Effects of Varying Floorholder Message Content When Using Alternative and Augmentative Communication (AAC) with Voice Output on the Telephone

By

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Abstract

Telephone communication can be difficult for individuals who use augmentative and alternative communication (AAC). This study investigated the effects of various floorholder messages on success of telephone interactions. The researcher called 120 randomly selected businesses in a major midwestern metropolitan area and used AAC with voice output to request business hours. Calls were assigned to one of three floorholder conditions (traditional telephone script, basic floorholder message, or specific instructions) or a no-floorholder condition. Dependent variables included whether the call was successful or unsuccessful (evaluated using a Chi-square analysis), the participant's reaction to the call, and responses to follow-up interview questions. The researcher analyzed the results of follow-up interview using analysis of variance (ANOVA) and Bonferroni post-hoc testing. Floorholder condition had no effect on the success of the phone calls. Participants in the basic floorholder group reported significantly greater belief that the caller was a real person compared to the control group (no floorholder). No other statistically significant differences were found.

Introduction

Augmentative and alternative communication (AAC) is defined by the American Speech-Language-Hearing Association (ASHA) as "all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas" (2015). AAC involves the use of aided or unaided symbols, or a combination of the two types. Unaided symbols are symbols that do not require any external device. These include various types of behaviors such as gestures, vocalizations, and manual signs. Aided symbols require the individual to use external materials to communicate a message. External materials may include tangible objects, line drawings, and/or photographs of objects. When using aided symbols, the individual may select symbols to communicate a message using a variety of techniques. These include direct selection (the individual directly selects a symbol using pointing, physically contacting the symbol, or eye gaze technology) and scanning (items are presented one by one and the individual uses a pre-determined method to indicate which message he/she desires to communicate).

A wide variety of individuals use AAC to communicate. These include both individuals who use AAC to supplement oral speech and individuals who have no oral speech capabilities and rely on AAC for all communication. There are many types of AAC, ranging from non-technological options such as a paper communication boards and gestural communication to high-tech electronic devices. A component of many high-tech AAC devices is the capability for speech output. Devices that produce speech output are known as speech-generating devices (SGD) or voice output communication aids (VOCA). Speech output is available in the form of digitized speech or synthesized speech. Digitized speech is an electronic recording of a natural voice that can be stored on a SGD and reproduced. This type of speech output limits the user to vocabulary that has been pre-recorded. Synthesized speech involves the use of a computerized

algorithm that converts text to speech. This method allows greater flexibility in adding vocabulary to a SGD (Beukelman & Mirenda, 2013).

Speech-generating devices are necessary for individuals with complex communication needs (CCN) who desire to communicate using a telephone. Despite the recent advances in technology that allow individuals with CCN to use telephones to communicate, many challenges still exist for these individuals in regards to telephone communication. Previous research has compared various types of telecommunication, as well as examining factors such as use of floorholder messages, conversational timing, and various voice options, that affect the success of AAC communication on the telephone.

Literature Review

Importance of Using AAC on the Telephone

Few researchers have studied the use of AAC on the telephone; however, this is a very important area. Being able to speak on the telephone is important in many situations, including conducting business, obtaining emergency assistance, and maintaining social relationships (Sellwood, Wood, & Raghavendra, 2012). With speech-generating technology, individuals with CCN are able to use AAC for telephone communication. While other options, such as text-based communication and using one's own voice on the telephone are available in some situations, in other circumstances using AAC on the phone is preferable.

In some situations, text-based communication is impractical or even impossible. For example, voice communication using natural or synthetic voice is often necessary for calling emergency services. Although some text based options such as telecommunication devices for the deaf (TDD) are available, not all individuals with CCN possess these devices (Rubin, 1995).

Additionally, lack of literacy or technological skills can limit some individuals' ability to use text-based communication (Sellwood et al., 2012). For individuals with disorders affecting speech intelligibility, using AAC is often more practical than natural speech for telephone communication. According to a study by Drager, Hustad, and Gable (2004), synthesized speech was more intelligible than natural dysarthric speech when using a telephone (dysarthria is defined by Duffy as "a collective name for a group of neurologic speech disorders that reflect abnormalities in the strength, speed, range, steadiness, tone, or accuracy of movements required for the breathing, phonatory, resonatory, articulatory, or prosodic aspects of speech production" [2013 p. 4]). The researchers found that many listeners felt more comfortable listening to synthetic speech than natural dysarthric speech. Survey respondents also reported more positive opinions of communicators who used synthetic speech rather than natural dysarthric speech (2004).

Telecommunication Options

Sellwood et al. (2012) surveyed perceived usefulness of various telecommunication access methods for adults with physical disabilities and communication difficulties. This study had four phases: recruitment, survey, focus group, and analysis.

During the recruitment phase, participants were solicited via email. All participants in the study, as well as the primary researcher, had both physical disabilities and CCN. For this reason, the researcher needed to consider factors such as (1) additional time/energy needed for both researcher and participants to complete tasks, (2) levels of literacy, and (3) possible influences from participants' family members and personal assistants during participants' responses. All of the participants met the following inclusionary criteria: 18 years or older, an AAC user, and adequate literacy skills to participate in the survey and subsequent online focus group.

The survey in this study included questions about age, gender, disability, type of AAC, modes of communication, and use of telecommunication and other technology. After completion of the survey, participants were invited to participate in a three-week online focus group. The online focus group was meant to collect detailed qualitative data to supplement survey results. Each week, participants discussed a new question on an online board. A total of 13 participants were included in the study. Because of the small sample size, the researchers collected descriptive data rather than statistical data. Only three of the participants actively participated in the focus group, which further limited the data available to the researchers.

Many of the individuals surveyed reported that they preferred other methods rather than using a landline phone for telecommunication. For activities such as making a complaint, doing business, and talking with friends, more respondents reported using email and short message service (SMS) than a landline. Email was the most commonly used telecommunication method across communication needs for the study participants. While email and SMS are useful as telecommunication methods for individuals with CCN, some situations simply require the use of a telephone. Participants reported that for some situations, such as making an emergency call, email and text messaging were not available.

As part of the survey, respondents rated the perceived usefulness of a video-assisted speech-to-speech relay (VAS). VAS refers to technology in which a trained relay officer joins a telephone conversation as a communication assistant to assist in repairing communication breakdowns. All survey respondents perceived this technology to be useful or very useful. Participants rated “talking with close family members, talking with friends, and doing business” relatively lower than other communication needs. For these types of communication, respondents indicated that they would prefer using their current communication mode rather than VAS. Ten

respondents indicated a benefit of VAS was that the individual with CCN and the relay officer could see each other. Half of the idered VAS more efficient than their current telecommunication options.

Most individuals surveyed preferred using text-based communication (i.e., email, SMS) for distance communication. However, these communication methods are not always readily available to individuals who are illiterate or who, because of physical, intellectual, or other impairments have difficulty typing or otherwise accessing a keyboard. Participants reported more confidence using AAC distance communication with family members and friends than with other communication partners. Based on the results of this investigation, it appears that individuals with CCN use text-based communication for a majority of their distance communication with familiar partners. However, because the survey did not ask how often various types of telecommunication occurred, the researchers could not definitively make this conclusion.

The results also suggested that study participants "are more likely to use landline telephones to communicate with unfamiliar communication partners" (p.29.8). Although results suggested that many AAC users prefer text-based communication, more than half of the respondents reported using a landline telephone to communicate in at least some situations. Participants reported that text-based communication is not always an option. It is important, therefore, that AAC users have additional distance communication options, such as using a telephone with a speech output device.

Effects of a Floorholder Message

Many individuals who use natural speech to communicate begin conversations with new partners with a brief introductory message. These messages are also important for individuals

who rely on AAC for communication, perhaps even more important. According to Beukelman and Mirenda (2013), introductory messages of individuals with disabilities typically have three basic components: (1) basic information about the speaker (may mention the individual's disability), (2) information about the individual's communication mode, and (3) an explanation about what the listener can do to facilitate communication. Messages such as these are sometimes called floorholder messages. Using a floorholder message is especially important for telephone conversations, when the speaker's disability is less likely to be immediately noticeable. Researchers have investigated the effects of using floorholder messages during telephone conversations, as well as effects of various types of floorholder messages.

Hanson and Sundheimer (2009) investigated the use of floorholder messages during AAC telephone communication, and how they affected communication success. These researchers called 100 randomly selected businesses to inquire about business hours using an SGD. Of the 100 participants in the study, 69 were judged to be female, 28 were judged to be male, and 3 could not be identified by gender. The ages of participants who answered follow-up questions ranged from 19-74, with a mean of 36.3 years. Researchers in this study used a DynaVox MT4 SGD with the Betty DECtalk® voice.

Before beginning the experiment, one author called the other author from a quiet room to establish correct volume and rate of speech. The researchers determined that 50% volume and a speech rate setting of 30 was appropriate. The study used two telephones: a Uniden landline telephone was used for 30 calls, and an LG cellular telephone was used for the remaining 70 calls. During all calls using the cell phone, the phone had good reception (defined as 4/5 or 5/5 bars). Two different phones were used because the original telephone became unavailable after the study began. Because the success rate was similar for calls with both phones, the data were

combined for analysis. The researchers used a speakerphone function, with the SGD three to four inches from the phone in a quiet room.

In each call, an experimenter asked “What are your hours?” The 100 calls were randomly assigned to four conditions: “(a) floorholder present, no delay, (b) floorholder present, delayed, (c) floorholder absent, no delay, (d) floorholder absent, delayed” (p. 93). In the “no delay” condition, the request was made immediately after a participant answered the call. In the “delay” condition, a three-second delay was present before the request was made. In the “floorholder” condition, the researcher used the SGD to transmit the message “Please wait, I’m using a computer to talk” before making the request (p. 93). In the “floorholder absent” condition, only the request was transmitted.

Calls were categorized as successful or unsuccessful based on whether or not the participant gave the correct information. Unsuccessful calls were further categorized depending on what made the call unsuccessful. These categories were “(a) partner hung up immediately upon hearing the synthesized speech or silence (in the case of the delayed condition); (b) partner hung up prior to completion of call, after hearing at least a few words; (c) partner did not hang up but could not provide requested information because of poor intelligibility; or (d) partner reacted with a hostile tone and comment (e.g., “Is this a joke!?”) or provided incorrect information in response to the request for information, such as “He’s unavailable” or “We’re all out”)” (p. 93).

The independent variable was the presence or absence of a floorholder message and delay. The dependent variable was whether or not the phone calls were successful. Twenty-four of the 100 total telephone calls across all conditions (24%) were successful (the participant provided the requested information).

The data were analyzed to determine which conditions resulted in the most successful telephone interactions. The condition with the highest percentage of successful calls was the floorholder present, no delay condition. In this condition, 46.2% of calls were successful. The floorholder absent, delay present condition resulted in a 29.2% success rate; the floorholder present, delayed condition had 16% success. The least successful condition was the floorholder absent, delayed condition, with only 4% success. As the researchers expected, using a floorholder increased the conversation success rate. Forty-one percent of the calls were classified as immediate hang-ups; the participant hung up the phone as soon as he or she heard the synthetic voice (in the no-delay condition) or silence (in the delay condition). The high rate of hang-ups is not encouraging for determining ways to increase communication success; many participants did not even hear the floorholder message because they had already hung up the phone. Most of the unsuccessful calls consisted of negative reactions from the participant, either by simply hanging up and not giving the caller a chance to make the request, or by replying with hostility, sarcasm, or rudeness.

After all calls, the investigators called back and asked questions about the call using natural speech. Of the 14 participants who agreed to answer the follow-up questions, seven thought that the experimental call was from a real person. The two participants surveyed who hung up immediately either thought the call was a prank or that there was a poor connection. The majority of those surveyed reported that they were “OK with [receiving the call].” Most said they had never previously received a call from a machine. According to the researchers, “the floorholder considered by itself did not result in significant differences, although clearly, starting the call with a floorholder enhanced the chance of success” (p. 96).

The results of this study suggest that the combination of appropriate timing and the use of a floorholder message can increase the success of telephone conversations. One of the main problems resulting in unsuccessful calls was that the participant did not think a real person was calling. This is a problem that occurs in telephone communication, but not face-to-face communication. Telephone communication lacks many of the nonverbal cues that indicate that the communicator is trying to compose a message. The researchers surmised that with face-to-face communication, it is obvious that the communicator is a real person, and often easy to tell that the communicator is using an SGD.

Nakamura, Arima, Sakamoto, and Toyota (1993) also studied the effects of a floorholder on conversational success; however, they investigated the effects of various types of floorholder messages. Their study investigated listener reactions during various conditions while speaking on a telephone using an SGD. There were 137 participants, most of them undergraduate students at a Japanese university. Other participants included parents, siblings, and friends of these undergraduate students. The SGD used for this study was an ASCII AVM-10. The study was conducted in Japanese. The experimenter used an SGD to call the participants and ask questions such as “Is (name) there?” Following the initial conversation, the experimenter called again and used natural speech to conduct a follow-up interview. For this interview, the experimenter presented a series of adjective pairs (e.g. comfortable/uncomfortable, safe/anxious). The subject was asked to use a five-point scale to describe which adjective was a closer match for their feelings. The experimenter also asked the participant about their age, gender, “What did you imagine about the speaker?” and “Did you have any comments or advice?” Researchers investigated three independent variables related to floorholder use: “explanation of disability, delay time, and gender of subjects.”

The first variable tested was the use of a floorholder message, which was an explanation of the caller's disability. Participants were divided into three groups: Natural Voice Explanation (NVE), Artificial Voice Explanation (AVE), and No Explanation (NOE). For the first group (NVE), investigators presented the following message: "This is Kagawa Denwa Daiko Service (this is an imaginary company and means Kagawa Telephone Agency). We will be connecting you with a person with a speech disability. As he speaks with a voice output device, it will take some time for him to respond to you. After the signal sound, we will connect you. Please take care of him. Thank you. (Signal sound)" (p. 253). A female professional announcer recorded this message using her natural voice. After presenting this message, the experimenter used the SGD to present the following message: "This is (the name of collaborator) speaking. Today, I cannot speak because of my sore throat. So, I would like to speak with you with a voice output device. It will take some time to operate and vocalize. I hope you will listen to me" (p. 253). In the second group (AVE), experimenters played only the SGD message ("This is [collaborator] speaking. . ."). For both the NVE and AVE groups, after the floorholder message, the experimenter began the conversation using voice output by asking predetermined questions. In the NOE group, the experimenter did not explain the use of the SGD and simply began presenting the message using voice output. Each telephone conversation was assigned an achievement score between 1 and 4 based on success of the interaction and attitudes of the receiver (4 indicated a "normal" conversation).

Using a floorholder message did not significantly improve achievement scores (p-.863), but it did significantly reduce listener anxiety $p < .01$). Individuals who received calls reported negative impressions of the callers, as determined by follow-up interviews. All groups reported that the conversations seemed mechanical. Some participants in the NOE group reported feeling

anxiety during the calls. When asked what they imagined about the caller, some participants gave responses such as “I thought it must be a kind of sales by telephone” (p. 256).

Presenting an explanation (floorholder) before the conversation had positive effects on the impressions of participants. Members of the NVE group reported the least amount of anxiety during the phone conversations. Although the caller’s feelings were not formally measured during this experiment, the experimenter (caller) commented that he felt more relaxed during calls that were preceded by an explanation. The researchers suggested that a future study investigating attitudes and impressions of voice output users should be conducted. They also suggested a need for further studies researching content of explanatory messages.

Nakamura, Vanderheiden, and Smith (1993) found similar success rates both with and without floorholder messages (91% and 94% respectively). In their study, interactions without floorholder messages actually had a slightly higher success rate. However, a limitation of this study is the fact that, because the study’s purpose was to investigate listener reactions, the researchers only included data about conversations with partners who agreed to answer follow-up questions. Their study resulted in a relatively high rate of successful calls; the data may have shown a lower success rate if all calls were included for analysis (as cited by Hanson & Sundheimer, 2009).

Effects of Type of Speech

Drager, Hustad, and Gable (2004) compared telephone use of two types of synthetic speech in terms of intelligibility and listener preferences. Forty listeners with normal hearing were recruited as study participants. Participants were randomly divided into two groups of twenty. In the “Telephone Group,” sentences were presented using a telephone handset. In the

"Speaker Group," sentences were presented using soundfield speakers. The researchers presented 40 sentences from the Hearing in Noise Test (HINT) (Nilsson, Soli, & Sullivan, 1994). Each sentence was recorded three times, using three different voices: a natural female voice with mild dysarthria, DECTalk® Beautiful Betty synthetic voice, and MacinTalk™ Victoria synthetic voice, high quality. Speech for both groups, in all three voices, was played from compact disc recordings. In the Telephone Group, a speakerphone was used, with the phone placed 0.6 meters from the sound source. For the Speaker Group, participants were seated one meter from a speaker in a sound-treated room. All sentences were presented at 65 dB SPL.

Each listener completed an intelligibility task and answered qualitative questions about the different voices. During the intelligibility task, participants listened to ten sentences for each type of speech. Each sentence was played only once. Participants were asked to transcribe the sentences. Following the intelligibility task, participants answered qualitative questions regarding their preferences for type of speech (synthesized speech or dysarthric human speech) and synthesizer (DECTalk® or MacinTalk™). Participants rated "their comfort level, understanding, perceptions of competence of the speaker, and their willingness to interact with the individual when she used her own speech to communicate" (p. 107). Each participant also listened to one sentence using each type of speech (DECTalk® and MacinTalk™) before being asked his/her preference for synthesizer.

Both the MacinTalk™ and DECTalk® voices had nearly 100% intelligibility, both in the speaker group and telephone group. Although intelligibility for both voices was nearly identical, listener preferences differed. When asked a forced-choice question for preference between the two synthesizers, 80% of those in the Speaker Group reported a preference for DECTalk®. In the Telephone Group, however, 50% reported a preference for MacinTalk and 50% preferred

DECTalk, indicating no preference within this group. They also found that for the dysarthric speaker, speech intelligibility was reduced when using a telephone, compared to using a speaker.

The results of this study were encouraging due to the high intelligibility of both synthetic voices during telephone communication. Intelligibility of both voices on the telephone was nearly equal to their intelligibility when presented through soundfield speakers. The researchers did not find significant differences in intelligibility between the two synthetic voices, suggesting that both the MacinTalk™ and DECTalk® voices had equally high intelligibility.

Riley and Fries (2000) conducted a similar experiment comparing the intelligibility of synthetic speech and natural speech. This study, however, used a natural voice from a speaker without dysarthria. Subjects included 26 individuals from the Pacific Northwest region of North America, ranging in age from 24 to 56 years. All participants passed a hearing screening, and all had limited exposure to individuals with speech disabilities.

The study used synthetic speech generated by a Lightwriter SL35 (DEC-Talk Perfect Paul voice) and natural male speech that was digitally recorded and stored on an Alphatalker communication device. Researchers used an Ameriphone™ speaker telephone to make calls. Researchers called participants at their homes or offices and asked them to move to a quiet room. Randomly selected sentences from the *Assessment of Intelligibility of Dysarthric Speech* (Yorkston and Beukelman, 1984) were used as stimuli.

Researchers collected demographic information and gave instructions to subjects. Participants were told that they would hear a series of sentences. They were allowed to write down sentences if they desired. If participants did not understand a sentence, they were permitted to request one repetition per sentence. Subjects were asked to repeat the sentences they heard

verbatim. Researchers presented two sets of eleven sentences each: one set using the natural voice and one set using the synthetic voice. Half of the participants heard the synthetic voice first; the other half heard the natural voice first. Answers were scored based on the number of correct words. Words with changed grammatical morphemes were considered incorrect. Changes in word order that did not affect the meaning of the sentence were considered correct, as were additions of words that did not change the meaning of the sentence.

The results revealed significant differences in intelligibility of natural speech compared to synthetic speech. The average intelligibility of the natural speech was 96.47%, compared to 90.84% for synthetic speech. Although synthetic speech was more than 90% intelligible, sentences with synthetic speech required more repetitions than did sentences with natural speech. Subjects requested repetition for 29.11% of the synthetic sentences, and only 9% of the natural-speech sentences. The researchers suggested that individuals may require more processing time to comprehend synthetic speech than natural speech and that this may result in a higher rate of hang-ups due to listener frustration. The authors also suggested a need for AAC users to have pre-programmed communication repair messages ready in the event of communication breakdowns.

Demographics was a limitation to the study in that all participants had normal hearing and at least a high school diploma. Conversational partners that AAC users encounter during daily interactions, however, are likely to have diverse education levels and hearing abilities, as well as other factors that may affect communication success.

Another limitation of this study is the fact that participants were told in advance that they would need to repeat the message verbatim, and that they could request a repetition if necessary. Because they knew that they would need to repeat the message, participants may have been more

attentive to the speaker than a typical partner would be during a real-world conversation. The participant instructions may also have caused a higher rate of requests for repetition than would have occurred in a natural communication situation. Participants may have understood the message that the AAC user wanted to convey, but requested a repetition to ensure that they could relay it back word-for-word. In a natural conversation, the listener is not required to repeat the message back verbatim, and therefore may be less likely to request a repetition. For this reason, the repetition data may not reflect the actual rate of repetition requests that AAC users encounter during real-world communication.

Effects of Timing

The effects of timing variations on telephone communication success have been investigated. They hypothesized that reducing timing delays could increase communication success on the telephone. Other research related to timing on face-to-face communication appears to support this hypothesis. For example, McCoy, Bedrosian, Hoag, and Johnson (2007) found that a quickly delivered message that was not concise was preferred over a more concise message that was given after a delay. Hoag, Bedrosian, McCoy, and Johnson (2004), however, compared message timing with accuracy of information and found that timing was a less important factor. It could be reasonably hypothesized that effects of timing on telephone communication using AAC may be similar to effects on face-to-face aided communication.

Work conducted by Hanson and Sundheimer (2009) supported this hypothesis with evidence that reducing delays in a conversation can increase communicative success. They used the floorholder message “Please wait, I’m using a computer to talk” either immediately after the subject answered the call or after a three-second delay. When the introduced a three-second delay before delivering their message, the communication success rate decreased. They also

found that, while message timing impacts communication success, it had a smaller effect than use of a floorholder message.

Nakamura et al. (1993) investigated the effects of timing on communication success on the telephone using AAC with voice output. For one group of phone conversations, the experimenter responded immediately to the participant. For the second group, the experimenter waited three seconds before delivering a message. This delay was meant to simulate the delay that may occur while an individual using AAC prepares a message. For preprogrammed messages, the delay was exactly three seconds. However, when the experimenter needed to compose an original message, the delay time varied slightly. The "degree of achievement" for each telephone conversation was rated according to the following scale:

1. When the subject said nothing or only said "hello" and hung up after they listened to the artificial voice at the beginning of a conversation, achievement was rated as 1.

2. When the subject hung up in the middle of a conversation, achievement was rated as 2.

3. When the conversation was completed with negative attitudes by the receiver, achievement was rated as 3. Examples of negative attitudes included (1) experimenter could get the answer but the receiver told a lie or spoke in harsh tones, or (2) experimenter could not achieve the task, because the receiver did not answer the question, or the receiver did not relay the phone to the person designated (for example, a mother did not relay to her daughter).

> 4. When the conversation was completed normally, achievement was rated as 4. Normal conversation means that experimenter completed the task without the negative attitudes mentioned above. If there were some requests for repetition of the verbal message presented by the voice output device, it was also rated as a 4 (p. 254).

Eighty-one percent of all conversations received a rating of 4. According to Nakamura and colleagues, this suggests that AAC with voice output is a practical and useful means of communication using a telephone. The authors also suggested that nearly 100% of telephone conversations using natural speech received a rating of 4. Despite the differences in achievement levels, using AAC for telephone communication appears to be reasonably effective. However, when an individual has negative experiences with nearly one in five telephone calls, he/she may become discouraged and be less likely to want to initiate a telephone conversation.

In this study, removing the delay did not appear to improve conversational success. Conversations in the “delay” condition and the “no delay” condition both had similar success rates.

Statement of the Problem

For individuals who use AAC to communicate, telecommunication can be a difficult but very important task. Fortunately for these individuals, today’s technology provides many options for distance communication. Telephone communication, one of the most commonly used distance communication methods, often presents challenges for AAC users. Previous research has studied various methods to improve the success of telephone communication using AAC. Using a floorholder message, reducing delays in timing, and choosing a voice with good intelligibility are all methods that may be helpful for AAC users to increase the success of

telephone communication. Although results were somewhat variable among studies, it appears that using a floorholder message in combination with appropriate timing can increase the success of telephone conversations. Researchers also found high success levels for various types of synthetic voices. Based on the current research, use of a floorholder message appears to be the strongest predictor of communication success on the telephone.

Because of this, the objective of the current study was to investigate the effects of various floorholder message content on the success of telephone communication using AAC and to determine the type of floorholder message that results in the most successful telephone interactions. This study compared floorholder messages during telephone calls to random businesses to request their business hours. Floorholder messages investigated in this study included a basic explanatory message informing the listener that the caller was using AAC, a traditional telephone script which introduced the caller by name, and specific instructions to the listener. A control group with no floorholder message was also included. The research question investigated in this study was: What is the effect of varying floorholder message content on the success of telephone interaction using AAC?

Hypothesis

The hypothesis was that including specific instructions in the floorholder message would result in the most successful telephone interactions.

Methods

Participants

Participants in this study included 120 individuals with business phone numbers in a major midwestern metropolitan area. To select participants for this study, the researcher used a

list of business phone numbers from an online business directory. The researcher assigned a number to each business and used the random number generator feature on Microsoft Excel to select businesses as participants. Two hundred fifty-four businesses were selected using this method. If a business did not answer the phone or had a prerecorded message telling the business hours, data were not recorded for that business; after these businesses were removed, 120 participants remained.

Of the 120 participants, the researcher judged 47 to be male and 72 to be female; one participant's gender could not be identified. Of the 47 participants who reported their gender, 20 reported that they were male, and 27 reported that they were female. For all participants who reported their gender, the reported gender matched the gender judged by the researcher. The mean age of interview respondents was 42, with ages ranging from 20 to 74.

Materials

The researcher used a Dynavox T10 AAC device with voice output, using the IVONA Jennifer voice. The volume and speech rate on the device were both set to 27. The researcher programmed a communication overlay with the following phrases:

"I am using a computer to talk"

"Hello, my name is Megan, and I am using a computer to talk"

"Please wait while I type my message"

"What are your business hours today?"

"Thank you. That's all I needed for now"

"Goodbye"

The researcher used a Cisco CP-8841 landline telephone on speakerphone mode for all experimental calls. The Dynavox T10 was positioned four inches from the telephone. Before beginning the experiment, the second author called the first author, who was in another room, to verify that the chosen voice was intelligible and that the volume and speech rate were appropriate. The researchers determined that the Jennifer voice was appropriate at 27 volume units and 27 speech-rate units. The primary researcher then called a university program associate using the same settings. The program associate confirmed that the synthetic voice was intelligible and an appropriate speed and volume.

Procedures

Four floorholder conditions were used: no floorholder, traditional telephone script ("Hello, my name is Megan, and I am using a computer to talk"), basic floorholder ("I am using a computer to talk"), and specific instructions ("Please wait while I type my message"). Prior to the experiment, the researcher used the random number generator feature on Microsoft Excel to randomly assign a floorholder condition to each call. All calls were recorded using an Olympus voice recorder for later analysis. During calls in condition one (no floorholder), the researcher waited three seconds after the call was answered before activating the "What are your business hours today?" button. During conditions two, three, and four (telephone script, basic floorholder, and specific instructions, respectively), the researcher activated the appropriate floorholder button immediately after the call was answered, waited three seconds, then activated the "What are your business hours today?" button. The three-second delay was used before asking the question because during a real-world phone call using AAC, composing a message or even selecting the correct pre-written message may take several seconds. If the call recipient asked for clarification, or if the synthetic voice overlapped with the call recipient's speech, the researcher

repeated the phrase. If the participant provided the appropriate information, the researcher activated the following buttons: “Thank you, that’s all I needed for now”; “Goodbye” and ended the call.

Each call was classified into one of the following categories: participant provided the requested information, participant interacted, participant hung up, or participant provided the wrong information. Calls were classified using the following operational definitions. To be classified as “accurate information provided,” the participant needed to engage in interaction with the researcher and provide the hours of operation for their place of business. To be classified as “participant interacted,” the participant needed to engage in interaction with the researcher without hanging up the phone or providing the wrong information. Interactions in which the correct information could not be obtained due to limitations in programmed vocabulary (e.g. the participant asked which department the researcher was interested in) were included in this category. To be classified as “participant hung up,” the participant hung up the phone immediately upon hearing the synthetic voice, during the pause before the researcher began interacting (during the no-floorholder condition), during the floorholder message, after the floorholder message, during the question, or after the question. Participants in this category did not provide the requested information. To be classified as “incorrect information,” the participant interacted with the caller but provided information other than what was requested (e.g. caller asked “what are your business hours?”; participant responded “fine, thanks, how are you?”).

Immediately after each call ended, the researcher called the participant again using her natural voice. If a different individual answered the phone on the second call, the researcher asked to speak to the original participant. The purpose of the study was explained and the researcher asked the participant if he or she was willing to answer questions about the call that he

or she had just received. If the participant agreed, the researcher asked for his/her age, gender, and whether or not he or she had previous experience with AAC. Subsequently, the participant was asked to respond to the following prompts regarding the experimental phone call:

1. Describe your reaction to the call.
2. Please rate your comfort level during the call on a scale of 1 to 5, where 1 is very uncomfortable and 5 is very comfortable.
3. Please rate the ease of understanding of what was said during the call on a scale of 1 to 5, where 1 is very difficult to understand and 5 is very easy to understand.
4. Please rate how pleasant the call was for you on a scale of 1 to 5, where 1 is very unpleasant and 5 is very pleasant.
5. Please rate the naturalness of the interaction on a scale of 1 to 5, where 1 is very unnatural and 5 is very natural.

The participant was then asked to rate his/her agreement with the following statements using a rating scale of 1-5, where 1 indicates strong disagreement and 5 indicates strong agreement.

6. I thought the caller was a real person.
7. I thought the call was a joke.
8. I thought the call was from a telemarketer.
9. I considered hanging up the phone (if the participant did not hang up).

Finally, the participant was asked: “Do you have any suggestions for me that could improve the phone call?”

Behavioral reliability

During 30 of the calls (25%), an undergraduate research assistant independently recorded data on participant gender and reaction and procedural reliability for each call. During data collection, the primary researcher and research assistant were positioned so that each could not see the other's data sheets. The researcher used point-by-point analysis to determine data reliability. For this process, the researcher divided the total number of agreements by the total number of agreements plus disagreements, multiplied by 100. Reliability for gender was 100%; reliability for reaction was 96.7%. Participants who responded to follow-up interview questions also verified their gender; there was 100% agreement between the recorded gender and the actual reported gender.

Procedural reliability

To determine procedural reliability, the primary researcher and research assistant each independently completed a procedural reliability checklist for each call. Procedural reliability items included:

- Waited three seconds prior to asking question
- Did not use natural voice
- Placed device speaker four inches from phone
- Read each question on the form in sequence (for individuals who participated in a follow-up interview)
- Randomized conditions

Using a point-by-point analysis (total number of agreements, divided by total number of agreements plus disagreements, multiplied by 100), the researcher determined procedural reliability to be 100%.

Independent variables

The independent variables were the presence or absence of a floorholder message and, for experimental calls in which a floorholder message was used, the type of floorholder message (basic floorholder, traditional telephone script, or specific instructions).

Dependent variables

Dependent variables included the outcome of the call, i.e., whether the call was successful or unsuccessful. An additional variable was whether the participant interacted with the researcher, provided the requested information, and/or hung up prior to completion of the conversation. If the participant hung up during the call, the timing of the hangup (immediately, during the floorholder, after the floorholder, during the question, or after the question) was an additional dependent variable. For participants who responded to follow-up interview questions, the final dependent variable was their responses to questions regarding their reactions to the call.

A phone call was classified as “successful” if accurate information was provided or the call recipient fully participated in the interaction. Calls in which the experimenter ended the call early due to AAC vocabulary limitations were included in the “successful” category if the participant fully participated in the call and did not become rude or hang up on the researcher. A call was classified as “unsuccessful” if the participant hung up the phone before completion of the interaction, if the participant responded in a rude manner, or if the participant provided information other that what was requested (e.g. the researcher asked for business hours; the participant said “good, how are you?”). Each telephone call was further categorized as (1) accurate information provided, (2) AAC limitations, (3) hangup, or (4) wrong information provided.

Results

Of the 120 total calls, 77 participants (64.2%) provided the requested information (see Figure 1). An additional two participants attempted to participate in the interaction; however, the correct information was not obtained due to limitations in vocabulary programmed into the SGD. For example, one participant responded to the question “What are your business hours?” with “For which location?” Because the researcher had not programmed the SGD with the vocabulary necessary to answer this question, the researcher did not obtain the desired information. Thirty-nine participants (32.5%) hung up before or during the interaction. Of the 39 participants who hung up the phone, 5 (13.2%) hung up immediately (before the floorholder message or question). Two participants (5.3 %) hung up during the floorholder message, seven participants (17.9 %) hung up after the floorholder message, three participants (7.9%) hung up during the question, and 22 participants (57.9%) hung up after the question. See Table 1 for a detailed account of participant hangups. Two participants (1.7%) provided incorrect information. For example, after the researcher asked for business hours, one participant replied “Fine thanks, how are you?”

Figure 1

Call Outcomes by Condition

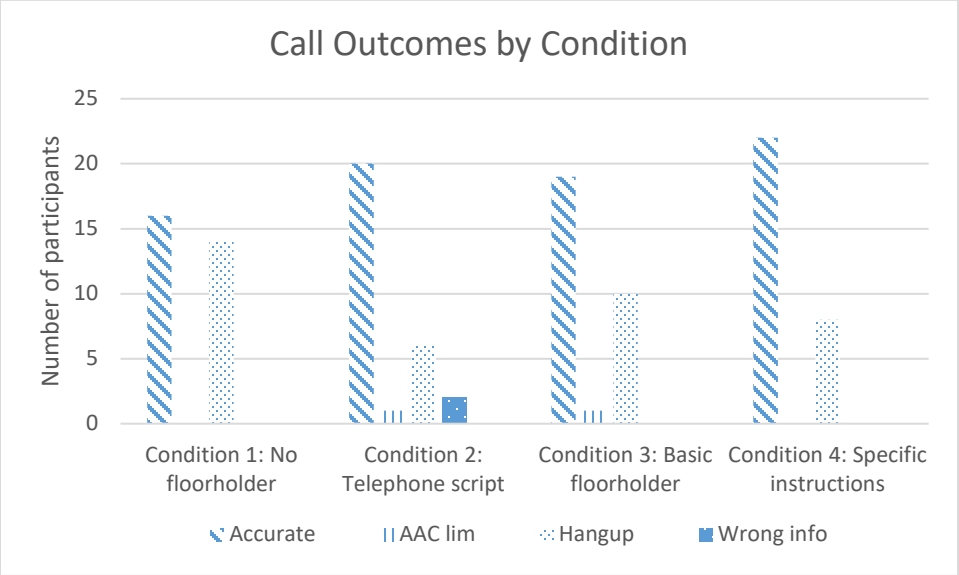

Table 1

Timing of Hangups by Condition

	Condition 1	**Condition 2**	**Condition 3**	**Condition 4**
Immediately	5	0	0	0
During floorholder	0	1	1	0
After floorholder	0	2	3	2
During question	0	0	2	1
After question	9	4	4	5
Total number of hangups	14	7	10	8

Overall, condition four (specific instructions) had the highest percentage of successful calls (accurate information provided, participant did not hang up), although this was not statistically significant. In this condition, 22 out of 30 participants (73.3%) provided appropriate information. Condition one (no floorholder) had the lowest percentage of successful calls (47%). 70.0% of calls in condition two (telephone script) were successful, and 67.7% of calls in condition three (basic floorholder message) were successful.

A Chi-square test was performed and no differences were found between expected frequencies and observed frequencies across floorholder conditions, X^2 (3, N=120) = 3.075, p = .42. The data indicate failure to reject the null hypothesis. Expected frequencies are shown in Table 2.

In addition, no differences were found between expected frequencies and observed frequencies of successful versus unsuccessful telephone calls, X^2 (1, N=120) = 2.124, p = .17. The data indicate failure to reject the null hypothesis (see Table 3).

Table 2

Expected and Observed Frequencies by Condition

Condition	Expected Frequency of Successful Calls	Observed Frequency of Successful Calls	Expected Frequency of Unsuccessful Calls	Observed Frequency of Unsuccessful Calls
1	15	16	15	14
2	15	21	15	9
3	15	20	15	10
4	15	22	15	8

Table 3

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	3.075[a]	3	.380	.417
Likelihood Ratio	3.019	3	.389	.417
Linear-by-Linear Association	2.124[b]	1	.145	.170
N of Valid Cases	120			

Follow-up Interview

Responses to follow-up interview questions were analyzed using an analysis of variance (ANOVA). See Table 3. Degrees of freedom k = 29 (30,1) and p (0.05) were used. A significant difference was found between conditions in response to item 6 (“Please rate your agreement with the following statement: ‘I thought the caller was a real person’”) (f=5.218, p=.004). A Bonferroni post hoc analysis was used to analyze multiple comparisons and revealed a significant difference (p=0.002) between conditions 1 and 3 on item 6 (“Please rate your agreement with the following statement: ‘I thought the caller was a real person’”). The mean rating given by participants in condition 1 for item 6 was 1.000 ($\pm$ 0.000). The mean rating given

by participants in condition 3 for item 6 was 3.643 (± 1.151). Every interview respondent in condition 1 reported that they "strongly disagree" with the statement "I thought the caller was a real person." Participants in condition 3 (basic floorholder message) reported significantly higher agreement with the statement compared to condition 1. No other statistically significant differences were found within the interview data. Bonferroni post-hoc results are shown in Table 3.

Table 3

ANOVA Between-Group Comparisons

Question	F value	Degrees of freedom	*P*-value
Q1: Previous communication with AAC users	.235	3	.871
Q2: Comfort level during call	1.583	3	.208
Q3: Ease of understanding	.615	3	.609
Q4: Pleasantness of call	.560	3	.645
Q5: Naturalness of interaction	1.701	3	.182
Q6: Thought caller was a real person	5.218	3	**.004****
Q7: Thought the call was a joke	.722	3	.545
Q8: Thought the call was from a telemarketer	.689	3	.564
Q9: Considered hanging up	.504	3	.682

Table 4

Bonferroni Post-Hoc Correction for Follow-Up Question 6

	Condition 1- no floorholder	Condition 2- telephone script	Condition 3- basic floorholder	Condition 4- specific instructions
Condition 1- no floorholder	----------	p =.063	p =**.002****	p =.260
Condition 2- telephone script	p =.063	----------	p =.869	p =1.000
Condition 3- basic floorholder	p =**.002****	p =.869	----------	p =.325
Condition 4- specific instructions	p =.260	p =1.000	p =.325	----------

During follow-up interviews, the researcher asked participants to describe their reactions to the experimental call. After the interviews, the researcher classified each reported reaction as "positive/neutral" or "negative." Neutral/positive reactions included comments such as "slightly surprised," "no reaction," "I just communicated as if they were any other person," and "once they explained everything, it was perfect." Negative reactions included comments such as "uncomfortable," "I had no idea what was going on," "I wondered if it was a sales pitch," and "it feels like talking to a computer." In condition one (no floorholder), 3/7 interview respondents (42.86%) reported positive/neutral reactions. In condition two (traditional telephone script), 8/14 respondents (57.14%) reported positive/neutral reactions. In condition three (basic floorholder message), 7/14 respondents (50.00%) reported positive/neutral reactions. In condition four (floorholder with specific instructions), 8/11 respondents (72.73%) reported positive/neutral reactions.

Discussion

The results of this study did not support the original hypothesis that using specific instructions within a floorholder message would result in a higher percentage of successful interactions. Based on raw percentages, using a floorholder message resulted in greater success compared to no floorholder, and using specific instructions resulted in greater success compared to the other types of floorholders. However, these differences were not statistically significant. It is possible that using a floorholder message with even more explicit instructions may have resulted in a statistically significant difference between condition 4 (specific instructions) and the other conditions.

Doss et al. (1991) suggested that including specific instructions in a floorholder message is important during face-to-face interactions, and Hanson and Sundheimer (2009) speculated that specific instructions may also be important for telephone conversation, although their experiment did not address specific instructions. The results of the present study did not provide evidence to support the idea that including specific instructions in a telephone floorholder message can improve the likelihood of a successful interaction. It is possible that even more explicit instructions would have improved the likelihood of success. Using specific instructions might make the floorholder message differ from messages often used by telemarketers. In this author's experience, automated marketing calls frequently attempt to sound like a real person by using personalized messages (e.g. the computerized call includes an introductory message with a first name). The more direct nature of the specific-instructions floorholder message may attract the call recipient's attention more efficiently than other messages.

For participants who hung up the phone prior to completion of the interaction, timing of the hangups varied across conditions. Interestingly, the majority of all hangups across conditions (64.2%) occurred after the researcher asked for the business hours. The no-floorholder condition

had the highest number of post-question hangups (nine hangups). The researcher expected the most hangups to occur either during the initial delay before the question was asked or immediately when the call recipient heard the synthetic voice (during the question) because at this point in the interaction, it was likely the participant surmised the call was a prank call, telemarketer, etc. The participants had already heard the question but chose to hang up the phone without answering the question. Unfortunately, of the nine individuals who hung up the phone after the question in condition one, only one participant agreed to answer the follow-up questions. According to this individual, because her business does not have store hours, the question was irrelevant to her, and she knew it was not a "person-to-person call." Because the remaining individuals in group 1 who hung up after the question declined to participate in the follow-up interview, it is unclear whether this explanation is representative of reasons why other participants hung up after the question.

Three participants in other conditions who hung up the phone after the question responded to some or all of the interview questions. These individuals reported reactions such as thinking it was a marketing call or thinking it was someone with a "voice box" (condition two-traditional telephone script). One participant in condition four who hung up after the question said that she always "screens calls" for her business by asking a question. After she asked the question and the researcher was unable to respond, she hung up. Based on these reactions, it appears that some individuals hung up because they thought the call was from a telemarketer, even though they had already heard the question.

All of the immediate hangups occurred in condition one (no floorholder). This was not surprising because during all calls, there was a three-second delay before the question was asked. In conditions two, three, and four, this delay occurred between the floorholder message (which

was selected immediately after the call was answered) and the question. For condition one, because there was no floorholder message, there was a three-second delay immediately after the participant answered the phone. This may have resulted in confusion for the call recipients, who may have thought nobody was on the phone. This confusion was evident in one participant, who said “Can you hold on for just a minute? Anybody there?,” then hung up. This demonstrates an inherent difficulty in using AAC on the phone. If the AAC user does not have pre-programmed, immediately accessible vocabulary to answer certain questions or repair certain conversational breakdowns, and the conversational partner is not aware that the other person is using AAC, the communication may be unsuccessful.

Two participants hung up during the floorholder message; this occurred in condition two (traditional telephone script) and condition three (basic floorholder message). These individuals did not participate in the follow-up interview, so the researcher was unable to determine why the participants hung up. It is possible that, as mentioned previously, the traditional telephone script sounded like a telemarketer when presented via synthetic voice.

Two calls were classified as unsuccessful because the participants responded to the question with irrelevant information. Both of these occurred during condition two (traditional telephone script). These participants responded with “good” or “good, how are you?” when asked for their business hours. One of these individuals reported confusion during the call. The other individual stated that he had difficulty understanding what was said, but attributed this difficulty to his cell phone connection rather than the synthetic voice. Cell phone connection may be another factor affecting the success of AAC interaction on the phone.

Of the calls that were classified as “successful” (either the participant provided the requested information; or the participant fully participated in the interaction, but the interaction

was limited due to vocabulary constraints), the majority of interview respondents (23/38; 60.53%) reported reactions that were considered by the researcher to be neutral or positive, following the criteria described in the Results section.

Although no statistical significance was found across conditions, participants' reported reactions in each condition mirrored the success rate of that condition. The condition with the greatest percentage of successful calls (condition four- floorholder with specific instructions) also had greatest percentage of positive/neutral reported reactions. Condition two (traditional telephone script) had the second-highest percentage of successful calls and also the second-highest percentage of positive/neutral reported reactions, followed by condition three (basic floorholder message) with the third-highest percentage of successful calls and the third-highest percentage of positive/neutral reported reactions. Condition one (no floorholder) had the lowest percentage of successful calls and the lowest percentage of positive/neutral reported reactions. These data suggest that use of floorholder messages which result in positive or neutral reactions from the call recipient might be related to a greater likelihood of a successful interaction. This finding was not surprising, as it aligns with conventional wisdom (i.e. if an individual hangs up during a telephone interaction, it is likely that he or she had a negative reaction to the call). However, it does suggest that choosing an appropriate floorholder message may impact the call recipient's reaction and therefore the outcome of the call.

Intelligibility of synthetic speech may impact the effectiveness of floorholder messages. Current literature describes intelligibility rates of various synthetic voices as ranging from 87.7% to 98.0% (Hardee, 2007), (Drager et al., 2004), (Riley & Fries, 2000). It is possible that further increasing AAC intelligibility could increase the success rate even more.

Limitations

A limitation of this study was that only a small percentage of participants responded to the follow-up interview questions regarding their reactions to the experimental call. Since participation in the follow-up interview was completely voluntary, the responses received may not be representative of the entire group of participants. It is possible that certain individuals were more likely to participate in the interview, for example, individuals with an interest in communication disorders or in research.

The researcher used a novel questionnaire to interview participants because a previously constructed, standardized instrument was not available. Because of this, the results may be less valid than if such an instrument could have been used. However, since a second researcher collected data independently and found the data to be more than 95% reliable, the use of a nonstandardized instrument does not appear to have negatively impacted reliability. Some interview participants reported confusion with some interview items. For example, several participants stated that they were confused by the rating scale that asked them to select a rating based on how strongly they agreed with a statement. Some individuals changed their answers after requesting repetition of the interview item. It is unclear how many participants' answers did not reflect their true opinion due to confusion with the rating scale.

Another limitation is that participants were all from a midwest metropolitan area. All participants worked at businesses in urban or suburban areas. Results from this study cannot be generalized to individuals in different geographical areas or to individuals in rural areas.

The researcher who made the calls did not have a communication disorder or any physical impairment that impacted her ability to select messages. Some individuals who use AAC do have physical impairments that may make it more difficult to efficiently select messages during a telephone conversation. For example, some AAC users use scanning to select messages.

This method requires the user to wait while several options are presented before selecting the desired message. For these individuals, use of a floorholder message may not have the same effect on improving conversational success on the phone. The researcher attempted to simulate the pause that may occur while an individual with CCN selects a message by waiting three seconds before activating the question message. The researcher did not add a pause before the floorholder message; this is a limitation of the study because individuals who use AAC may not always be able to select a floorholder message immediately when making a call.

Future Research

Future studies should explore the effect of using even more explicit instructions within the floorholder. Future research should expand this study to include rural, suburban, and urban areas across the country. It would be informative to explicitly ask participants who hung up the phone why they did so. In the current study, some participants voluntarily explained why they hung up when they were asked to describe their reactions to the experimental call. Asking all interview respondents to provide this information may have been useful. Future studies should also recruit individuals with communication impairments and physical disabilities, who use AAC in their daily lives, to make experimental calls using various selection methods. This would provide a better picture of telephone AAC use in real-world communication situations. Further research should also investigate the effects of floorholder messages combined with varied synthetic speech to determine the combined impact of these factors. The areas of floorholder message content investigated in this study can also be further explored. For example, future researchers could study the effects of more descriptive explanations in floorholder messages.

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Appendix

Follow-up interview

My name is Megan, and I just used a computer to call you. This is part of a research study investigating reactions of people who receive calls from individuals who use computers to talk. Would you mind answering a few questions about your reaction to the call? It will take about three minutes. Before I ask the questions, I need to let you know that information from this research study will be included in a Master's thesis, as well as a possible future professional journal publication and/or conference presentation. I will not report your name or any other information that could identify you. This is completely voluntary; you are not obligated to participate.

What is your age?

What is your gender?

Have you previously communicated with someone who uses a computer or other device to talk?

The following questions are related to the call you just received.

Describe your reaction to the call.

Please rate your comfort level during the call on a scale of 1 to 5, where 1 is very uncomfortable and 5 is very comfortable.

Please rate the ease of understanding of what was said during the call on a scale of 1 to 5, where 1 is very difficult to understand and 5 is very easy to understand.

Please rate how pleasant the call was for you on a scale of 1 to 5, where 1 is very unpleasant and 5 is very pleasant.

Please rate the naturalness of the interaction on a scale of 1 to 5, where 1 is very unnatural and 5 is very natural.

Please rate your agreement with the following statements using a scale of 1 to 5, where 1 is strongly disagree and 5 is strongly agree. The higher the number, the higher your agreement with the statement.

1. I thought the caller was a real person.
2. I thought the call was a joke.
3. I thought the call was from a telemarketer.
4. I considered hanging up the phone (if the participant did not hang up).

Do you have any suggestions for me that could improve the phone call?