Co-worker: What? I just read yours? Told ya I'm gettin ornery. But see if I'm right, go ahead.  
 AAC-Ron: **No city**  
 Co-worker: [laughing] I was right  
 AAC-Ron: [voc] I can do a lot of **things** but reading **lines** is not **one** [voc]  
 Co-worker: [laughing] uh oh did I lose my ten dollar bill? I lost my ten dollar bill. You see a ten dollar bill floatin' around it's mine.  
 AAC-Ron: **Look in the truck**  
 Co-worker: His should have been black ones  
 AAC-Ron: **Look in the truck**  
 Co-worker: Huh?  
 AAC-Ron: **Look in the truck**  
 Co-worker: Good thinking you're right. What truck?

Phrasal discourse markers and formulaic sequences in conversation (e.g. *you know, I mean, well, that's what I thought*) are not common in AAC turns, nor are dysfluencies (e.g. filled pauses and repeats) which are therefore not present in the transcripts. AAC users also have very limited stance markers and hedges (e.g. *maybe, potentially*) in their texts compared to non-AAC users, as shown in the following turns:

Text excerpt 2: Non-AAC turns

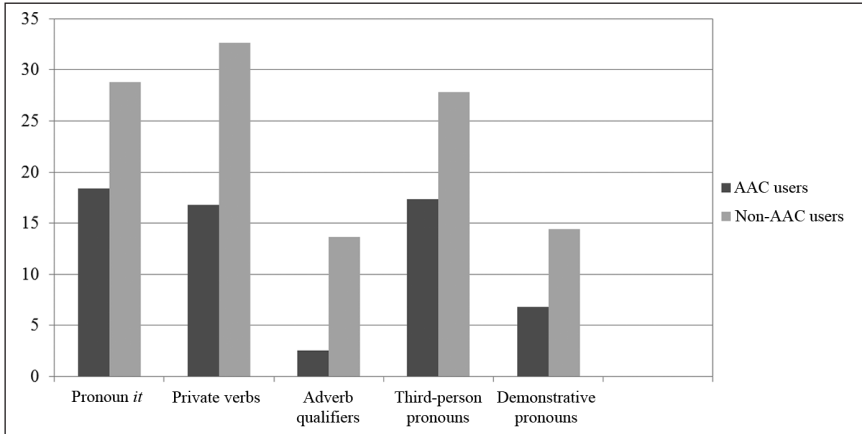
Non-AAC: **Yeah I'm just I'm just** confused of whether we're getting payment from two different sources I just **uh** faxed that W-9 to DFACS again **uh** maybe I'll call them and see **uhm**

Non-AAC: **Well that's what I thought I you know** I faxed that thing to them 3 times and **uh** I don't know if two people are wor- [laughs] DFACS are working on it and **uhm** so maybe I'll call her and see if she's working with person because she might be processing the check too

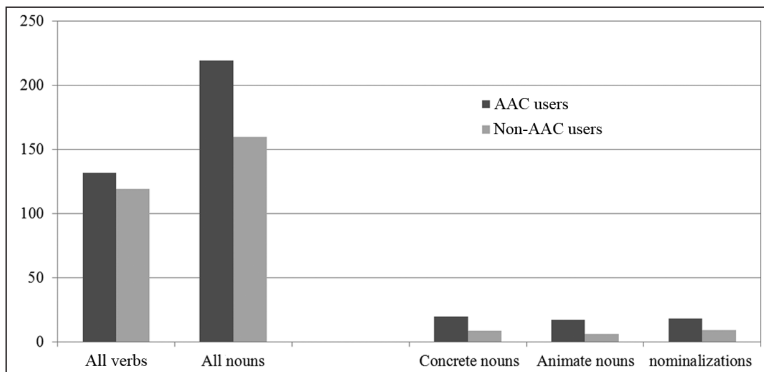
Non-AAC: **I was like** he still hasn't got one from the [overlap] I sent them the information too and **you know** that's a different agency that's GCSS uh but I'll check on this

Figures 5 and 6 present a comparison of linguistic features characterizing AAC versus non-AAC workplace texts. The distributions of these features accounted for major differences in average dimension scores for Dimension 1. In Figure 5, non-AAC texts have higher normalized counts for pronoun *it*, private verbs (e.g. *guess, believe*), adverb quantifiers (e.g. *just, so, really*), third-person pronouns, and demonstrative pronouns than their AAC counterparts.

Figure 6 shows that AAC users have more normalized counts for content words – nouns and verbs. AAC users rely on lexical verbs to indicate actions or procedures in



**Figure 5.** Comparison of AAC and non-AAC texts across private verbs and pronouns.

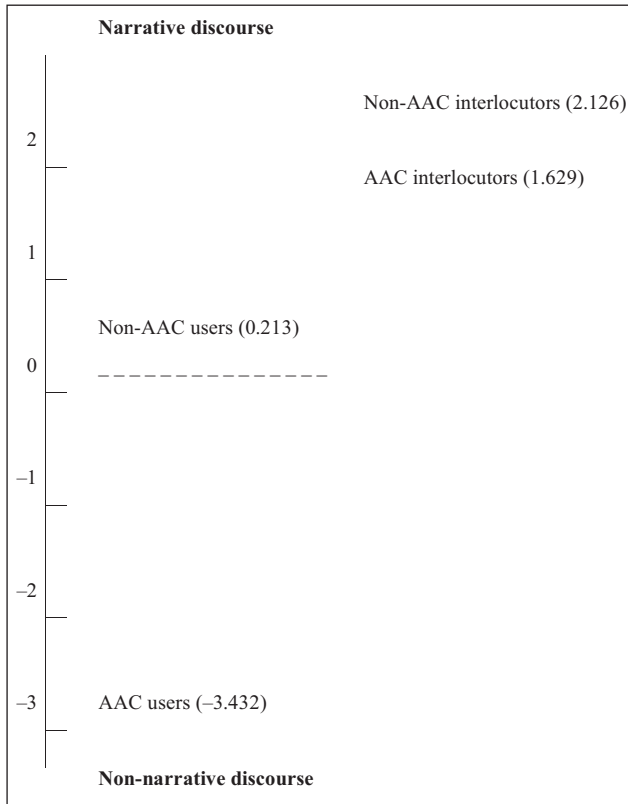


**Figure 6.** Comparison of AAC and non-AAC texts across verbs, nouns, and semantic categories of nouns.

their responses to interlocutors. These lexical verbs include very few mental/private verbs compared to typical conversation corpora (Friginal, 2009). More proper nouns (especially names of people, places, and events) are frequently distributed across AAC texts, including the use of concrete nouns (e.g. *camera*, *computer*), animate nouns (e.g. *applicant*, *patient*, *child*), and nominalizations (e.g. *communication*, *interaction*).

### *Comparison of narrative versus non-narrative discourse features of AAC and non-AAC texts*

Narrativity is characterized by the co-occurrence of past tense verbs, third-person pronouns (except *it*), perfect aspect verbs, and public verbs (e.g. *said*, *gave*, *walked*) (Biber, 1988). These co-occurring features are very common in fictional written texts (especially in



**Figure 7.** Comparative scale for narrative versus non-narrative discourse.

prose). Narrative discourse is also common in spoken texts, particularly those that include sub-registers of conversation such as face-to-face talk and telephone-based discourse when speakers are familiar with each other or are talking within a shared range of topics. Informal social talk and office gossip often feature third-person pronouns and past tense verbs (Friginal, 2009). Figure 7 shows a comparison of the average dimension scores of the four groups of texts in the ANAWC for narrative versus non-narrative discourse features.

In general, workplace discourse has an overall positive range for narrative features as speakers engage in discussions of past events or past experiences. Many of these discussions directly relate to on-the-job topics such as operating office equipment or sharing impressions about an event or a person. As in Biber’s Dimension 1, this dimension also conspicuously distinguishes AAC users (Dimension Score = -3.432) from other speakers in the ANAWC, as shown in Figure 7. AAC users have very few past tense and perfect aspect verbs in their turns. There are very limited opportunities for AAC users to ‘tell stories’ that could easily be programmed with their component systems to match typical, real-time office talk. The delay in speech production clearly prevents AAC users from introducing an extended narrative or responding to a turn to discuss their own past experiences. The contrasts in the two text samples below show how a non-AAC user (IT specialist)

incorporated narrative features in her turns (narrative experience and impressions), while her AAC counterpart, in a relatively similar job-related topic or context, focused more on giving directions (e.g. 'I am training for you if you are getting it I need to know.').

Text excerpt 3: Office narratives

Non-AAC Katie: **Did** you hear some of those speech things that like . . . **happened** you can't even hear [overlap] like what's **being transmitted** . . . it's like **did** you **say** that **did** you **say** that . . . well I think it's interesting coz the only experience I have with that is when the very first time that uhm Microsoft office **came** out with voice recordable you know dictating for Microsoft word and . . . uhm . . . and I I I **sat** down and actually and I still have the very first page you know I **sat** down and **did** all of my **did** the training so that it [overlap] so so so so that it **recognized** I think it **was** 97 and uhm and **did** you know . . . **went through** the set of instructions it **had** so that it **recognized** my voice and then I'd just talk for like a page . . . [pause]

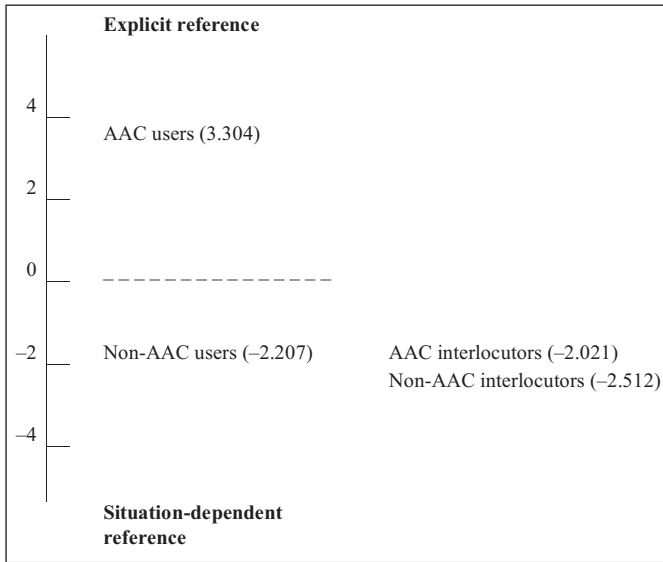
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AAC-Saul: I am serious about Lisa . . . I need for you to let me know . . . because if she cannot do it she will weigh you down [voc] I am not putting the weight on you to give the decision but you will give input in my decision [voc] . . . you need to understand this role that you have requires overseeing people . . . your job relies on others to be successful . . . you need to understand this role that you have requires overseeing people . . . your job relies on others to be successful.

I am training for you if you are getting it I need to know . . . [voc] training for you if you are not getting it I need to know . . . [0:06] I set out Doreen to train you . . . but if you are not getting it I need to know . . . all I know is what you tell me if you don't let me know I don't know

### *Comparison of explicit versus situation-dependent reference features of AAC and non-AAC texts*

The positive features of this dimension include lexico-syntactic structures common in many formal and informational written texts (e.g. relative clauses, nominalizations, phrasal coordination). Biber (1988) reported that explicit references are frequent in official documents, professional letters, press reviews, and academic prose. Situation-dependent references are composed of time and place adverbials (e.g. *earlier*, *later*, *behind*) which depend heavily upon referential inferences identified by the actual physical and temporal contexts of the discourse. Speakers performing tasks, broadcasts (especially in live sporting events), and telephone conversations refer to time and locations by making use of adverbial markers. AAC texts averaged on the positive side of this dimension (Dimension Score = 3.304), while all the other groups of speakers had negative scores. The frequency of relative clauses (WH relative clauses on object and subject positions; pied-piping constructions) in AAC texts is not necessarily high; however, it is clear that non-AAC users have greater use of time/place adverbials and other adverbs in their turns than AAC users. (Note, again, that these negative and positive features in each dimension are in complementary distribution.) Professional/workplace spoken discourse,



**Figure 8.** Comparative scale for explicit reference versus situation-dependent reference.

because of speakers’ familiarity with each other and the typical task-based nature of most interactions, has more temporal and physical references overall.

The following text samples illustrate some uses of time/place adverbials in non-AAC texts followed by excerpts from an AAC exchange. Non-AAC users refer to particular situations that specify temporal and physical contexts in the discourse. Most of these adverbials are used in narrative sequences and also in giving detailed instructions. Friginal (2008, 2009) reported that time/place adverbials characterize the language of telephone-based customer service interactions, especially in tasks where call-takers provide troubleshooting assistance to callers. AAC user Len in the excerpt was limited to short responses (e.g. *yeah, yes, it’ll be okay*) primarily because of the way the co-worker framed questions or asked Len to confirm his response. This nature of questioning and confirming AAC user responses from co-workers is very common in ANAWC. In part, confirmatory checks are necessitated by the quality of speech produced by various speech-to-text equipment or by delays in AAC user responses.

Text excerpt 4: Situation-dependent references in non-AAC and AAC texts

Non-AAC Paula

Non-AAC: Some paper **right there** no in the uhm **above that**

Co-worker: This one?

Non-AAC: Yeah yeah like **right now** . . . you’d you’d be transcribing

Co-worker: Got ya [unclear] ok

Non-AAC: Yeah mmm-hm definitely but as far as just like maybe taking some notes **right now** . . . or something about you know the type of. . . tasks that she’s doing **tomorrow**

\*\*



Non-AAC: I'll come **in a little earlier** and **this morning** there was an ambulance coming **this way** lights flashing and car turned right there and she froze

AAC Len

Co-worker: Did you have to pay or somebody from the chair company or from tech?

AAC-Len: Yeah

Co-worker: You want me to flush this? Oh what happened? Oh I closed it . . . great . . . alright put your foot back in here . . . okay [unclear] okay . . . okay I thought I closed it. **Now** it's closed [unclear] sorry Len. I thought I closed it

AAC-Len: Yeah you got to close it all the way

Co-worker: yeah I know I thought I did it all the way . . . coz it didn't go any further. Do you want me to wet this piece? Do you want to wet it?

AAC-Len: It'll be okay

Co-worker: It'll be okay?

AAC-Len: Yeah

Co-worker: Sorry about that . . . oh and this one too both of them

AAC-Len: Yeah

## Discussion

Douglas Biber's seminal book *Variation across Speech and Writing* (1988) introduced multi-dimensional analysis, which makes use of large electronic corpora and multivariate statistical techniques in the study of linguistic variation. Since its publication this model has been replicated, focusing on a range of registers and specialized corpora and incorporating additional statistical measures. This study is an application of multidimensional analytical approach to an examination of workplace discourse of individuals with communication impairments who use AAC devices. A comparison between AAC and non-AAC texts along the first three dimensions previously identified by Biber (1988, 2006) highlights macro-level differences in linguistic co-occurrence patterns in these two groups of workplace texts. From a broader perspective on linguistic variation, the three comparative dimensions show that AAC texts resemble the linguistic patterning of written corpora. AAC users produce discourse that is primarily informational (Dimension 1), non-narrative (Dimension 2), and referenced explicitly (Dimension 3). These results indicate that AAC texts mirror the linguistic co-occurrence patterns of newspaper, professional letters, and academic writing more than texts representing interactive, spoken communication (e.g. face-to-face communication, telephone exchanges) typical in the workplace.

Internal variation based on linguistic co-occurrence patterns in the ANAWC could be further analyzed to show microscopic differences in AAC versus non-AAC comparisons. For instance, most measures focusing on lexical variety/diversity and richness 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, have more content words – nouns and verbs – on average (normalized frequencies) in their turns (Figure 6). These key content words are often delivered as a one-word or part of a phrasal response to a question (e.g. *Atlanta, the kitchen, communicate*). The time it takes for AAC users to type and play responses to questions clearly influences their very

limited responses and average length of turns. However, related ongoing analyses examining the annotations on the ANAWC for length of pauses, the average wait times in AAC user responses, and the frequency and functions of various vocalizations suggest that several paralinguistic markers are able to compensate for these limitations. One-word and phrasal responses appear to be sufficient, for the most part, to sustain the flow of workplace discourse within an AAC user context.

All other speaker groups in the ANAWC (non-AAC users and their co-workers; co-workers of AAC users) maintained a relatively similar pattern of linguistic co-occurrence. Workplace discourse is highly interactive and involved, often making use of narrative markers (e.g. past tense verbs and third-person pronouns) and situation-dependent references (use of time and place adverbial markers). Non-AAC corpus data show extensive use of communicative features such as discourse markers of participation (e.g. *I mean, you know*), information management (e.g. *okay, well*), and dysfluent speech features such as repeats (e.g. *III think yes*) and filled pauses (transcribed as: *ehm, um, uh*). These markers are extremely limited in AAC transcripts.

Detailed qualitative analyses of conversational features such as small talk, topic shifts, turn-taking, and interruptions in the ANAWC are being conducted to also focus on how AAC devices influence the way co-workers frame utterances or questions to AAC users. With regard to topic selection, an initial analysis of the ANAWC shows that common topics in general workplace settings (e.g. weather, health, family, appearance, professional life, sports, and people known by the participants) (Holmes, 2009) were also frequent in the corpus, together with other topics such as food and drinks, technology/mass media, and (extended) greeting routines (Pearson et al., 2011). These identified topics and contexts potentially help in mapping the structure of workplace exchanges. Further analysis will account not only for the typologies and number of topics, functions, and distributions in ANAWC, but also for hierarchies and conflict mechanisms based on, for example, power or gender dynamics (Di Ferrante, 2012).

The majority of the turns by the AAC participants who contribute to this corpus were responses to questions (mostly: *yeah, yes, no, I don't know*), which reflects the way interlocutors address many of the communicative tasks when working with AAC users. Beyond the documented limitations of AAC devices for workplace communication, however, the linguistic limitations of AAC users appear to be manageable in this dataset during a 40-hour workweek. Pre-programmed data might be necessary for the likes of theoretical physicist Stephen Hawking (who uses an AAC device) and for one of the participants in this study (Saul = IT specialist), who are engaged in providing lectures or training support to various listeners. An improved device that allows easy access to these preparation/typing and recording tools or pre-recorded responses provides users with the opportunity to minimize wait times and also provide longer, in-depth answers. For others in more conventional office settings (e.g. grant administration or parks and recreation management), support for the use of specific key/common vocabulary (content words) and some office-based formulaic sequences may improve the flow of question-answer turns. In these groups, the co-workers of AAC users are able to adjust and compensate for the nature of responses produced by these devices, with opportunities for improvements.

## Conclusion

The AAC and Non-AAC Workplace Corpus (Pickering and Bruce, 2009), collected in seven workplace settings in the US, has over 220 hours of spoken interaction from eight focal participants and more than 100 interlocutors. An approximate word count of almost half a million words of the ANAWC is a substantial database that may very well represent a majority of the contexts and ranges of vocabulary and grammatical structures of broader AAC discourses. However, there are limitations with regard to the current number of focal participants and the range and scope of multi-modal annotations for corpus-based analyses so far. At present, various analyses from quantitative and qualitative approaches are being conducted to understand further and in greater depth the nature of talk produced by AAC users relative to others in comparable job situations. A clear application of the findings of these ongoing studies will inform and direct the improvement of AAC devices to enable them to better produce speech that matches the minimum level of expectations of co-workers and listeners in the workplace, as well as those of the users themselves.

Descriptions of the functional features of AAC texts, as well as interlocutors' reception to these features, help both groups in successfully navigating a range of on-the-job discursive topics. Overall, the linguistic features of discourse used in job situations by AAC users differ from those of non-AAC discourse in comparable work contexts, but these differences, at least in the context of the present study, do not directly seem to restrict or hinder the flow/transfer of information. The 'written' structure of AAC texts are positively captured in Biber's first three dimensions against the underlying 'interactive, personal, spoken' features of most workplace texts. In addition, this model hints at future linguistic directions to pursue for supplementary corpus-based studies.

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