Comp. by: 201508 Stage: Proof Chapter No.: 13 Title Name: Conradetal
Date:3/1/20 Time:12:56:46 Page Number: 187

13 Applications of Applied Linguistics to Augmentative and Alternative Communication Device Users in the Workplace

LUCY PICKERING

The voice I use is a very old hardware speech synthesizer made in 1986. I keep it because I have not heard a voice I like better and because I have identified with it.

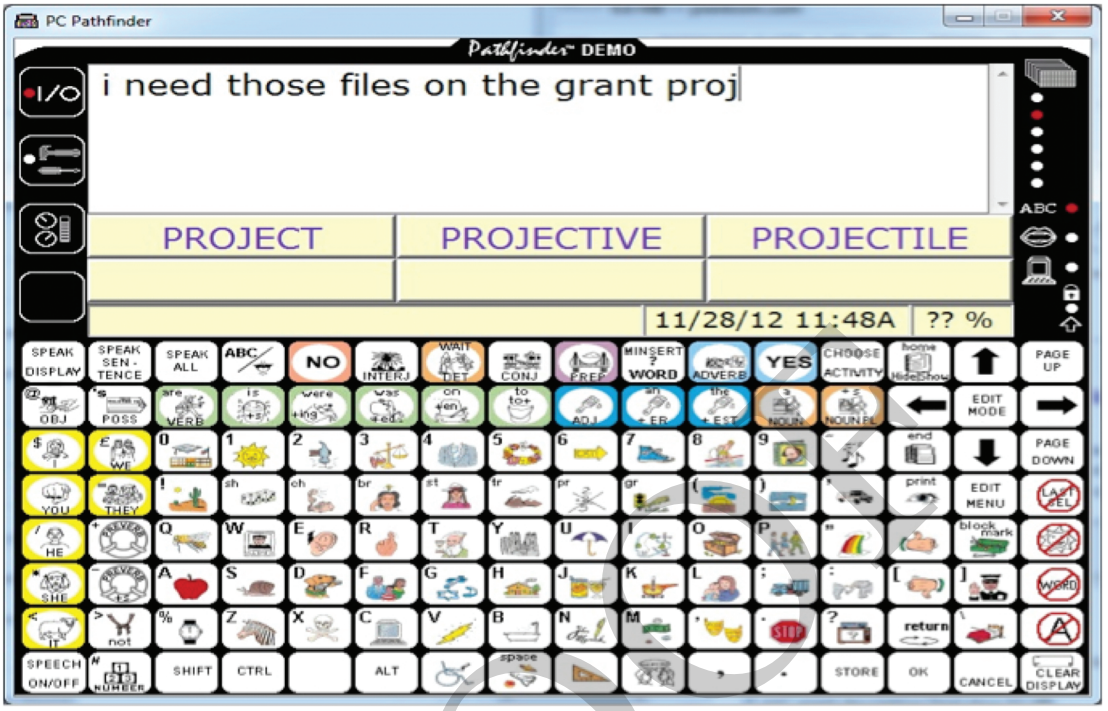
Stephen Hawking

Overview of Key Concepts and Issues in Augmentative and Alternative Communication

Augmentative and Alternative Communication (AAC) is an umbrella term used to describe a range of strategies and technologies designed for people with complex communication needs as the result of a developmental disorder such as cerebral palsy or an acquired or degenerative neurological condition such as traumatic brain injury or amyotrophic lateral sclerosis (ALS). All of these conditions can cause **dysarthria** or difficult or unclear articulation of speech in people who have no mental impairment. (Mental impairment and loss of ability to comprehend language may also occur with some of these conditions, but these issues are not addressed in this chapter.) Perhaps the most recognizable AAC user worldwide is the physicist and cosmologist Dr. Stephen Hawking (1942–2018) who is shown above and had a slow-progressing form of ALS or motor neurone disease.

An AAC system is an "integrated group of components, including [any] symbols, aids, strategies and techniques used by individuals to enhance communication" (ASHA, 1991, p. 10). A range of systems are currently available and span low-tech systems that function without electronic components (e.g., picture boards) to high-tech speech generating devices (also called Voice Output Communication Aids or VOCAs) that use computer technology. Increasingly, there is also a use of mobile

Comp. by: 201508 Stage: Proof Chapter No.: 13 Title Name: Conradetal
Date:3/1/20 Time:12:56:46 Page Number: 188



(a)

Figure 13.1 Screen shots of the AAC device "Pathfinder" and the App "Speech Assistant AAC"

devices such as smart phones. Access strategies or interfaces with the devices depend on the level of the motor skills of the user and a number are now available including head and eye tracking technology, laser pointers, and swipe or touch interfaces. For example, head-pointing interfaces use optical sensors that track head movement using a small, reflective dot placed on the user's glasses or forehead, while switch interfaces can be activated using any other body part such as the hand, knee, or foot. Two touch screen examples are shown in Figure 13.1. The first is a computerized symbol board and the second is an app available for the iPhone.

Despite this apparent wealth of resources for AAC users, there is an ongoing frustration with VOCAs due to the time it takes users to program spontaneous utterances in a real-time conversational environment. A common misperception is that these devices enable conversations that resemble natural speech in terms of speed and fluency; however, this only occurs when users are working with pre-programmed utterances. If users wish to generate spontaneous new utterances (also called SNUG – spontaneous novel utterance generation), devices are quite limited in terms of quickly accessing context-specific language. In fact, one of the most commonly cited challenges with AAC is a limitation on the words and utterances that are available for easy and quick access (Wisenburn & Higginbotham, 2008).

(b)

Figure 13.1 (*cont.*)

Devices typically allow users to express only 65 words per minute, one-third of the average normal conversational rate of 180 words per minute (Dominowska, 2002). Higginbotham and Wilkins (1999) note that these time delays often exclude augmented speakers from inhabiting the same communication "time stream" as their non-AAC user co-participants; users must choose whether to "come in late" or let the opportunity pass. These constraints create an imbalance between AAC and non-AAC users. AAC users have lower initiation rates and fewer conversational turns; users may forget what they were trying to say, and listeners may stop attending (Higginbotham & Caves, 2002; Hoag, Bedrosian, McCoy, & Johnson, 2004). An AAC user describes below how this can frustrate daily interactions:

> Even now with speech on my communicator there are times when my responses aren't quick enough and people will go on to the next question or topic while I'm still answering

> the first one or look to people around me to answer for me . . . And this is with people who know how frustrating this has to be for me. (Odom & Upthegrove, 1997, p. 259)

One of the reasons for this obstacle with regard to spontaneous utterances is the way in which AAC devices are traditionally programmed using natural language processing (NLP) systems. NLP techniques use computer algorithms to assign probabilities to words or sentences based on statistical language models. As Higginbotham, Lesher, Moulton, and Roark (2012) explain: "word prediction and word completion models are often developed by collecting large text corpora (often exceeding 10 million words) and then making predictions based on patterns observed in those collections" (p. 15). Vocabulary and language patterns are then typically divided into core vocabularies that are assumed to be common among all users and thus highly generic, and fringe vocabularies that contain unique content words that may have a low commonality outside certain basic contexts (Balandin & Iacono, 1998). In other words, as all contextual factors have effectively been eradicated from the language input, it is more difficult to tailor the devices to particular users and their specific needs. Core vocabularies that are more easily accessible typically do not meet the needs of users in the workplace as they require an expanded vocabulary and use words that they do not use in any other context (Creech, 1993). It has been increasingly acknowledged that it is imperative to move beyond this basic programming addressing primarily the expression of generic "needs and wants" of users to systems that allow a focus on domain or genre-specific prediction in order to support AAC users' participation in "socially valued roles" such as workers or parents (Bryen, 2008).

This development requires a sophisticated understanding of linguistic and sociolinguistic patterns used in a given context and within the AAC literature there has been a call to conduct more **social validation studies**, that is, studies that focus on identifying core language patterns by investigating language users' experience in the specific context of interest (Bryen, 2008; Graves, 2000). Thus far, there have only been a few studies examining the workplace. Balandin and Iacono (1998) asked professionals involved in the field of AAC (speech pathologists, teachers, and rehabilitation counselors) to predict what sort of topics and vocabulary might occur in meal-break conversations at work and could be usefully programmed into VOCAs. Overall, approximately two-thirds of the predictions were correct, but approximately one-third of suggested topics did not appear. Graves (2000) also asked non-AAC using employees to document conversational topics. Sixteen workers in residential homes kept a diary in which they noted topics of conversations and found that areas of interests, leisure activities and food and drink featured most frequently.

Several other studies have targeted AAC users specifically using both surveys and focus groups to ascertain perceived needs and current gaps for AAC users in employment (Light, Stoltz & McNaughton, 1996; McNaughton, Light & Arnold,

2001; Odom & Upthegrove, 1997). Technological difficulties faced by AAC users in the workplace was a frequent topic of discussion, and these included the limited speed of SNUG communication which many felt negatively impacted their communicative effectiveness. One user stated: "Of course, the speed is not like normal speech. So, often a moment passes before one can type a comment. And I find it necessary to edit my comments, and therefore my thoughts are sometimes oversimplified" (McNaughton et al., 2001: 187).

Under any measure, these experiences are understudied, and a clear understanding of the needs of AAC users and their non-AAC interlocutors in the workplace has yet to be fully developed. It is possible that this has been neglected in the field of AAC because it is primarily a linguistic issue rather than a technological one. AAC developers have focused primarily on message formulation and retrieval options and access technologies. Thus, Tetzchner and Basil (2011) note that there is a lack of discussion of "real conversational usage" of people with aided communication:

> Many professionals working with augmentative and alternative communication are more interested in technology and intervention practices than in communication processes; the forms and functions of the utterances produced may not be a real focus for them.
> (Tetzchner & Basil, 2011, p. 148)

Pullin, Treviranus, Patel, and Higginbotham (2017) additionally note that as a field, AAC research may need to consider new research tools as ways of "engaging in accessible and contextual participatory research" (p. 146). This is the locus at which AAC research and applied linguistics research meet, and in the project described below, we leveraged a contextualized and participatory applied linguistics research design to answer the question: What are the specific language needs of AAC users in order to participate in **workplace interactions** as identified through the collection of face-to-face interactions between both AAC and non-AAC users? And the intention was to provide a comprehensive assessment of the typical discourse patterns of both AAC users and comparable non-AAC users in the workplace.

My Work with AAC

Personal Reflection

In the year that I started middle school in the UK, my mother was diagnosed with Multiple Sclerosis (MS), and was confined to a wheelchair. At that time, there wasn't the kind of wide acceptance of accommodations for disabilities that exist now, and I recall many moments of frustration and resentment for my mother and the rest of our family as we tried to negotiate our new status and keep life as normal as possible. So, in 2009, when I was asked to join a project designed to improve the daily experience of AAC users in the workplace, I jumped at the chance.

I collaborated with Carrie Bruce, a research scientist at the Center for Assistive Technology and Environmental Access at the Georgia Institute of Technology, and we received a grant from Georgia State University. The goal of the collaborative project was to develop a workplace-specific corpus focused on the needs of AAC users that could be used to conduct the kinds of social validation studies described above and address some current gaps in our understanding of their linguistic experiences in the workplace.

My Work with the Augmentative and Alternative Communication and Non-Augmentative and Alternative Communication Workplace Corpus

Creating the Corpus

A **corpus** is a principled collection of either written or spoken natural texts. Friginal and Hardy (2014) provide several examples of how and why this approach might be used including, from linguistics, the case of lexicography. A lexicographer who is compiling a dictionary may create a corpus of naturally occurring language to establish the frequency of particular words and the contexts in which they typically appear. In such a case, the electronic corpus that is created will run to many millions of words at which point it becomes impossible to search the data manually. Thus, corpora are also designed to be "machine readable," that is, the data are marked up or annotated in order for software programs to be able to "read" different characteristics of the texts. Typically, these are lexico-syntactic features or **part-of-speech (POS) tags** that tag each word as a noun, verb, adjective, and so on, but corpora can be tagged for any features that are of interest. For example, the Hong Kong Corpus of Spoken English-Prosodic is tagged for intonational features such as falling and rising tones (Cheng, Greaves & Warren, 2005). Specialized corpora can also be created and used to investigate specific questions.

Our specialized corpus targeted AAC device users who were employed outside the home. Following the recommendations of AAC researchers (Beukelman & Mirenda, 1992; Higginbotham, 1995; Higginbotham & Bedrosian, 1995), we also collected data from non-AAC users in comparative work contexts. This provided performance data from non-AAC users to which AAC users could be compared and also provided a real-life measure of vocabulary and language use. The corpus comprises over 200 hours of spoken interaction (approximately 1 million words) collected in seven different workplace locations. Four AAC users and four non-AAC users in parallel professional contexts wore a voice-activated digital audio recorder for one week (i.e., five consecutive working days) and recorded their workplace interactions with over 100 interlocutors in total. Details regarding the eight primary participants are given in Table 13.1, which is organized by paired AAC and non-AAC participants.

The eight participants had complete control over the recording process. They started and stopped the recording at the beginning and end of each workday, throughout the day, or when requested to do so by an interlocutor which, of course, resulted in the wide range of recording times among participants shown in

Table 13.1. Information on participants and data collected in each workplace

Participant	AAC Status	Gender	Job / Workplace	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

Table 13.1. Overall, the data set comprised a wide variety of typical kinds of workplace interactions including meetings, informal office talk (including small talk, which is discussed in the data analysis activity), workplace telephone talk, conferences calls, and presentations.

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) and adapted from Friginal (2008, 2009). Transcriptions include additional interaction-based elements such as non-verbal information (e.g., ambient noise or laughter), length of pauses, number of filled pauses and overlapping speech. All personal identifiers were stripped (e.g., names, proper nouns, addresses, phone numbers) and replaced with generic proper nouns.

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 two sub-corpora were created – one comprising all the data from the four primary AAC users and one with the data from their non-AAC user counterparts. An example of text input from AAC-user Saul and the resulting tagged output is shown in the appendix at the end of this chapter.

Sample Findings from the ANAWC Our initial research has focused on identifying language patterns that distinguish AAC device users' language from that of non-AAC users in the workplace and specifically overall differences in the grammatical and vocabulary features of the AAC users and non-AAC users sub-corpora. This is achieved through a method called **multidimensional analysis** in which patterns of co-occurring features are laid out along functional dimensions (see Friginal & Hardy, 2014 for a detailed discussion of this method). Friginal, Pearson, Di Ferrante, Pickering, and Bruce (2013) investigated three dimensions: 1) involved versus informational production – the difference between spoken and written texts; 2) narrative versus non-narrative features – use of linguistic features to tell stories about past events and experiences; and 3) explicit vs. situation-dependent features – use of time and place markers that reflect the physical context of the discourse.

The AAC and non-AAC users patterned in opposite ways across all three of these dimensions. AAC users' discourse was primarily informational. In comparison to non-AAC user discourse, it lacked personal pronouns, private verbs such as *I think*, *I wonder* and typical spoken discourse markers such as *you know*, *I mean*. There was instead a high concentration of nouns and noun phrases reflecting the often-curtailed responses of the AAC user. An example is given below in which AAC-user

Ron uses only the nouns 'city' and 'address' to communicate with one of his co-workers:

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 big 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

(Friginal et al., 2013: 288–289)

These findings support the "trade-off" that AAC users report 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 and stay relevant in the time stream of the conversation. AAC users' discourse also lacked narrative features in comparison to their non-AAC counterparts. This too is a result of contending with the time delay in creating utterances, which precludes AAC users from spontaneously elaborating on the narrative contributions of others. Where these narrative texts did appear in the AAC user data, they were frequently part of pre-programmed speech such as in the example below from Sarah who was giving a presentation on disability etiquette to a large audience:

Text excerpt 2: AAC user Sarah

AAC-Sarah: [0:06][preprogramed] I would like to introduce Marissa Sanderson my assistant who will interpret for me periodically throughout this presentation [0:02] please feel free to stop me if you have a question or a comment [+] I am here to talk to you about people first language and disability etiquette [0:03] Mark Twain said the difference between the right word and the almost right word is the difference between lightning and the lightning bug [0:02] how many of you have heard the word handicapped? [0:04] the origin of the word handicapped refers to a person with a disability begging with a cap in his hand this is how the majority of society used to view people with disabilities

Similarly, AAC users' texts demonstrated fewer situation-dependent in terms of time or place adverbs such as those shown in the example below from non AAC-user Paula:

Text excerpt 3: Non-AAC User 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: Yeahmmm-hm definitely but as far as just like may be 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

(Friginal et al., 2013: 293–294)

In sum, unlike the typical workplace discourse found in the non-AAC texts, which was 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.

Data Analysis Activity

Interpersonal dynamics and the ability to form positive relationships are considered to be critical "soft skills" that are needed in the workplace (McNaughton & Bryen, 2002). They are built, in part, by the kinds of non-task-related talk that co-workers engage in throughout their workday including what we might call ***small talk*** or *chitchat* and *joshing* or *banter.* In the activity on the website accompanying this book, you will examine some of the small talk samples that appear in the ANAWC. There is a lot of small talk in all the workplace data we collected, and one of the projects we undertook was to identify what topics were most commonly discussed and how listeners responded to them to help us understand what different kinds of vocabulary are needed. You will find all the materials you need on the website accompanying this book.

Going Further

For work in this area, personal and academic background is important. Personally, I found that "grass-roots" work in the local community, such as volunteering with different organizations to promote the visibility of people with disabilities, educated me well in the kinds of day-to-day experiences that occur both inside and outside the workplace. You can pursue volunteer opportunities in your own community.

Academically, linguistics classes will teach you about the nature of language and communication. General Linguistics and Introduction to Linguistics classes provide a solid understanding of subsystems of language that we have talked about here such as grammar and vocabulary. Classes in Sociolinguistics are useful for this area of work because they discuss contexts of language use such as the workplace discourse.

This chapter has focused specifically on the linguistic experiences of adult AAC users in the workplace but of course, there are many other important issues in the field of AAC that linguistic analysis can be applied to. Two areas are addressed in fields closely related to applied linguistics. First, there is a growing literature on the use of AAC with children with complex communication needs. In April 2018, the CDC issued a report estimating a continued increase in diagnoses of autism disorders for children,[1] and many of these will be assessed for AAC use. This will be done by speech pathologists who have usually studied in departments specializing in Speech Communication Disorders or by special education teachers from departments of education. These programs often have cross-over courses with Linguistics or English departments as their concerns overlap in many areas.

The second area is speech science. While there have been huge strides forward in text-to-speech systems and speech synthesis, it is still not possible to mirror a natural tone of voice with the ability to produce all the inflections that come with it. As one AAC user explains, "I want to be able to sound sensitive or arrogant, assertive or humble, angry or happy, sarcastic or sincere, matter of fact or suggestive and sexy" (Portpuff, 2006, p. 6, as cited in Pullin & Hennig, 2015, p. 170). Classes that investigate these issues can be found in Computational Linguistics programs and also in departments of Human Systems Engineering and Computer Engineering.

Discussion Questions

1. **The following YouTube clip shows VOCA-user comedian Lee Ridley, who performed as "Lost Voice Guy" on *Britain's Got Talent* in 2018. www.youtube.com/watch?v=xsqInns6LXQ.**

   Watch the clip and then discuss the questions below:

   a. Can you identify the SNUG utterance Lee programs in the clip as opposed to the preprogrammed utterances?

[1] www.autismspeaks.org/science/science-news/cdc-increases-estimate-autism%E2%80%99s-prevalence-15-percent-1-59-children

b. How is it identifiable?
c. How has Lee prepared for this possibility and how does he prepare the audience for the change in "time stream"?

2. **Consider this data sample, which is an extended extract of text extract 2 shown above. Halfway through the extract, Sarah shifts from preprogrammed language to vocalizations indicated by VOC in the transcripts). These are then interpreted by Marissa who is Sarah's aid. It is not uncommon for AAC-users to use a mix of their own remaining speech ability (i.e., what remains of their oral motor functioning) and their device if they feel they are still partially intelligible to those around them. 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 understood. Discuss why you think Sarah shifted to vocalizing her thoughts.**

AAC-Sarah: [0:06] I would like to introduce Marissa Sanderson my assistant who will interpret for me periodically throughout this presentation [0:02] please feel free to stop me if you have a question or a comment [+] I am here to talk to you about people first language and disability etiquette [0:03] Mark Twain said the difference between the right word and the almost right word is the difference between lightning and the lightning bug [0:02] how many of you have heard the word handicapped? [0:04] the origin of the word handicapped refers to a person with a disability begging with a cap in his hand this is how the majority of society used to view people with disabilities
AAC-Sarah: also people with disabilities are not heroes or inspirations [voc]
Marissa: that's one of my pet peeves
AAC-Sarah: [voc]
Marissa: I don't want to be anybody's hero I don't want to be an inspiration
AAC-Sarah: [voc]
Marissa: I am a person

3. **One unanticipated finding from the ANAWC was the amount of non-task-related talk or small talk that occurred in the data. This was particularly salient as it is precisely the kind of fast-paced spontaneous talk that AAC-users cannot participate in. Reflect on your own work environment (if possible, note down what conversational topics occur while you are at work). How much of your work conversation would you estimate is non-task related and what functions does this non-task-related conversation serve?**

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Comp. by: 201508 Stage: Proof Chapter No.: 13 Title Name: Conradetal
Date:3/1/20 Time:12:56:48 Page Number: 202

APPENDIX:

Example of text input and resulting tagged output from AAC-user Saul

Text input

[SAUL]

Right now uh I'm going to call one of our consumers and set up the delivery for Monday but um [+] we have 2 drop off sites in Carolina [+] one being in Columbia and one being in North Charleston [+] we got another call from Spartanburg Spartanburg is close to Greenville [+] and I know Mr. Jim will be back on next week and

Tagged Output

```
Right ^nn++++
now ^rn+tm+++
uh ^uh++++=FILLEDPAUSE
I ^pp1a+pp1+++
'm ^vb+bem+aux++
going ^md"++pmd"++
to ^md+prd+++
call ^vb++++
one ^pn++++
of ^in++++
our ^pp$+pp1+++
consumers ^nns++++
and ^cc++++
set ^vbd+++xvbn+
up ^rb+phrv+++
the ^ati++++
delivery ^nn++++
for ^cs+sub+++
Monday ^nr++++
but ^cc++++
um ^uh++++
```

```
we ^pp1a+pp1+++
have ^vb+hv+aux++
2 ^cd++++=two
drop ^vb++++
off ^rb+phrv+++
sites ^nns++++
in ^in++++
Carolina ^np++++=Carolina
one ^cd++++=one
being ^vbg+beg++xvbg+
in ^in++++
Columbia ^np++++=Columbia
and ^cc++++
one ^cd++++=one
being ^vbg+beg++xvbg+
in ^in++++
North ^nr+pl+++=North
Charleston ^np+++??+=Charleston
we ^pp1a+pp1+++
got ^vbd+++xvbn+
another ^dt++++
call ^nn++++
from ^in++++
Spartanburg ^np+++??+=Spartanburg
Spartanburg ^np+++??+=Spartanburg
is ^vbz+bez+vrb++
close ^in+cmpx+++
to ^in"++++
Greenville ^np+++??+=Greenville
and ^cc++++
I ^pp1a+pp1+++
know ^vb+vprv+++
Mr ^npt++++=Mr.
. ^.+clp+++=EXTRAWORD
Jim ^np++++=Jim
will ^md+prd+++
be ^vb+be+vrb++
back ^rp++++
on ^in++++
next ^rb++++
week ^nn++++
and ^cc++++
```