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Angelica Nicole Phillips
University of Nebraska-Lincoln, angelica.phillips@huskers.unl.edu

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EXAMINING THE ASSOCIATION BETWEEN INTERVIEWER AND RESPONDENT SPEAKING PACE IN TELEPHONE INTERVIEWS

By

Angelica Nicole Phillips

A THESIS

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EXAMINING THE ASSOCIATION BETWEEN INTERVIEWER AND RESPONDENT SPEAKING PACE IN TELEPHONE INTERVIEWS

Angelica Nicole Phillips, M.A.

University of Nebraska, 2020

Advisor: Kristen Olson

Telephone interviewers are typically trained to speak at a pace of two words-per-second to enhance respondent cognitive processing. Although interviewer speaking pace varies across different question characteristics such as question length and complexity, the pace at which respondents answer questions in a telephone survey and whether pace varies by question characteristics has received scant attention. Furthermore, although there is a longstanding hypothesis that the speed at which interviewers ask questions influences the speed of respondent replies and that this in turn influences the quality of answers provided by respondents, few empirical studies directly examine the relationship between interviewer speaking pace and respondent speaking pace.

This thesis examines the association between question-level interviewer and respondent speaking pace among the first two conversational turns in telephone interviews. Given lack of replication of how question characteristics are associated with the pace of interviewer question administration in previous research, I start by examining whether question linguistic and cognitive complexity, question sensitivity, and the position of the question in the interview are related to the pace of interviewer question administration. I additionally examine whether question linguistic and cognitive complexity, question sensitivity, respondent familiarity, and the position of the question in the interview are related to the pace of respondent initial replies to questions. Finally, I examine whether interviewer speaking pace predicts respondent speaking pace and if this relationship is moderated by question complexity. Using behavior coded transcripts from the Work and Leisure Today 2 Survey (AAPOR RR3=7.1%), I find that on average, interviewers speak at a pace of 3.15 (95% CI=3.136, 3.154) words-per-second and respondents reply at a pace of 1.33 (95% CI=1.319, 1.335) words-per-second. Interviewers ask linguistically complex questions at both a slower and a faster pace (depending on the indicator for question linguistic complexity), and respondents reply to linguistically complex questions faster than to questions that are not as linguistically complex. No other question characteristics are associated with interviewer or respondent speaking pace. Furthermore, interviewer question-asking pace is a significant positive predictor for respondent pace ($b=0.13$, $p=0.006$). The relationship between interviewer and respondent speaking pace is significantly moderated by question linguistic complexity.

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INTRODUCTION

Telephone-administered surveys are used to collect survey data from respondents quickly and at a lower cost than in face-to-face interviews (Dillman, Smyth, and Christian 2014; Olson et al. 2019). Interviewers provide a social element to both telephone and face-to-face surveys; an interviewer's actions have the potential to influence respondent behaviors (Dillman, Smyth, and Christian 2014; Dykema et al. 2019; Fowler and Mangione 1990). Under a total survey error framework, interviewers can potentially introduce measurement error into the data by, knowingly or not, influencing the behaviors or response of the respondent (Biemer and Lyberg 2003; Fowler and Mangione 1990; van der Zouwen 2001). However, not all interviewers deleteriously affect the answers provided by respondents (van der Zouwen 2001).

Interviewers can positively influence respondent behaviors by modelling "good" response behaviors such as speaking slowly (Fowler and Mangione 1990). For example, survey centers typically, but not always, train interviewers to speak at a slow pace in order to aid respondents in understanding and cognitively processing the survey questions (Cannell, Miller, and Oksenberg 1981; Fowler and Mangione 1990; Viterna and Maynard 2001). This slow interviewer speaking pace may suggest to the respondent that they should also take their time formulating and providing their response, which may lead to higher quality responses (Viterna and Maynard 2001). However, few studies support the claim that a slower interviewer speaking pace increases response quality (Viterna and Maynard 2001). Additionally, interviewers frequently deviate from the suggested two-words-per-second speaking pace (Cannell, Miller, and Oksenberg 1981). The question then becomes, what influences interviewer and respondent speaking pace?

Characteristics of survey questions, such as question complexity, sensitivity, and position within the interview, can influence the behaviors of both interviewers and respondents. Question characteristics are associated with interview speed (Olson, Smyth, and Kirchner 2019), interviewer behaviors such as misreading questions (Olson, Smyth, and Kirchner 2019), and respondent behaviors such as satisficing-related outcomes (Vandenplas et al. 2018). To the extent that question characteristics predict speaking behaviors of interviewers and respondents, question characteristics could also be associated with the speaking pace of these actors. Because many survey organizations train their interviewers to speak at a particular pace (Viterna and Maynard 2001), and because response speed has been used as an indicator of question comprehension and response quality (Yan and Tourangeau 2008), the paucity of studies examining whether question characteristics are associated with speaking pace for both interviewers and respondents is surprising.

An additional element that could be associated with respondent speaking pace is the speaking pace of the interviewer. Interviewers provide a social aspect to telephone and face-to-face survey interviews. The interaction between the interviewer and the respondent is then susceptible to social norms of conversations, meaning that the two social actors can potentially influence each other's actions (Schwarz 1996), and thus the pace of interviewer question asking may predict the pace of respondent answers. However, previous research on speaking behaviors in interviews has not directly examined this relationship. This thesis examines the question of whether interviewer question-asking pace is associated with respondent speaking pace.

Furthermore, the association between interviewer and respondent speaking pace may be influenced by the questions that the interviewer asks the respondent. If a question is complex and thus requires a substantial amount of cognitive effort for the respondent to comprehend, respondents may exhibit more comprehension difficulties when the complex question is read at a faster pace by the interviewer. The extent to which question characteristics moderate the relationship between interviewer and respondent speaking behaviors in interviews is an additional area of research that has not been explored.

In sum, the research questions for this paper are: (1) Are question characteristics related to the linguistic complexity of questions, the cognitive complexity of questions, question sensitivity, and the position of the question in the interview associated with the pace of interviewer initial question reading? (2) Are question characteristics related to the linguistic complexity of questions, the cognitive complexity of questions, respondent familiarity with the question structure, question sensitivity, and the position of the question in the interview associated with the pace of respondent initial replies to questions? (3) Is interviewer pace a predictor of respondent pace, controlling for the effect of question characteristics? (4) Do either the linguistic or cognitive complexity of a question moderate the relationship between interviewer speaking pace and respondent speaking pace? The conceptual model for these research questions are depicted in Figure 1. To address these research questions, I use data from the Work and Leisure Today 2 survey, a nationally representative dual-frame random digit dial telephone interview of U.S. adults.

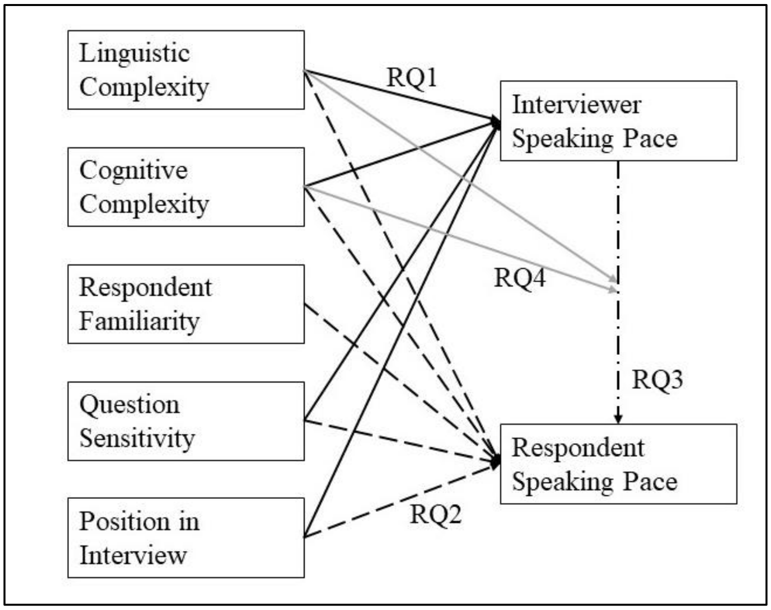

Figure 1. Conceptual Model of the Relationship between Question Characteristics, Interviewer Speaking Pace, and Respondent Speaking Pace

LITERATURE REVIEW

Question Characteristics, Interviewer Speaking Pace, and Respondent Speaking Pace

There are many measures of speaking behaviors in survey interviews. Previous research has examined the total amount of time it takes for the interviewer and respondent to complete a question (Garbarski et al. 2020; Olson and Smyth 2015), the total time spent on an interview (Kirchner and Olson 2017), the amount of time it takes for a respondent to formulate their response (Bassili and Scott 1996; Holbrook et al. 2020), and the number of questions completed per minute across an entire interview (Vandenplas et al. 2018) as some examples. Each of these measures capture slightly different information on the speaking behaviors of interviewers and respondents.

Response durations such as the total amount of time spent on a given question (Garbarski et al. 2020; Olson and Smyth 2015) or on the interview (Kirchner and Olson

2017) capture the amount of time both the interviewer and the respondent spend communicating. In general, researchers have considered longer response times as an indicator of potential problems with survey questions or with the interaction between the interviewer and the respondent (Couper and Kretuer 2014; Garbarski et al. 2020; Olson and Smyth 2015; Yan and Olson 2013; Yan and Tourangeau 2008). However, this measurement of speaking behavior does not differentiate the amounts of time for each actor in an interview. To address this limitation, other measures have attempted to measure the amount of time it takes for a respondent to formulate their response.

Response latencies measure the number of seconds between the end of the interviewer's question administration speaking turn and the beginning of the respondent providing their response, capturing the amount of time it takes for a respondent to formulate their response (Bassili and Scott 1996; Vandenplas et al. 2018). Researchers generally assume that a shorter response latency indicates fewer cognitive comprehension difficulties (Bassili and Scott 1996; Bassili and Fletcher 1991; Holbrook et al. 2020). Response latencies are useful for identifying problematic questions in a survey, but this measurement assumes that all of the respondent's cognitive processing of a question occurs prior to their initial answer and that respondents process the question only after the interviewer finishes reading the question. Rather, respondents could speak to the interviewer at a slower pace as they consider their final response. Speaking pace therefore could be an additional measure of respondent cognitive processing.

A disconnect exists between how interviewers are trained to speak and how research analyzes speaking behavior. Survey organizations typically train interviewers in terms of speaking pace, which is the rate of speech, rather than the duration of speech

(Viterna and Maynard 2001). Speaking pace is calculated by dividing the number of words spoken by a duration of the speech event to capture a speaking rate. In survey interviews, pace has been operationalized as words per second, words per minute, and questions per minute within interviews (Cannell, Miller, and Oksenberg 1981; Holbrook et al. 2020; Viterna and Maynard 2001; Webb 1972).

Most research investigating the speaking pace of actors in an interview aggregate across multiple question in an interview - such as large modules or the entire interview itself - to obtain an average speaking pace (Loosveldt and Buellens 2013; Vandenplas et al. 2018). While speaking pace across the interview as a whole is valuable, it does not capture the variation in speaking pace as it occurs across questions nor does it differentiate the speaking pace of the interviewer from that of the respondent.

Even in a standardized interviewer-administered survey, the interaction between the interviewers and respondents reflects conversational social norms (Schwarz 1996). Standardized survey interviews are specialized conversations in which the two conversational actors have specific roles with ascribed behavioral rules; the interviewer's role is to ask questions and the respondent's role is to provide answers to these questions (Schaeffer 2001; 2004). However, as a "conversation with a purpose" (Schaeffer 2001; 2004), social norms of conversational communication still apply to the interaction between an interviewer and respondent in a standardized interview (Schaeffer 2001; 2004; Schwarz 1996). Both interviewers and respondents assume that the other actor is a "cooperative communicator" (Schwarz 1996) within an interview, meaning that they abide by the logic of conversation and the cooperative principle of conversations (Garbarski, Dykema, and Schaeffer 2016; Schwarz 1996).

The cooperative principle of conversation states that each actor should contribute information to the conversation at an appropriate time, with the appropriate amount of detail, and for the purpose of contributing relevant information to the conversation (Grice 1975). Cooperative communicators abide by a set of conversational maxims: the maxims of manner, relation, quantity, and quality (Levinson 1983; Grice 1975). In the maxim of manner, actors are assumed to avoid obscurity and speak with clarity. In the maxim of relation, actors contribute relevant information to the conversation. In maxims of quantity and quality, actor contribute an appropriate amount of information and provide contributions that are true and not fabricated, respectively.

Certain question characteristics may make it difficult for either an interviewer or a respondent to abide by these conversational maxims. As a result, actors may change their speaking behaviors to maintain their status as a cooperative communicator despite the difficulties posed by challenging questions. Interviewers may change their pace of question administration depending on the question they are asking. Namely, interviewers may adjust their pace to ask questions more quickly or more slowly so that respondents can better comprehend the question and subsequently provide a more thoughtful response.

When answering a question, a respondent first comprehends the question, retrieves relevant information from memory to respond to the question, makes a judgment about their estimated response, and provides a response to the interviewer (Tourangeau, Rips, and Rasinski 2000). By speaking at a slower pace, the interviewer can influence the processing at each of these stages of the respondent's cognitive response process by allowing more time for the respondent to comprehend the question and form a response (Cannell, Miller, and Oksenberg 1981). However, interviewers do not always adhere to the recommendation of speaking slowly during interviews (Cannell, Miller, and Oksenberg 1981).

Linguistic Complexity

Question complexity can be divided into two distinct forms: question linguistic complexity and question cognitive complexity. Previous research examining question characteristics in survey interviews has looked at question complexity as a whole (Garbarski et al. 2020; Holbrook, Cho, and Johnson 2006; Olson, Smyth, and Kirchner 2019), but has not made distinct the potentially different ways that questions can be complex. One way to understand complexity is by differentiating between the cognitive functions required to comprehend a given survey question. Linguists Caplan and Waters separate sentence comprehension into two components (1999). Interpretive processing is utilized to understand the sentence structure and the meaning of the words in the sentence. This cognitive function is distinct from post-interpretive processing, which is utilized to comprehend a sentence with the goal of completing a separate task. This separate task can take the form of providing a response to a survey question (Caplan and Waters 1999). Under this comprehension dichotomy, question linguistic complexity reflects the difficulties in interpretive processing of a question in order to understand the structure and meaning of the sentence. Question cognitive complexity then reflects the difficulties in post-interpretive processing of a question in order for the interviewer to read the question to the respondent or for the respondent to reply to the question.

There are multiple measures that can be used to indicate linguistic complexity of survey questions. Two tools commonly used in survey research are the Question

Understanding Aid or QUAID measure and the Flesch-Kincaid Grade Level. QUAID is a web-based tool used to identify potential problems in questions that may negatively affect the comprehension of the question (Graesser et al. 2000; Graesser et al. 2006). The problems can include unfamiliar technical terms, imprecise relative terms, vague or ambiguous noun phrases, complex syntax, and working memory overload (Graesser et al. 2000; Graesser et al. 2006). There have been mixed empirical findings on whether survey questions with QUAID-identified problems are associated with comprehension difficulties. Some studies on telephone-administered interviews have found no association between questions with QUAID-identified problems and response times (Garbarski et al. 2020; Olson, Smyth, and Kirchner 2019), while other studies which include both telephone-administered interviews and web-administered surveys suggest that questions with QUAID-identified problems are associated with poor response quality (Dykema et al. 2020; Graesser et al. 2006; Lenzner, Kaczmirek, and Lenzner 2010).

An additional measure of linguistic complexity is the Flesch-Kincaid Grade Level, which indicates what grade reading level is required to comprehend a passage of text (Flesch 1948). This measure utilizes the number of syllables and words in a passage to calculate a readability statistic (Flesch 1948), and has been used in survey research to predict data quality indicators such as response times and response latencies. Similar to the mixed findings with QUAID, some studies which span survey modes find that Flesch-Kincaid Grade Level values are not associated with indicators of data quality (Dykema et al. 2020; Lenzner 2014; Holbrook, Cho, and Johnson 2006). Meanwhile, other studies using telephone-administered interviews show that survey questions with a higher Flesch-Kincaid Grade Level are associated with more question misreadings (Olson, Smyth, and

Kirchner 2019), longer response times (Garbarski et al. 2020; Olson and Smyth 2015), and more requests for clarification from the respondent (Olson, Smyth, and Ganshert 2018). These mixed findings indicate that reading level may be associated with both reading and response behaviors.

Linguistic complexity captures complexity in sentence syntax, vocabulary, and structure such that readers or listeners could have difficulties comprehending the meaning of the sentence (Caplan and Waters 1999; Gibson 1998). These linguistically complex sentences may require listeners or readers to hold a substantial amount of information in their working memory, have clauses with uncommon words, have more words in the question, or have a complex syntactical structure, among other characteristics (Gibson 1998). Linguistically complex questions can lead to undue cognitive burden on both the survey interviewer and respondent (Lenzner, Kaczmirek, and Lenzner 2010). Because interviewers are the first actor to encounter the complexity of a question as they read the question to the respondent, linguistic question complexity can potentially influence interviewer behaviors such as question asking pace. Under the interviewer burden model (Japec 2008), interviewers must first comprehend the question themselves before asking the question. Linguistically complex questions may be difficult for an interviewer to comprehend or understand how to read, thereby increasing the interviewer burden, which could then reduce the ability of the interviewer to slowly and accurately read the question to the respondent (Olson, Smyth, and Kirchner 2019).

One consequence of linguistic complexity is that interviewers will adapt – and in particular, slow – their pace of these questions. A study on reading behaviors found that children reading linguistically complex text passages aloud tend to insert more nongrammatical pauses in their speech as compared to less complex passages (Benjamin and Schwanenflugel 2010). Limited research has been conducted on the reading behaviors of adults, but a reasonable assumption is that interviewers will read more complex questions at a slower pace than less complex questions. In face-to-face surveys, complex questions are associated with longer response times, which provides initial support for the mechanism that linguistically complex questions take longer to read and reply to (Couper and Kreuter 2013). This leads to the first hypothesis that (H1A) interviewers will ask more linguistically complex questions at a slower pace than less linguistically complex questions.

Conversely, linguistically complex questions are more likely to be misread by interviewers than less complex questions in telephone-administered interviews (Olson, Smyth, and Kirchner 2019), which could speed up rather than slow question asking pace. Because interviewers are trained to read questions exactly as worded, question misreadings may prompt an interviewer to then correct their misreadings and subsequently say more words within the time spent reading the question (Olson, Smyth, and Kirchner 2019). This behavior could lead to increased question asking pace rather than decreased question asking pace on linguistically complex question because of interviewers correcting question misreadings. Therefore, I alternatively hypothesize that (H1B) interviewers will ask linguistically complex questions at a faster pace than less linguistically complex questions.

Linguistic complexity in questions may also influence respondent speaking pace. Questions with higher linguistic complexity require more in-depth cognitive processing to comprehend (Lenzner, Kaczmirek, and Lenzner 2010). It has been found that questions with a higher reading level are associated with longer response times on both web-administered surveys and telephone-administered survey interviews (Lenzner, Kaczmirek, and Lenzner 2010; Olson and Smyth 2015), which may be because questions with a higher reading level require more cognitive processing to comprehend. It may be that respondents reflect this increased cognitive processing on linguistically complex questions by speaking in a slower response pace. Therefore, I hypothesize that (H2A) respondent speaking pace will be slower for more complex questions.

Alternatively, the cognitive burden from a highly linguistically complex question may also encourage respondents to satisfice, meaning that they do not complete all cognitive steps to process the given question (Krosnick 1991). Under this mechanism, respondents may provide a fast response as they may not exert the effort necessary to comprehend and prepare a response for the linguistically complex question. I therefore provide a competing hypothesis that (H2B) respondents will have a faster response pace on linguistically complex questions as compared to questions that are less linguistically complex.

Cognitive Complexity

Cognitive complexity captures the cognitive processing necessary to complete a given task for the question. Under Caplan and Waters' dichotomy of sentence comprehension, post-interpretive processing is the cognitive processing where an individual aims to understand a statement in order to complete a separate task (1999). An interviewer's task is to read the respondent the question and record responses. Respondents' tasks are to comprehend the questions and provide a response to the interviewer. Questions that make it difficult for the actor to complete their respective task may then be classified as cognitively complex. For interviewers, these cognitively complex questions may require interviewers to make decisions on what to read, such as whether to read parenthetical statements or an optional definition (Olson, Smyth, and Kirchner 2019).

One set of items that require interviewers to make decisions when reading the question includes items with parenthetical statements, items with all capital letters to denote emphasis, and battery items. Questions that require interviewers to make decisions, such deciding whether to verbally emphasize questions that are displayed in all capital letters or to read parenthetical statements, increase interviewer burden (Japec 2008). In telephone survey interviews, interviewers have been found to misread questions that include interviewer decisions at a higher rate than questions without interviewer decisions (Dykema et al. 2016; Olson, Smyth, and Kirchner 2019), meaning that these characteristics may similarly influence interviewer speaking pace. Parenthetical statements, even those which interviewers are trained to read, are not always read to the respondent and instead are viewed as optional statements to read within telephone interviews (Dykema et al. 2016; Olson and Smyth 2015; Olson, Smyth, and Kirchner 2019). Therefore, when interviewers encounter questions with parenthetical statements or emphasized text, interviewers have to make an immediate decision for how to read the question to the respondent. Interviewers may also have to make decisions for how to ask battery questions to respondents. Interviewers are typically trained to read the full question stem and response options for the first few battery items, leaving it to the discretion of the interviewer for whether to read these optional components on later battery items (Dykema et al. 2019; Fowler 1995; Olson, Smyth, and Cochran 2018;

Olson, Smyth, and Kirchner 2019; Ongena and Dijkstra 2007). Therefore, interviewers must make the decision about whether to ask items that appear after the first item in a battery with the full set of response options. This fast decision-making increases the cognitive effort an interviewer must exert to read the question (Japec 2008), which could result in a slower speaking pace because the interviewer must think and speak at the same time. Therefore, I hypothesize (H3A) that interviewers will read cognitively complex questions at a *slower* speaking pace.

On the other hand, questions that include interviewer decisions such as parenthetical statements or visual emphasis on words in the stem are associated with question misreadings during telephone interviews, potentially increasing the speaking pace of interviewers (Dykema et al. 2016; Olson, Smyth, and Kirchner 2019). Thus, an alternative hypothesis is that questions with interviewer decisions may be associated with an *increased* interviewer speaking pace. Question misreadings may result in an interviewer adding words and thus elongate the interviewer's conversational turn through the interviewer correcting their misreading. The longer conversational turn violates the conversational maxim of quantity (Levinson 1983; Grice 1975), which would then drive the interviewer to speak at a faster pace to avoid having an unnecessarily long conversational turn.

Additionally, cognitively complex questions such as those with interviewer decisions give interviewers autonomy over what to read, can increase interviewer burden (Japec 2008). Similar to respondent satisficing as a response to increased burden (Krosnick 1991), interviewers can also satisfice in their question-asking behaviors as a way to reduce burden (Japec 2008). Highly burdened interviewers have shorter interview durations on average (Japec 2008), meaning that it is possible that interviewers choose to speak at a faster pace in order to quickly finish the interview to reduce this cognitive burden.

These two mechanisms, conversational maxims and interviewer burden, lead to the alternative hypothesis that (H3B) cognitively complex questions will be associated with a *faster*, rather than slower, interviewer pace.

Cognitively complex questions for respondents make it difficult for respondents to provide a response to the survey question. An example of this type of question is one with many phrases within it, meaning that the respondent would need to hold more information in their working memory to complete their response task. Longer questions require increased cognitive processing from the respondent to form and provide a response, which has been found to be associated with longer response times (Couper and Kreuter 2013; Olson and Smyth 2015; Yan and Tourangeau 2008). This association between question length and response times holds across survey modes. These longer response times may be partially driven by the respondent pausing as they cognitively process the question; these pauses may then drive a slower speaking pace in addition to a longer response duration. Because respondents take longer to respond to questions that are more cognitively complex, I hypothesize (H4A) that cognitively complex questions will be associated with a *slower* respondent speaking pace.

Alternatively, increased respondent burden from cognitively complex questions may lead to respondent satisficing. The increased burden from these questions may cause the respondent to shortcut one or more of the cognitive response steps in order to reduce their cognitive burden (Krosnick 1991; Lenzner, Kaczmirek, and Lenzner 2010;

Tourangeau, Rips, and Rasinski 2000). As a result, burdened respondents may exhibit a *faster* response pace as they do not fully consider their response before providing it to the interviewer. Therefore, I alternatively hypothesize that (H4B) cognitively complex questions will be associated with a *faster* respondent speaking pace.

Respondent Familiarity

The highly repetitive structure of battery items due to the shared question stem and identical response options may make it easier for the respondent to learn how to respond to subsequent questions in a battery. In battery items, a shared question stem is presented with a list of items followed by identical response options (Dillman, Smyth, and Christian 2014). Generally, these questions begin with a longer initial question orienting the respondent to the question structure as well as the response task (Dillman, Smyth, and Christian 2014). For example, an interviewer may initially ask the respondent "I am going to read a number of statements about your job. Please indicate whether you strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree with each statement. How about: I like my job." Each following question may then be shorter as interviewers have the option of omitting the response options. After asking the initial question in the previous example, an interviewer may simply ask the respondent "I have access to the equipment I need to do my job" with the assumption that the respondent already knows the response options and how to respond to the question.

Repeated information is easier to recall than information that has not been repeated (Peterson 1966), meaning that repeated information in battery items such as the shared question stem and identical response options in battery items may be easier recalled by respondents (Olson, Smyth, and Cochran 2018). The repeated and thus easily recalled information in battery items may then make it easier for respondents to learn the response task and subsequently more easily respond to items that appear later in a battery. The number of conversational turns that occur before a response is provided decreases for items that appear later in a battery within telephone survey interviews (Olson, Smyth, and Cochran 2018), indicating that respondents provide adequate responses faster for questions that appear later in a battery.

While respondent learning behaviors for battery items has only been examined in terms of the number of conversational turns and response values (Olson, Smyth, and Cochran 2018), a similar relationship may appear when examining response pace. As respondents learn to respond to survey questions with repetitive structures such as with battery items, response pace may quicken due to an increased familiarity with how to respond. Because of the potential for respondents to learn how to respond to battery items, I hypothesize (H5) that respondents will have a faster response pace on items that appear later in a battery (after the first item) as compared to questions that are not in a battery structure.

Question Sensitivity

Question sensitivity can influence the speaking behaviors of both interviewers and respondents (Holbrook et al. 2020; Krumpal 2013; Olson and Smyth 2015; Tourangeau and Yan 2007). Sensitive questions are questions which may have socially undesirable answers such as having been incarcerated, those which invade the respondent’s privacy, or those which have a risk of having the information disclosed to a third party (Tourangeau, Rips, and Rasinski 2000). Emotions are thought to be “contagious,” meaning that conversational actors can recognize the emotions of the other actor and begin to experience similar emotions. For example, if one person is uncomfortable, the other person can also become uncomfortable (Hatfield, Cacioppo, and Rapson 1992). In the case of sensitive questions, the discomfort felt by respondents because of having to disclose private information to a stranger may cause the interviewer to similarly feel uncomfortable. This could make it so that both interviewers and respondents want to quickly remove themselves from the discomfort by quickly proceeding past sensitive questions (Holbrook et. al 2020; Krumpal 2013).

Interviewers ask sensitive questions at a faster pace than non-sensitive questions in face-to-face surveys (Holbrook et al. 2020). Respondents reply to sensitive questions faster that non-sensitive questions, and this association holds across survey modes (Holbrook et al. 2020; Krumpal 2013; Olson and Smyth 2015; Tourangeau and Yan 2007). These actions potentially reduce burden on both the respondent and the interviewer and quickly remove both actors from the uncomfortable situation of discussing a sensitive topic.

Despite the fact that interviewer speaking pace in response to sensitive questions has only been examined in face-to-face surveys, interviewers may still ask sensitive questions at a faster pace in telephone surveys because of the interpersonal interaction with respondents. Because of the discomfort discussing topics that appear in sensitive questions, I predict that (H6) interviewers will ask sensitive questions at a faster speaking pace. Additionally, I predict that (H7) respondents will reply to sensitive questions at a faster speaking pace.

Position in the Interview

The location of a survey question within the interview may influence the pace of both interviewers and respondents. Namely, interviewers may ask questions near the end of the interview at a faster pace, and respondent may reply to these questions with shorter response latencies and response durations, because of a desire to finish the interview (Galesic and Bosnjak 2009; Holbrook et al. 2020). Interviewers have shorter turn durations on questions near the end of the interview in face-to-face interviews, indicating that they speed up as the interview progresses (Holbrook et al. 2020). While interviewer speaking pace in response to question location has only been examined experimentally in face-to-face survey interviews, interviewers may similarly exhibit a faster speaking pace closer to the end of telephone interviews because of increased burden from the length of the survey (Japec 2008). Additionally, respondents may similarly anticipate the end of the interview because of the amount of time already spent in the telephone interview. Respondents exhibit more behaviors indicative of satisficing (Krosnick 1991) such as stronger recency effects and more nondifferentiation of responses on questions that appear later in both web- and telephone-administered surveys (Galesic and Bosnjak 2009; Holbrook et al. 2007). With increased satisficing because of fatigue, respondents may also be more likely to speak at a faster pace in order to quickly finish the interview.

Therefore, with an examination of all questions in an interview, I hypothesize (H8) that interviewers will ask questions at a faster speaking pace as the interview progresses. Namely, questions that appear later in the interview will be asked at a faster pace than those earlier in the interview. Similarly, I hypothesize (H9) that respondents will reply to questions at a faster speaking pace as the interview progresses.

The Relationship between Interviewer Pace and Respondent Pace

In interviews, the interviewer and the respondent are assumed to act as cooperative communicators who abide by norms of conversational turn-taking (Schwarz 1996; Wiemann and Knapp 1975). In social interactions such as conversations, actors can influence each other's behaviors through nonverbal cues such as through speed of speech (Hatfield, Cacioppo, and Rapson 1992). For example, conversational actors speak at a similar speed over the course of a conversation (Matarazzo et al. 1963; Webb 1972). This mirroring is thought to occur because the speaking pace of one conversational actor may have "contagious" properties such that the other conversational actor begins to act in a similar way (Hatfield, Cacioppo, and Rapson 1992). Because interviewers and respondents are assumed to be cooperative communicators in interviews (Schwarz 1996), and because standardized interviews may have characteristics similar to "normal" conversations (Schaeffer 2001), there is reason to believe that the pace of respondent replies may be similar to the pace of interviewer question-asking over the course of the interview.

Communication accommodation theory asserts that the behaviors of communicative actors in a social interaction will converge such that actors begin to behave similarly to each other (Giles, Coupland, and Coupland 1991). One of the ways this accommodation can manifest is by actors' speaking pace becoming more similar to each other. Within a face-to-face interview context, longer interviewer speech durations are associated with longer respondent speech durations (Matarazzo et al. 1963). Similarly, Webb's (1972) study comparing the rate of speech on different pre-recorded automated interviews found that recordings with a faster syllable-per-minute rate were associated with a faster response pace from respondents despite the fact that the other “actor” in that social context was a pre-recorded voice. This indicates that respondents may speak in a more similar pace as interviewers over the course of the interview.

Very little previous research examines whether the speaking pace of an interviewer is associated with speaking pace of respondents in telephone interviews, despite the assumption made in standardized interviewer training that a slower interviewer speaking pace may encourage respondents to similarly slow their speaking pace (Cannell, Miller, and Oksenberg; Fowler and Mangione 1990; Viterna and Maynard 2001). It has been hypothesized that interviewers can model “good” response behaviors such as speaking slowly, and that respondents may interpret these behaviors as the interviewer communicating the desired pace of responses using their own speaking pace (Fowler and Mangione 1990; Holbrook, Green, and Krosnick 2003). However, despite these hypotheses, the relationship between interviewer and respondent speaking pace, particularly at the question-level, has not been empirically examined. Thus, I hypothesize that (H10) interviewer speaking pace will have a positive relationship with respondent speaking pace after controlling for question characteristics. In other words, as interviewers ask questions faster, it is hypothesized that respondents will also reply faster to those questions.

The interaction between the interviewer and respondent in telephone interviews does not occur without the interviewer asking survey questions to the respondent. The respondent simultaneously receives information about the interviewer’s speaking pace while also receiving information about the question characteristics through the actual question being asked by the interviewer. An interviewer’s speaking pace is likely to vary across question characteristics, and interviewer speaking pace variation in adaptation to these question characteristics may result in differences in how respondents process these questions. This may lead to a difference in respondent speaking pace as a result of both the question characteristics and the interviewer's adaptation to these question characteristics. Therefore, the question becomes how does the relationship between the interviewer's speaking pace and the respondent's speaking pace differ by question characteristics?

Speaking pace can greatly influence how much information the listener can comprehend (Arons 2008). For example, one study found that speech remains comprehensible only up to twice the rate of "normal" speech (Arons 2008). While it is unreasonable for a typical interviewer to speak that quickly without the aid of a recording device, it remains that some comprehension may be lost at faster rates of speaking. Additionally, speaking at a rate of four words per second is twice the speed of the recommended two words per second speaking pace for interviewers (Cannel, Miller, and Oksenberg 1981), but is still within the estimated average speaking pace of 3.8 to 4.6 words per second (Tauroza and Allison 1990).

It is possible that a respondent may perceive complex questions read at a faster pace as more difficult to comprehend than complex questions read at a slower pace. For example, a complex question read at a faster pace may be perceived as more difficult to comprehend and respond to than a less complex question read at a fast pace because of the combination of a loss of comprehension ability from the fast speaking pace and from the increased complexity of the question (Charoenruk and Olson 2018). If complex questions read at a faster pace are more difficult to comprehend, respondents could display this complex comprehension through having a slower response. I then hypothesize that (H11A) *complex* questions read at a *faster* speaking pace will be associated with a *slower* response pace. Alternatively, respondents may face this difficult comprehension task and choose to satisfice. In this case, respondent satisficing may manifest as a *faster* response pace for these more *complex* questions when read at a *faster* pace. Therefore, I provide a competing hypothesis that (H11B) complex questions read at a faster speaking pace will alternatively be associated with a faster, rather than slower, respondent speaking pace. Table 1 summarizes all of the hypotheses that are tested in this thesis.

Table 1. Hypothesis Summary Table

Hyp.	Mechanism	Actor	Hypothesis
Linguistically complex questions			
H1a	Interviewers may slow their pace on linguistically complex questions in order to avoid misreadings.	Interviewer	Interviewers will ask **linguistically complex** questions at a **slower** pace
H1b	Interviewers may be more likely to misread linguistically complex questions and subsequently have a faster pace. Interviewers may also be motivated to ask these questions faster in order to quickly finish their turn, such as with long questions.	Interviewer	Interviewers will ask **linguistically complex** questions at a **faster** pace
H2a	Linguistically complex questions may require more cognitive processing for the respondent to comprehend and thus have a slower speaking pace reflecting this processing.	Respondent	Respondents will reply to **linguistically complex** questions at a **slower** pace
H2b	Respondents may mirror the increased speaking pace of interviewers asking linguistically complex questions at a faster pace. Respondents may additionally satisfice on linguistically complex questions and a faster pace may reflect this satisficing.	Respondent	Respondents will reply to **linguistically complex** questions at a **faster** pace
Cognitively Complex Questions			
H3a	Interviewers may require more in-depth cognitive processing to read cognitively complex questions, with a slower	Interviewer	Interviewers will ask **cognitively complex**

Hyp.	Mechanism	Actor	Hypothesis
	speaking pace reflecting this cognitive processing.		questions at a **slower** pace
H3b	Interviewers may increase their question-asking pace on cognitively complex questions because of increased interviewer burden, which may lead to a desire to quickly finish the question.	Interviewer	Interviewers will ask **cognitively complex** questions at a **faster** pace
H4a	Respondents may require more in-depth cognitive processing to comprehend and formulate a response to cognitively complex questions, which may be reflected by a slower speaking pace.	Respondent	Respondents will reply to **cognitively complex** questions at a **slower** pace
H4b	Respondents may choose to satisfice on cognitively complex questions which may be reflected by a faster speaking pace.	Respondent	Respondents will reply to **cognitively complex** questions at a **faster** pace
Respondent Familiarity			
H5	Respondents may reply to battery items faster because of the familiar and repetitive structure of these questions, allowing the respondent to quickly and easily formulate a response.	Respondent	Respondents will reply to questions that are part of a **battery** at a **faster** pace
Sensitive Questions			
H6	The discomfort in asking sensitive questions will be reflected by a faster interviewer speaking pace so that the interviewer can quickly proceed past the sensitive topic.	Interviewer	Interviewers will ask **sensitive** questions at a **faster** pace
H7	The discomfort in replying to sensitive questions will be reflected by a faster respondent speaking pace so that the respondent can quickly proceed past the sensitive topic.	Respondent	Respondents will reply to **sensitive** questions at a **faster** pace
Later Questions in Interview			
H8	Interviewers may anticipate the end of the interview and will have a faster pace on questions as the interview progresses out of a desire to finish the interview.	Interviewer	Interviewers will ask questions **closer to the end of the interview** at a **faster** pace
H9	Respondents may also anticipate the end of the interview because of the length of time having spent in the interview, which may make a respondent have a faster pace out of a desire to finish the interview.	Respondent	Respondents will reply to questions **closer to the end of the interview** at a **faster** pace
Relationship between Interviewer Pace and Respondent Pace			
H10	Respondents may adapt their speaking pace to that of the interviewer, thus	Respondent	**Interviewer pace** will be **positively**

Hyp.	Mechanism	Actor	Hypothesis
	exhibiting a positive relationship between interviewer and respondent speaking pace.		associated with **respondent pace**
H11a	Complex questions combined with a faster interviewer question-reading pace may make it more difficult for the respondent to comprehend and formulate a response, which may be reflected by a slower respondent speaking pace.	Respondent	A **faster interviewer pace** on **complex** questions will be associated with a **slower respondent pace** than a faster interviewer pace on less complex questions
H11b	Complex questions combined with a faster interviewer question-reading pace may make it more difficult for the respondent to comprehend and formulate a response, which may result in the respondent choosing to satisfice. This satisficing may then be reflected by a faster respondent speaking pace.	Respondent	A **faster interviewer pace** on **complex** questions will be associated with a **faster respondent pace** than a faster interviewer pace on less complex questions

DATA AND METHODS

Data

The data for this paper come from the Work and Leisure Today 2 (WLT2) Survey. The WLT2 survey is a dual-frame random-digit-dial (RDD) telephone survey of U.S. adults conducted during September 2015 by Abt SRBI (Olson, Smyth, and Timbrook 2020). There were 902 respondents, 451 of which came from the landline sampling frame and 451 from the cell phone sampling frame (AAPOR RR3=7.1 percent). The target population for this survey was U.S. adults who owned either a landline or a cell phone. Adults were selected within households using the Rizzo method with the next birthday method for households with three or more adults (Rizzo, Brick, and Park 2004). The WLT2 survey covered topics such as respondent employment, leisure activities, internet usage, and demographics, and the survey took an average of 15 minutes to complete. Additionally, the WLT2 survey included a split-ballot experiment in which respondents were randomly assigned to one of two versions of the survey at the time of sampling. This experimental treatment varied the wording and the visual presentation of questions on the computer-assisted telephone interview (CATI) screen used by the interviewers to conduct the interview.

Behavior coding of the WLT2 data used the Sequence Viewer software (Dijkstra 1999). Trained undergraduate behavior coders transcribed each conversational turn and synced audio recording to the transcripts of each interview. This process identified the time the conversational turn began and ended, which was then used to derive the duration of the conversational turn in deciseconds. In this paper, a conversational turn begins immediately after the last utterance of the previous conversational turn. A conversational turn ends immediately after the last utterance for that specific turn. This means that, for example, a respondent's pause prior to answering a question is captured within the respondent's conversational turn.

This paper only examines the speaking pace of interviewers and respondents during the first two conversational turns of each question, capturing the first time the interviewer speaks (presumably to ask the question) and the first time the respondent speaks (presumably to answer the question). These conversational turns are then paired in the dataset so that the first time the interviewer speaks and the first time the respondent speaks on a given question are treated as a single paired observation. An example of the data structure is found in Table 2, where a question that has four conversational turns is depicted. In this example, the first two conversational turns make up one observation while the third and fourth conversational turns are not examined in this paper.

Table 2. Example of Data Structure

Conversational Turn	Transcript	Number of words	Duration (seconds)	Pace (words per second)	Using this turn?
1	Interviewer: Ok so now how many people including yourself live in your household?	12	7.099	1.690	Yes
2	Respondent: Uh it'd be 3. Well, if you count the dog, 4.	11	4.000	2.750	Yes
3	I: We not gonna count the dog, we said people.	9	3.300	2.727	No
4	R: He counts to me!	4	1.000	4.000	No

Dependent Variables – Question-Level Speaking Pace

The dependent variable in this paper is the initial speaking pace at the question-level for both the interviewer and the respondent. Pace is calculated as the number of words spoken by an actor as identified on the transcripts divided by the number of seconds that the actor spoke during their conversational turn. The numerator for an actor's speaking pace comes from the number of words spoken during their conversational turn, which was calculated using the Stata 15 command *wordcount*. Some conversational turns included notations for sounds or behaviors such as laughter, coughs, sighs, and elongated pauses, which appear in the text of the conversational turn as a single word (e.g. "laugh-R", "cough", "sigh", "[pause]"). The number of words in each conversational turn excludes these sound notations. For example, a turn in which the respondent laughs may appear as "Laugh-R. Well, I'd say you can't be too careful" has an initial word count of nine. In order to not erroneously include an additional word in the calculation of pace for the "Laugh-R" notation, the instance of laughter was removed. The conversational turn then reads, "Well, I'd say you can't be too careful," with a word count of eight. There were a total of 996 turns that appear in the first two conversational turns of a question which accounted for these types of notations (3.35 percent of all first two turns of a question).

The denominator of speaking pace is measured as the number of seconds for the conversational turn. This value was transformed from deciseconds to seconds for the calculation of speaking pace in the unit of words per second. Conversational turns in which the actor was interrupted while speaking were excluded. Additionally, conversational turns in which any words were inaudible were excluded from analyses. Conversational turns with unavailable timing data, coding errors for who is speaking, notes written into the turn describing the way in which an actor is speaking (e.g., "[interviewer talking to coworker]"), or turns in which no speaking occurred (e.g., notes that an interviewer did not ask the question) were also excluded from analyses. These exclusions accounted for 5,463 conversational turn pairs (12.11 percent of all conversational turn pairs).

To calculate the speaking pace of an actor, the number of words was divided by the number of seconds for each conversational turn. "Extreme" pace observations of 10 words per second or greater were excluded because of the implausibility of this speaking pace (Tauroza and Allison 1990). Conversational turn observations for question 19 were also excluded because the introduction to this battery of survey items was recorded separately from the actual item prompts. One interviewer and their three respondents were also excluded because of having a workload below 10 total interviews; this small workload causes unstable variance estimates (Raudenbush and Bryk 2002). Exclusions due to "extreme" observations of pace, the removal of question 19 and the respondents associated with the single excluded interviewer led to an exclusion of 4,720 conversational turn pairs (10.46 percent of conversational turn pairs). After all of the exclusionary criteria in the data, I have a final sample size of 36,374 conversational turn pairs (retention of 80.62 percent of the total available conversational turns), in which the average speaking pace of interviewers is 3.15 words per second, and that of respondents is 1.33 words per second. Descriptive statistics for these variables, along with the independent and control variables, appear in Table 3. The relationship between interviewer and respondent speaking pace cannot be examined if the speaking pace is unavailable for one of the actors. Because the first two conversational turns in a question are treated as a paired observation, when either the interviewer or respondent do not have a valid calculation of pace for a given question, the paired observation is excluded.

Independent Variables – Linguistic Complexity

The primary independent variables for this paper are characteristics for the questions in the WLT2 survey. The WLT2 survey included an experimental condition that varied question wording and visual emphasis of the questions across two versions. To account for these differences in question wordings, each version-specific question counts as having separate question characteristics. This means that while a single respondent could only answer up to 57 questions within the survey, there were a total of 112 questions after accounting for the differences across question wording in the two questionnaire versions. After excluding the battery item question 19 (which included four survey items), there were a total of 104 unique questions respondents could have received within the analytical sample of this thesis. Linguistic complexity for both interviewers and respondents is measured using two indicators: the Flesch-Kincaid Grade Level and the Question Understanding Aid (QUAID). The Flesch-Kincaid Grade Level was calculated for each question stem using Microsoft Word. This measure of linguistic complexity indicates the grade level required to read that passage of text ($\bar{x}$=6.531, indicating roughly a sixth- to seventh-grade reading level is required for the interviewers to read the CATI screen text). In the analyses, the Flesch-Kincaid Grade Level is grand-mean centered at the reading level of 6.531.

The online QUAID tool was used to identify linguistic problems with the scripted question stem. QUAID identified up to five problems that could indicate the linguistic complexity of each question's stem: unfamiliar technical term (49.04 percent of question stems), vague or imprecise relative term (77.88 percent of question stems), vague or ambiguous noun-phrase (34.62 percent of question stems), complex syntax (3.85 percent of question stems), and working memory overload (9.62 percent of question stems) (Graesser et al. 2006). A count of the number of QUAID-identified problems for each question stem is used as a measure of question linguistic complexity and is grand-mean centered at 1.750 problems.

Question length is an indicator of a question's *linguistic complexity* for an interviewer and an indicator of *cognitive complexity* for the respondent. The length of a question is calculated as the number of scripted words in the question stem as written in the questionnaire and is grand-mean centered in the analyses at 19.298 words. This measurement only accounts for all scripted words in a question stem and not the response options (e.g. "how concerned are you about threats to personal privacy in America today?"), unless the response options are scripted in the question stem (e.g. "compared to

10 years ago in 2005, do you think people have **more leisure time**, **less leisure time**, or **about the same amount**?”).

Independent Variables – Cognitive Complexity

A previously mentioned, cognitive complexity for respondents is measured using the number of scripted words in a question stem ($\bar{x}$=19.298 words). Cognitive complexity of a question for *interviewers* is operationalized by whether the question requires an interviewer to make any type of decision before reading the question. These decisions include parenthetical statements, questions that include some phrases in all capital letters for emphasis, and questions that appear after the first item in a battery. Each of these question characteristics require interviewers to make decisions for how, or if, to read those phrases differently than the other phrases in the question stem to the respondent. Although interviewers were trained to read parenthetical statements in the WLT2 survey, there may be variation in how often interviewers read these statements (Dykema et al. 2016). Words with visual emphasis such as being in all capital letters may also be read in a different way than words without visual emphasis (Olson, Smyth, and Kirchner 2019). Finally, interviewers must make the decision for whether to read the response options for items that appear after the first item in a battery (e.g. Dykema et al. 2019). Questions that include interviewer decisions are operationalized with a 0/1 indicator variable for whether the question contains at least one characteristic that requires an interviewer to make a decision (37.50 percent of questions require interviewer decisions).

Independent Variables – Respondent Familiarity

Respondent familiarity with the question structure is operationalized using a 0/1 indicator variable for whether the question appears after the first item in a battery of questions. 15.38% of all questions appear after the first item in a battery of questions.

Independent Variables – Question Sensitivity

The sensitivity of a question is indicated using a 0/1 indicator variable (13.46 percent of questions are sensitive). Question sensitivity was evaluated by trained coders. Examples of questions that were coded as sensitive include questions about whether the respondent has ever been fired from a job, how many alcoholic drinks the respondent had in the past seven days, and respondent income.

Independent Variables – Position of Question in Interview

The placement of a question within the interview is measured using the question's sequence number, which is a value that indicates the order in which the respondent received the question (range 1-57). This value is different from the question number because not all respondents received the same questions in the same order due to skip patterns, experimental conditions in the questionnaire, and some question randomization patterns for sub-items within batteries of questions. The placement of a question within the interview is grand mean centered at 27.132.

Control Variables

Because interviewer characteristics may affect question-reading pace during telephone survey interviews (Charoenruk and Olson 2018), I control for measures of interviewer tenure, gender, race, and software experience. Interviewer tenure is operationalized as an indicator of the interviewer having one year or more of experience working at the survey organization (42.31 percent). I also control for the interviewer's gender (42.31 percent female), whether they are white (46.15 percent), and whether they have experience using the CATI software prior to the WLT2 survey (19.23 percent).

Interviewers may additionally adapt their speaking pace according to respondent characteristics, such as respondent education and age (Belli, Weiss, and Lepkowski 1999; Cannell, Fowler, and Marquis 1968). While respondent characteristics may not be as visible in telephone-administered survey as compared to face-to-face interviews, characteristics such as education and age may still be recognized through speech patterns with reasonable accuracy (Campbell-Kibler 2009; Drager 2010). Respondent education is measured using an indicator for whether the respondent has completed a bachelor’s degree or higher (42.16 percent). An indicator for whether the respondent is 65 years or older (31.48 percent) is additionally included as a control variable for respondent age. Missing data for respondent age was imputed with the modal observed age for the four gender x education cells. Missing data for respondent education was imputed with the modal observed education for the four gender x age cells.

Respondent speaking pace may also vary by gender, region, or race because of existing differences in speaking behaviors by these groups (Anderson 2008; Clopper and Smiljanic 2011; Gumperz and Cook-Gumperz 1981; Yuan, Liberman, and Cieri 2006). As such, measures for these respondent characteristics are included as control variables. Indicators for whether the respondent is female (51.72 percent), and whether the respondent is white (73.97 percent) are included as control variables. Additionally, respondent region is operationalized as whether the respondent lives in the North East (14.79 percent), Midwest (24.47 percent), South (33.82 percent), or West (26.92 percent) of the United States. Missing data for respondent race was imputed with the modal observed race and gender (respectively) for the four age x education cells. Missing data for respondent gender (n=6) was imputed using the interviewer's interpretation of whether the respondent was male or female.

Finally, questionnaire characteristics that may otherwise influence speaking pace of either the interviewer or respondent are included as control variables in the model. Previous research has come to varying conclusions on how question type, operationalized as attitude or opinion questions, behavior questions, and demographic or attribute questions, influence respondent speaking behaviors (Olson and Smyth 2015; Yan and Tourangeau 2008). To account for the variation in speaking pace by question type, this categorical variable is included in the analytical models. Additionally, respondents who were sampled from a cell phone frame have been found to have longer interviews than respondents sampled from a landline frame (Timbrook, Olson, and Smyth 2018). An indicator for whether the respondent was sampled from a cell phone sampling frame (49.94 percent) is included as a control variable. The experimental version of the questionnaire (Version 1=49.67 percent; Version 2=50.33 percent) is additionally included as a control variable.

Table 3. Descriptive Statistics for Speaking Pace, Question, Respondent, and Interviewer, and Questionnaire Characteristics

	n	Percent/Mean	Standard Deviation
Dependent Variables			
Interviewer Speaking Pace	36374	3.145	0.866
Respondent Speaking Pace	36374	1.327	0.801
Independent Variables			
Linguistic Complexity			
QUAID measurements – count	104	1.750	1.031
Unfamiliar technical term	104	49.04%	--
Vague or imprecise relative term	104	77.88%	--

Vague or ambiguous noun-phrase	104	34.62%	--
Complex syntax	104	3.85%	--
Working memory overload	104	9.62%	--
Flesch-Kincaid Grade Level	104	6.531	3.067
Cognitive Complexity			
Question length – Number of words in question stem	104	19.298	14.073
Interviewer decisions (indicator)	104	37.50%	--
Parentheses in question stem	104	11.54%	--
All caps used in question stem	104	19.23%	--
Question appears after the first item in a battery	104	15.38%	--
Respondent Familiarity			
Question appears after the first item in a battery	104	15.38%	--
Question Sensitivity			
Sensitive question	104	13.46%	--
Position in Interview			
Question sequence number	36374	27.132	15.529
Control Variables			
Respondent Characteristics			
Education			
Bachelor's degree or higher (ref=less than BA)	899	42.16%	--
Region			
North East	899	14.79%	--
Midwest	899	24.47%	--
South	899	33.82%	--
West	899	26.92%	--
Gender			
Female (ref=male)	899	51.72%	--
Race			
Nonwhite (ref=white)	899	26.03%	--
Age			
65 years or older (ref=64 or younger)	899	31.48%	--
Interviewer Characteristics			
Tenure			

Worked for 1 year or longer (ref=worked less than 1 year)	26	42.31%	--
Gender			
Female (ref=male)	26	42.31%	--
Race			
Nonwhite (ref=white)	26	46.15%	--
Software experience			
Has experience with this CATI system (ref=no experience with this system)	26	19.23%	--
Questionnaire Characteristics			
Sampling frame			
Cell phone sampling frame (ref=landline)	899	49.94%	--
Questionnaire version			
Version 2 (ref=version 1)	899	50.33%	--
Question type			
Attitude/opinion	104	25.96%	--
Behavior	104	30.77%	--
Demographics-attributes	104	43.27%	--

Analysis Methods

The data in this paper have a complex four-level nested structure. Each of the conversational turn pairs are nested within up to 104 unique questions for the 899 respondents. Because not all respondents received the same set of questions due to skip patterns and experimental treatments in the survey, questions and respondents are cross-classified at the second level in the nesting structure. Each of these questions and respondents are also nested within the 26 interviewers at the third level of the nesting structure, yielding 36,374 total observations of pace.

There is reason to believe that each of level of nesting in the data (question-level, respondent-level, and interviewer-level) may uniquely contribute variance to the speaking pace of both the interviewer and respondent. To account for the complex nesting structure of this data, I estimate the speaking pace of the actors using cross-classified hierarchical linear models using the *mixed* command in Stata 15. In these models, speaking pace is cross-classified by question and respondent, which are both nested within interviewers. The structure of this data is visually displayed in Figure 2.

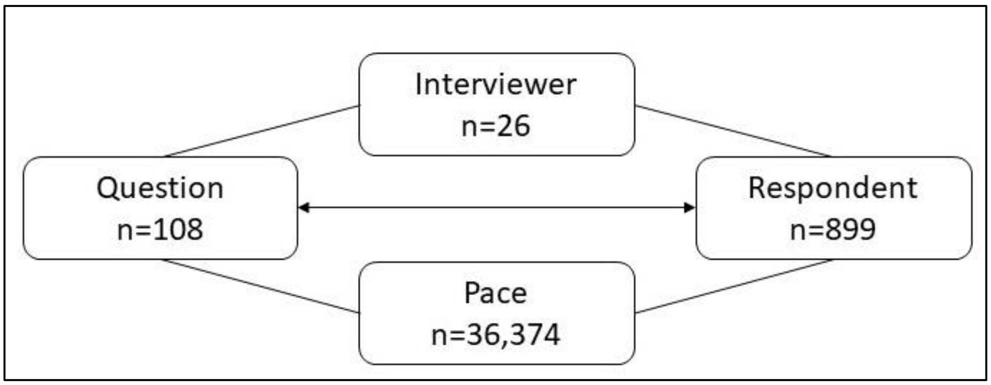

Figure 2. Four-Level Cross-Classified Data Structure of Interviewers, Questions, Respondents, and Speaking Pace

The base model for research question 1 (examining the relationship between question characteristics and interviewer question-reading pace) predicts the interviewer speaking pace ($Y_{i(j_1,j_2)k}$) as a function of the overall mean (γ_{0000}) plus a random effect due to the respondent (u_{0j_1k}), a random effect due to the question (u_{00j_2k}), a random effect due to the interviewer (υ_{000k}), and a residual term ($e_{i(j_1,j_2)k}$), where u_{0j_1k}, u_{00j_2k}, and υ_{000k} are normally distributed with mean zero and variance τ_{uj_1}, τ_{uj_2}, and τ_{uk} respectively, and $e_{i(j_1,j_2)k}$ is normally distributed with mean zero and variance σ_e^2 (Beretvas 2010, p. 330).

$$Y_{i(j_1,j_1)k} = \gamma_{0000} + \upsilon_{000k} + \mu_{0j_1k} + \mu_{00j_2k} + e_{i(j_1,j_2)k}$$

An identical equation is estimated for research question 2, which examines the relationship between question characteristics and pace of initial respondent replies ($Z_{i(j_1,j_2)k}$):

$$Z_{i(j_1,j_1)k} = \gamma_{0000} + \upsilon_{000k} + \mu_{0j_1k} + \mu_{00j_2k} + e_{i,(j_1,j_2)k}$$

The base model is used to evaluate the proportion of variance at each level: the variance in the interviewer (for research question 1; model 1a) or respondent (for research question 2; model 1b) speaking pace is due to respondents, questions, or interviewers. The proportion of variance attributed to interviewers is calculated as:

$$\rho_{interviewer} = \frac{\hat{\tau}_{uk}}{\hat{\tau}_{uk} + \hat{\tau}_{uj_1} + \hat{\tau}_{uj_2} + \hat{\sigma}_e^2}$$

The proportion of variance attributed to each level can be calculated by modifying this given equation such that the variance for the level of interest appears in the numerator.

After estimating the base model, the second model (models 2a and 2b) for each research question includes covariates for interviewer characteristics (interviewer tenure, gender, race, and software experience), respondent characteristics (respondent education, region of country, gender, race, and age), question type (attitude/opinion, behavior, or demographic-attribute questions), questionnaire version, and RDD sampling frame (landline or cell phone) as controls. These variables are included in all subsequent models. The third model (model 3a and b) for each research question includes the main effects for question characteristics (cognitive complexity, linguistic complexity, battery items, position in the questionnaire, and question sensitivity) to test hypotheses H1a through H9.

To address research question 3 and hypothesis H10, which examines the relationship between interviewer and respondent speaking pace, model 4b includes the direct effect of interviewer speaking pace as a predictor of respondent speaking pace. Finally, research question 4 is addressed in model 5b, which includes an interaction between interviewer speaking pace and respondent linguistic and cognitive question complexity indicators. This model tests the hypotheses H11a and H11b, which states that interviewers asking complex questions with a faster pace will be associated with a respondent pace that is either (H11a) slower or (H11b) faster.

To facilitate interpretation of the random coefficients in the analytical models, all continuous variables are grand-mean centered at the level at which that variable occurs. Interviewer speaking pace, respondent speaking pace, and the question sequence number are grand-mean centered at the conversational turn level (n=36,374). The number of QUAID flags, the Flesch-Kincaid Grade Level, and the length of each question are grand-mean centered at the question level (n=108).

RESULTS

Base Models

Tables 4 and 5 show the results of the null models (no covariates) predicting interviewer speaking pace and respondent speaking pace respectively. Table 4 shows that there are significant variance components for the interviewers, questions, and respondents as evidenced by a statistically significant chi-square test for each variance component. Furthermore, 21.28 percent of the variance in interviewers' speaking pace is due to the interviewer, and 17.28 percent of interviewers' speaking pace is due to the question. Respondents account for 7.01 percent of the variance in interviewers' speaking pace; this amount is roughly one-third of the amount of variance that can be attributed to the interviewers.

Table 5 displays the proportion of variance in respondent speaking pace that is due to the respondent, question, and interviewer. Overall, 13.99 percent of variance in respondent speaking pace that is due to the respondent, 10.72 percent of the variance in respondent speaking pace is due to the survey question, and 0.29 percent of the variance in respondent speaking pace is due to the interviewer.

Table 4. Model Variance Components, Predicting Interviewer Speaking Pace

	Variance	P-value	Proportion of Variance
Null model 1a			
Interviewer τ_{uk}	0.158	<0.0001	0.213
Question τ_{uj_2}	0.129	<0.0001	0.173
Respondent $\tau_{uj_{10}}$	0.052	<0.0001	0.070
Residual σ_e^2	0.405		0.544
Likelihood ratio test for variance components ($\chi^2(3)$)	20227.77	<0.0001	
Model fit statistics			
Log-likelihood	-36278.57		
AIC	72567.14		

Note: n=899 respondents, 104 questions, and 26 interviewers. Total n=36374

Table 5. Model Variance Components, Predicting Respondent Speaking Pace

	Variance	P-value	Proportion of Variance
Null model 2a			
Respondent $\tau_{uj_{10}}$	0.091	<0.0001	0.1399
Question τ_{uj_2}	0.070	<0.0001	0.1072
Interviewer τ_{uk}	0.002	0.0532	0.0029
Residual σ_e^2	0.489		0.7500
Likelihood ratio test for variance components ($\chi^2(3)$)	7605.83	<0.0001	
Model fit statistics			
Log-likelihood	-39752.89		
AIC	82358.82		

Note: n=899 respondents, 104 questions, and 26 interviewers. Total n=36374

Respondent, Interviewer, and Study Characteristics

Model 2a in Table 6 contains the association between respondent, interviewer, and study characteristics and interviewer speaking pace. Speaking pace is calculated as words per second, so a faster speaking pace is indicated with larger numbers and a slower speaking pace is indicated with smaller numbers. Therefore, positive coefficients indicate that the characteristic is associated with a faster speaking pace and negative coefficients are associated with a slower speaking pace. Interviewers spoke at a faster pace when speaking to a respondent with higher education as compared to respondents with a lower level of education (b=0.044, p=0.010). Additionally, interviewers spoke on average 0.029 words per second faster to female respondents as compared to male respondents (p=0.085). While this value is statistically significant, a change of 0.029 words per second is likely not noticeable in an interview setting. No other respondent characteristics were significantly associated with interviewer speaking pace.

When examining the effect of interviewer characteristics on interviewer speaking pace, interviewers who have worked at the survey facility for one year or longer spoke at a slower pace on average as compared to interviewers who worked for less than a year at the survey facility (b=-0.295, p=0.070). Interviewer gender, race, and CATI software experience were not significantly associated with interviewer speaking pace. Finally, interviewers asked behavior questions at a significantly faster speaking pace as compared to attitude and opinion questions (b=0.195, p=0.034). The study sampling frame and questionnaire version were not significantly associated with interviewer speaking pace.

Model 2b in Table 7 indicates the association between respondent, interviewer, and study characteristics and respondent speaking pace. When examining the effect of respondent characteristics on respondent speaking pace, I find that respondents with a higher education speak at an average pace of 0.078 words per second slower than those who have a lower education (p-value<0.0001). Additionally, respondents living in the

West region of the United States speak slower than those living in the Northeast region (b=-0.061, p=0.056). Female respondents speak slower than male respondents (b=-0.057, p=0.005), and older respondents speak faster than younger respondents (b=0.066, p=0.004). Respondent race was not significantly associated with speaking pace. I also find that interviewers who worked at the survey facility for one year or longer yielded a slower respondent response pace on average (b=-0.067, p=0.021). Interviewer gender, race, and software experience were not associated with respondent speaking pace. Finally, I find that respondents from the cell phone sampling frame spoke at an average pace 0.226 words per second slower than those from the landline sampling frame (p<0.0001). Questionnaire version and question type were not significantly associated with respondent speaking pace.

Question Characteristics

Linguistic Complexity

The association between linguistic complexity of survey questions and interviewer speaking pace is found in model 3a in Table 6. For interviewers, linguistic complexity is indicated by the number of QUAID-identified comprehension problems, the Flesch-Kincaid Grade Level of the question, and the length of the question. QUAID-identified comprehension problems were associated with a faster interviewer speaking pace (b=0.082, p=0.015). Additionally, longer questions were associated with a faster interviewer speaking pace (b=0.010, p<0.0001). The associations between the number of QUAID flags a question has and interviewer speaking pace as well as question length and interviewer speaking pace provide partial support for hypothesis H1b, which states that interviewers will read linguistically complex questions at a faster speaking pace.

However, a one-grade level increase in a question's Flesch-Kincaid Grade Level is associated with a decrease of 0.063 words per second in interviewer question reading pace ($p<0.0001$). This indicates that questions with a higher reading level, and thus with a greater linguistic complexity, are generally read at a slower rather than faster speaking pace, but that this depends on the measure of linguistic complexity. The association between the question's Flesch-Kincaid Grade Level and interviewer speaking pace provide partial support for hypothesis H1a, which states that interviewer will read linguistically complex questions at a slower pace.

Model 3b in Table 7 examines the relationship between question characteristics and respondent speaking pace. For respondents, linguistic question complexity was indicated using a count of the QUAID-identified problems as well as the Flesch-Kincaid grade level. Questions with a greater number of QUAID-identified problems were associated with a faster respondent speaking pace ($b=0.1007$, $p<0.0001$). This association between the number of QUAID-identified problems and respondent speaking pace partially supports hypothesis H2b, which was that respondents would reply faster to linguistically complex questions. However, a question's Flesch-Kincaid grade level was not associated with respondent speaking pace. Therefore, hypothesis H2b was not fully supported because only one of the two indicators for linguistic complexity was associated with a faster speaking pace. There was no evidence that linguistically complex questions were associated with a slower respondent speaking pace, meaning that hypothesis H2a was not supported.

Cognitive Complexity

The association between cognitive complexity and interviewer and respondent speaking pace also appear in Tables 3a and 3b, respectively. Interviewer cognitive complexity was operationalized by questions that had interviewer decisions such as question that appear after the first item in a battery, questions with parenthetical statements, and questions with visual emphasis on certain words. Questions with interviewer decisions were not associated with interviewer speaking pace (b=-0.0226, p=0.737). Interviewer speaking pace was therefore not different for more or less cognitively complex questions, meaning that neither hypotheses H3a nor H3b were supported.

For respondents, cognitive complexity was operationalized with question length, where longer questions had a greater cognitive complexity. Similar to interviewers, respondent speaking pace did not vary by cognitive complexity. This means that neither hypotheses H4a nor H4b were supported, as question length was not associated with respondent speaking pace (b=-0.0022, p=0.347).

Respondent Familiarity

I hypothesized that questions that appear after the first item in a battery would be associated with a faster respondent speaking pace (H5). Model 3b in Table 7 shows that items that appear after the first item in a battery did not differ in respondent speaking pace compared to questions that are either not in a battery or are the first item within a battery of questions (b=0.0030, p=0.969). This means that hypothesis H6 was not supported.

Question Sensitivity

Sensitive questions were hypothesized to be associated with a faster interviewer speaking pace. Model 3a in Table 6 shows that sensitive questions were not associated with interviewer speaking pace (b=-0.1063, p=0.260). Therefore, hypothesis H6 was not supported. Question sensitivity was similarly not associated with respondent speaking pace (b=0.0436, p=0.573), indicating that hypothesis H7 was not supported.

Position in the Interview

Position in the interview, that is, the order in which the given question was presented to the respondent, was hypothesized to yield a faster speaking pace for both interviewers and respondents for questions that appear later in the interview (H8 and H9, respectively). However, the results from model 3a in Table 6 and model 3b in Table 7 show that the question sequence number was not associated with interviewer question-asking pace (b=0.0018, p=0.213) or with respondent pace (b=-0.0019, p=0.186). Thus, there is no evidence to support hypotheses H8 nor H9 with regards to the position of the question in the interview. The inclusion of all focal independent variables to predict interviewer speaking pace in model 3a resulted in a decreased proportion of variance in interviewer speaking pace that is due to interviewers (0.176) and questions (0.131) as compared to that of the base model in Table 4 (0.213 and 0.173, respectively). The proportion of variance in interviewer speaking pace that is due to respondents increased to 0.078 in model 3a as compared to that from the base model in Table 4 (0.070).

The Relationship between Interviewer Pace and Respondent Pace

Model 4b in Table 7 includes the coefficients for the control variables, all independent variables, and adds interviewer speaking pace predicting respondent speaking pace. I hypothesized that a faster interviewer speaking pace would be associated with a faster respondent speaking pace (H10). I find that interviewer speaking pace is positively associated with respondent speaking pace. Specifically, a one word-per-second increase in interviewer speaking pace is associated with an increase of 0.0134 words per second in respondent speaking pace ($p=0.018$). Because of the positive association between interviewer and respondent speaking pace, there is support for hypothesis H10. Including interviewer speaking pace in model 4b does not substantially change the associations between the other variables from model 3b and respondent speaking pace.

To explore whether the association between interviewer speaking pace and respondent speaking pace depend on question complexity, three interaction terms are included in model 5b. The first two interaction terms for interviewer pace are with the QUAID indicators and with Flesch-Kincaid grade level. The third interaction term is between question length and interviewer pace. I have two competing hypotheses - that complex questions read at a faster pace will be associated with a relatively slower respondent speaking pace (H11a) and that complex questions read at a faster pace will be associated with a relatively faster respondent speaking pace (H11b).

The results from model 5b indicate that the interaction between the interviewer’s speaking pace and the question’s QUAID-identified problems is statistically significantly associated with respondent speaking pace. Additionally, the inclusion of all focal independent variables and interaction terms resulted in a decreased proportion of variance in respondent speaking pace that is due to respondents (0.118), questions (0.093), and interviewers (0.002) as compared to that of the base model in Table 5 (0.1399, 0.1072, and 0.0029, respectively). As shown in Figure 3, respondent speaking pace increases as interviewer pace increases for questions that have more QUAID-identified problems.

However, respondent pace does not differ by interviewer speaking pace for questions with fewer QUAID-identified problems. A similar pattern is found when examining the interaction term between Flesch-Kincaid Reading level and interviewer pace (Figure 4); respondent speaking pace increases as interviewer speaking pace increases on questions that are considered more linguistically complex as indicated by a higher reading level, although this interaction effect is not statistically significant. Also, as Figure 5 indicates, the relationship between interviewer speaking pace and respondent speaking pace did not differ by question length, which is an indicator of cognitive question complexity for respondents. Overall, these findings indicate partial support for hypothesis H11b, in which respondent speaking pace is greater as a result of a faster interviewer speaking pace on complex questions. There was not support for hypothesis H11a, which was that respondent speaking pace is slower for complex questions read at a faster pace.

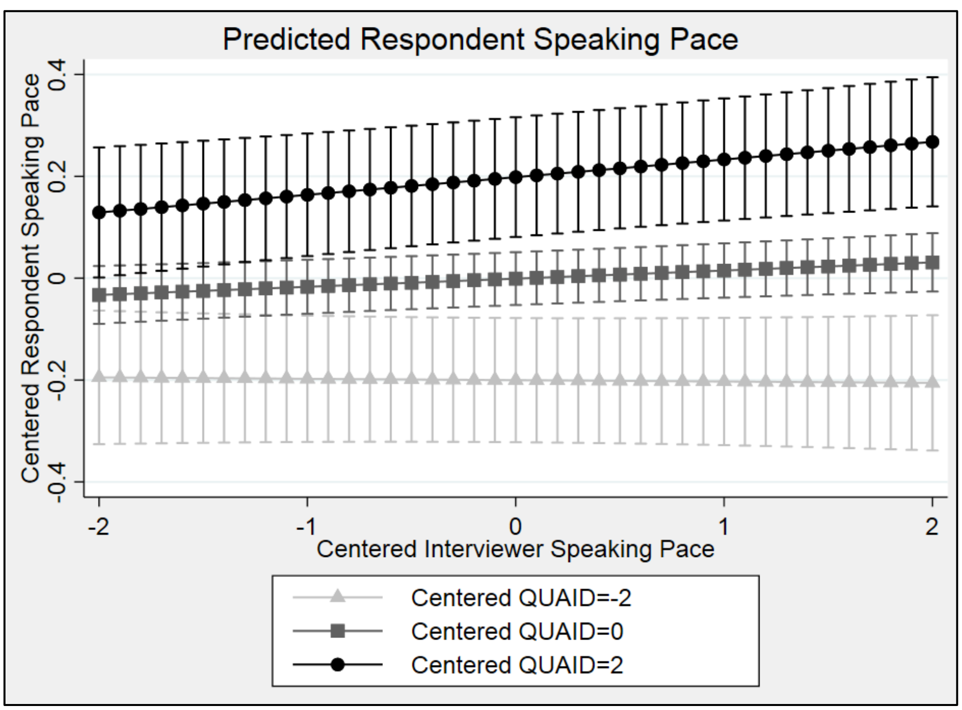

Figure 3. Predicted Respondent Pace by Interviewer Pace and QUAID-Identified Problems

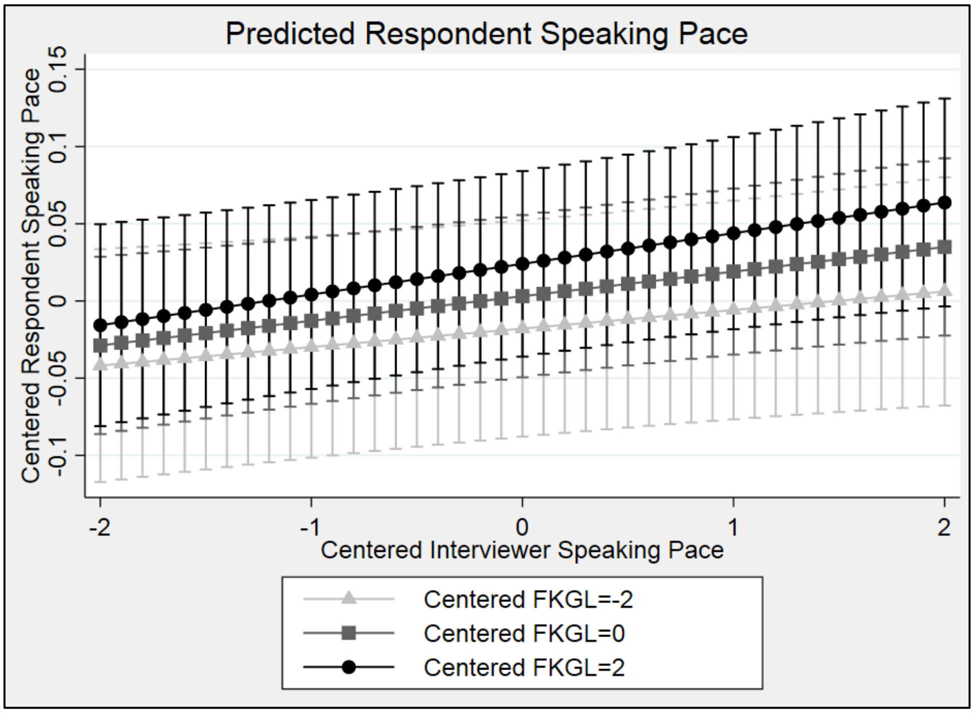

Figure 4. Predicted Respondent Pace by Interviewer Pace and Flesch-Kincaid Grade Level (FKGL)

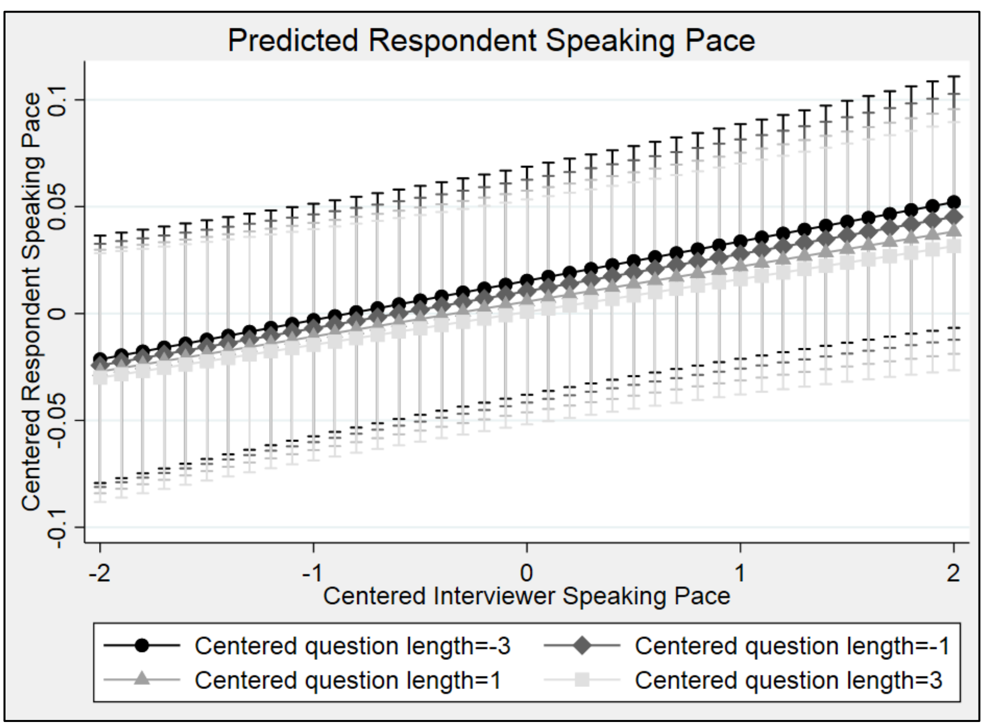

Figure 5. Predicted Respondent Pace by Interviewer Pace and Question Length

Table 6. Coefficients and Standard Errors from Cross-Classified Multilevel Linear Models Predicting Interviewer Speaking Pace

	Model 2a: Main Effects of Control Variables		Model 3a: Main Effects of Focal Question Characteristics	
Variable	Coefficient (SE)	P-value	Coefficient (SE)	P-value
Control Variables				
Respondent Characteristics				
Education (ref=less than BA)				
Bachelor’s degree or higher	0.044	0.010	0.041	0.016
	(0.017)		(0.017)	
Region (ref=North East)				
Midwest	-0.003	0.903	-0.004	0.896
	(0.027)		(0.028)	
South	-0.004	0.880	-0.003	0.896
	(0.026)		(0.026)	
West	0.026	0.341	0.026	0.345
	(0.027)		(0.027)	
Gender (ref=male)				
Female	0.030	0.085	0.031	0.075
	(0.017)		(0.017)	
Race (ref=white)				
Nonwhite	-0.017	0.389	-0.016	0.410
	(0.020)		(0.020)	
Age (ref=64 or younger)				
65+ years	-0.010	0.605	-0.005	0.806
	(0.020)		(0.020)	
Interviewer Characteristics				
Tenure (ref=worked less than 1 year)				

Worked 1 year or longer	-0.295 (0.163)	0.070	-0.295 (0.163)	0.070
Gender (ref=male)				
Female	-0.266 (0.172)	0.123	-0.266 (0.172)	0.122
Race (ref=white)				
Nonwhite	-0.151 (0.149)	0.314	-0.150 (0.149)	0.315
Software experience (ref=no experience)				
Has experience with CATI system	0.126 (0.197)	0.523	0.127 (0.196)	0.519
Study Characteristics				
Sampling frame (ref=landline)				
Cell Phone Sampling Frame	0.004 (0.019)	0.818	0.003 (0.019)	0.858
Questionnaire version (ref=version 1)				
Version 2	0.032 (0.154)	0.833	0.043 (0.149)	0.776
Question type (ref=attitude/opinion)				
Behavior	0.195 (0.092)	0.034	0.065 (0.084)	0.436
Demographics-attributes	0.128 (0.086)	0.135	0.024 (0.090)	0.787
Focal Question Characteristics				
Linguistic Complexity				
QUAID Count			0.082 (0.034)	0.015
Flesch-Kincaid Grade Level			-0.063 (0.012)	<0.0001

Question Length			0.010 (0.002)	<0.0001
Cognitive Complexity				
Interviewer decisions			-0.023 (0.067)	0.737
Question Sensitivity				
Sensitive question			-0.106 (0.094)	0.260
Position in Interview				
Question sequence number			0.002 (0.001)	0.213
Intercept	0.013 (0.169)	0.937	0.117 (0.168)	0.487
Log-Likelihood	-36265.748		-36245.857	
Wald Chi-Square	27.18 df=15	0.027	76.11 df=21	<0.0001
AIC	72571.5		72543.71	
		Proportion of variance at each level		Proportion of variance at each level
Question Variance	0.123	0.177	0.086	0.131
Respondent Variance	0.051	0.073	0.051	0.078
Interviewer Variance	0.116	0.167	0.116	0.176
Residual Variance	0.405	0.583	0.405	0.616

Note: n=899 respondents, 104 questions, and 26 interviewers. Total n=36374

Table 7. Coefficients and Standard Errors from Cross-Classified Multilevel Linear Models Predicting Respondent Speaking Pace

	Model 2b: Control Variables		Model 3b: Main Effects of Focal Characteristics without Interviewer Pace		Model 4b: Main Effects of Focal Characteristics with Interviewer Pace		Model 5b: Interaction Effects	
Variable	Coefficient (SE)	P-value	Coefficient (SE)	P-value	Coefficient (SE)	P-value	Coefficient (SE)	P-value
Control Variables								
Respondent Characteristics								
Education (ref=less than BA)								
Bachelor's degree or higher	-0.078 (0.020)	<0.0001	-0.075 (0.020)	<0.0001	-0.076 (0.020)	<0.0001	-0.076 (0.020)	<0.0001
Region (ref=North East)								
Midwest	-0.030 (0.033)	0.353	-0.030 (0.033)	0.359	-0.030 (0.033)	0.363	-0.029 (0.033)	0.366
South	-0.041 (0.031)	0.188	-0.041 (0.031)	0.183	-0.041 (0.031)	0.185	-0.041 (0.031)	0.186
West	-0.061 (0.032)	0.056	-0.061 (0.032)	0.057	-0.061 (0.032)	0.056	-0.061 (0.032)	0.057
Gender (ref=male)								
Female	-0.057 (0.020)	0.005	-0.058 (0.020)	0.004	-0.059 (0.020)	0.003	-0.059 (0.020)	0.003
Race (ref=white)								
Nonwhite	-0.009 (0.023)	0.694	-0.010 (0.023)	0.673	-0.010 (0.023)	0.673	-0.010 (0.023)	0.681
Age (ref=64 or younger)								
65+ years	0.066 (0.023)	0.004	0.061 (0.023)	0.010	0.061 (0.023)	0.009	0.061 (0.023)	0.009
Interviewer Characteristics								

Tenure (ref=worked less than 1 year)								
Worked 1 year or longer	-0.066 (0.029)	0.021	-0.066 (0.029)	0.021	-0.062 (0.028)	0.026	-0.061 (0.028)	0.028
Gender (ref=male)								
Female	-0.003 (0.030)	0.911	-0.003 (0.030)	0.920	0.000 (0.029)	0.994	0.001 (0.029)	0.963
Race (ref=white)								
Nonwhite	0.003 (0.027)	0.909	0.002 (0.027)	0.932	0.005 (0.026)	0.863	0.005 (0.026)	0.861
Software experience (ref=no experience)								
Has experience with CATI system	-0.040 (0.035)	0.261	-0.040 (0.035)	0.251	-0.042 (0.034)	0.214	-0.042 (0.034)	0.212
Study Characteristics								
Sampling frame (ref=landline)								
Cell Phone Sampling Frame	-0.226 (0.022)	<0.0001	-0.225 (0.022)	<0.0001	-0.225 (0.022)	<0.0001	-0.225 (0.022)	<0.0001
Questionnaire version (ref=version 1)								
Version 2	0.053 (0.057)	0.346	0.071 (0.054)	0.185	0.070 (0.053)	0.191	0.069 (0.053)	0.195
Question type (ref=attitude/opinion)								
Behavior	-0.100 (0.069)	0.145	-0.066 (0.075)	0.385	-0.066 (0.075)	0.383	-0.066 (0.075)	0.378
Demographics-attributes	-0.063 (0.064)	0.328	-0.025 (0.082)	0.759	-0.025 (0.082)	0.763	-0.026 (0.082)	0.753
Focal Question Characteristics								
Linguistic Complexity								

QUAID Count			0.101 (0.028)	<0.0001	0.100 (0.028)	<0.0001	0.100 (0.028)	<0.0001
Flesch-Kincaid Grade Level			0.009 (0.010)	0.347	0.010 (0.010)	0.303	0.010 (0.010)	0.289
Cognitive Complexity								
Question Length			-0.002 (0.002)	0.347	-0.002 (0.002)	0.198	-0.002 (0.002)	0.187
Respondent Familiarity								
Question appears after the first item in a battery			0.003 (0.079)	0.969	0.005 (0.078)	0.945	0.007 (0.078)	0.925
Question Sensitivity								
Sensitive question			0.044 (0.077)	0.573	0.045 (0.077)	0.559	0.046 (0.077)	0.552
Position in Interview								
Question sequence number			-0.002 (0.001)	0.186	-0.002 (0.001)	0.182	-0.002 (0.001)	0.182
Interviewer Pace					0.013 (0.006)	0.018	0.016 (0.006)	0.008
Interaction Effect								
Interviewer Pace * Flesch-Kincaid Grade Level							0.002 (0.002)	0.266
Interviewer Pace * QUAID							0.009 (0.006)	0.092
Interviewer Pace * Question Length							-0.001 (0.000)	0.232
Intercept	0.264 (0.070)	0.000	0.221 (0.081)	0.006	0.219 (0.080)	0.006	0.219 (0.080)	0.006
Log-Likelihood	-39668.07		-39658.402		-39655.662		-39651.942	
Wald Chi-Square	186.11 df=15	<0.0001	207.38 df=21	<0.0001	214.87 df=22	<0.0001	222.80 df=25	<0.0001
AIC	79376.14		79368.80		79365.32		79363.88	

		Proportion of variance at each level		Proportion of variance at each level		Proportion of variance at each level		Proportion of variance at each level
Question Variance	0.068	0.108	0.058	0.093	0.058	0.093	0.058	0.093
Respondent Variance	0.074	0.117	0.074	0.119	0.073	0.118	0.073	0.118
Interviewer Variance	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002
Residual Variance	0.489	0.774	0.489	0.786	0.489	0.787	0.489	0.787

Note: n=899 respondents, 104 questions, and 26 interviewers. Total n=36374

DISCUSSION AND CONCLUSION

Few studies have examined speaking pace for interviewers and respondents at the question-level. This thesis sought to examine whether question characteristics are associated with both interviewer question-asking pace and respondent speaking pace at the question-level, as well as whether interviewer speaking pace is associated with respondent speaking pace. Table 8 provides a summary of the support for each of the hypotheses in this thesis. Of the sixteen hypotheses, one hypothesis was fully supported (H10), four hypotheses were partially supported (H1a, H1b, H2a, and H11b), and eleven hypotheses were not supported by the data.

Interviewers ask linguistically complex questions at both a slower and faster pace, depending on the indicator used to identify linguistically complex questions. Respondents were found to reply to linguistically complex questions at a faster pace, but only for certain indicators of question linguistic complexity. Respondents speak at a slightly faster pace when the interviewer spoke at a faster pace as well, meaning that there was a positive association between interviewer and respondent speaking pace. Finally, I found partial support that complex questions read at a faster pace were associated with a faster respondent speaking pace compared to less complex questions read at a faster pace. However, I found no support for associations between question cognitive complexity and either interviewer or respondent speaking pace. Similarly, I found no support for an association between battery items and respondent speaking pace. Both question sensitivity and the position of a question in the interview were also not associated with either interviewer or respondent speaking pace. These findings indicate that in general, many of the hypotheses which were informed largely by research on speech duration were not supported when examining speech pace within telephone interviews.

Table 8. Support for Hypotheses

Hypothesis	Actor	Hypothesized Outcome	Outcome
H1a	Interviewer	Interviewers will ask **linguistically complex** questions at a **slower** pace	Partially supported
H1b	Interviewer	Interviewers will ask **linguistically complex** questions at a **faster** pace	Partially supported
H2a	Respondent	Respondents will reply to **linguistically complex** questions at a **slower** pace	Not supported
H2b	Respondent	Respondents will reply to **linguistically complex** questions at a **faster** pace	Partially supported
H3a	Interviewer	Interviewers will ask **cognitively complex** questions at a **slower** pace	Not supported
H3b	Interviewer	Interviewers will ask **cognitively complex** questions at a **faster** pace	Not supported
H4a	Respondent	Respondents will reply to **cognitively complex** questions at a **slower** pace	Not supported
H4b	Respondent	Respondents will reply to **cognitively complex** questions at a **faster** pace	Not supported
H5	Respondent	Respondents will reply to questions that are part of a **battery** at a **faster** pace	Not supported
H6	Interviewer	Interviewers will ask **sensitive** questions at a **faster** pace	Not supported
H7	Respondent	Respondents will reply to **sensitive** questions at a **faster** pace	Not supported
H8	Interviewer	Interviewers will ask questions **closer to the end of the interview** at a **faster** pace	Not supported
H9	Respondent	Respondents will reply to questions **closer to the end of the interview** at a **faster** pace	Not supported
H10	Respondent	**Interviewer pace** will be **positively** associated with **respondent pace**	Supported
H11a	Respondent	A **faster interviewer pace** on **complex** questions will be associated with a **slower respondent pace** than a faster interviewer pace on less complex questions	Not supported
H11b	Respondent	A **faster interviewer pace** on **complex** questions will be associated with a **faster respondent pace** than a	Partially supported

		faster interviewer pace on less complex questions	

In research question one, I asked if question characteristics such as linguistic complexity, cognitive complexity, question sensitivity, and the position of the question in the interview are associated with the pace of interviewer initial question reading. I find that question linguistic complexity is associated with the pace of the interviewer's initial question reading, but that this association varies by the operationalization of question linguistic complexity. There were two competing hypotheses for the association between linguistic complexity and interviewer question-asking pace: interviewers were hypothesized to speak either more slowly (H1a) or more quickly (H1b) on linguistically complex questions as indicated by the question's Flesch-Kincaid Grade Level, QUAID-identified problems, and question length. However, I found that these three indicators of linguistic complexity did not influence interviewer question-asking pace in the same direction, indicating that the Flesch-Kincaid Grade Level, QUAID-identified problems, and question length may actually measure three distinctly different question characteristics. Future research should examine why these question characteristics differ in their association with interviewer speaking pace.

The other question characteristics – question cognitive complexity, sensitivity, and the position of the question in the interview – are not associated with the pace of interviewer initial question reading. I hypothesized competing mechanisms for cognitively complex questions – that interviewers would ask cognitively complex questions at a *slower* pace because of the cognitive effort that goes into making decisions for how to read a question to a respondent, or that interviewers would try to reduce their burden by asking cognitively complex questions at a *faster* pace. It could be that *both* mechanisms occurred and cancelled each other out. Therefore, future research could benefit by further parsing out these two mechanisms to discover to what extent cognitively complex questions influence interviewer question-asking pace and other interviewer question-asking behaviors. Furthermore, previous research indicated that both sensitive questions and questions closer to the end of the survey interview are associated with shorter conversational turns (Galesic and Bosnjak 2009; Holbrook et al. 2020). However, many previous studies focused on speech *duration*, rather than question-asking *pace*. Interviewers may have fewer words to speak and thus they speak for a shorter period of time for both sensitive questions and questions closer to the end of the interview, but interviewers do not necessarily ask these questions *faster* than other questions. As the current study is one of the first examining interviewer question-asking *pace* at the conversational turn level, future research should seek to replicate these findings on how question characteristics are associated with interviewer question-asking pace. Furthermore, future research should consider expanding Japec's (2008) model of interviewer burden and identify different sources of interviewer burden. It may be that interviewers do *not* experience burden during an interview from reading cognitively complex questions because of having already been exposed to potentially complex questions during interviewer training. Interviewer burden may then arise from *other* sources aside from question comprehension within an interview.

In research question two, I asked if question characteristics such as linguistic complexity, cognitive complexity, respondent familiarity with the question structure, sensitivity, and the position of the question in the interview were associated with respondent speaking pace. Respondents were found to reply to linguistically complex questions at a faster speaking pace, but only when examining the number of QUAID-identified problems and not for the Flesch-Kincaid Grade Level of a question. Few, if any, studies compare how QUAID and Flesch-Kincaid Grade Levels function as indicators of question complexity when predicting respondent pace. Future work should also explore to what extent, and potentially why, Flesch-Kincaid Grade Levels differ from QUAID-identified problems in how these indicators of question complexity influence respondent speaking pace and other respondent behaviors in survey interviews.

Question length – the measure of respondent cognitive complexity – was not associated with respondent speaking pace. As with interviewers, I hypothesized two competing mechanisms for how respondents would reply to cognitively complex (that is, longer) questions; respondents would either reply to cognitively complex (longer) questions at a slower pace because of the increased cognitive effort required to form an adequate response or they would reply at a faster pace because of satisficing (Krosnick 1991). These two processes may have also cancelled out an association between question length and respondent pace. Other outcomes that are more direct indicators of response quality or operationalizations of a satisficing process may have different associations with question length. For instance, “don’t know” responses to questions may be a better measure of data quality and potential breakdowns of the cognitive response process. Future research would benefit by further examining more direct measures of response quality, as well as how these response quality indicators are associated with respondent speaking pace.

Items that appeared later in a battery, which was the indicator for respondent familiarity with the question structure, were not associated with respondent speaking pace. I only examined three battery items in this survey. The battery items examined in the data were relatively short, with each battery containing either three or four items. Previous research has found that respondents “learn” how to respond to battery items after the first few items asked (Olson, Smyth, and Cochran 2018). It is possible that the respondents in this study were unable to “learn” the structure of a battery when there were only three or four total items within the battery. Additionally, two of the three examined batteries in this study were attitudinal batteries, meaning that question type and battery items were partially conflated. Future research could further explore how battery items influence respondent speaking behaviors by utilizing battery items of various different question types so that battery items are not conflated with question type.

Respondent speaking pace may not have been associated with question sensitivity in part because the questions considered “sensitive” in the WLT2 survey were not highly sensitive. For example, one sensitive question in this survey asked the respondent if they have ever been laid off from a job. It could be that the topic was not perceived as sensitive to the respondents, especially when compared to questions on sexual activity or drug use. Additionally, respondents who have “something to hide” on the sensitive topic, such as those who have been laid off from a job, perceive the question as more sensitive than those who have not been laid off from a job (Tourangeau and Yan 2007). Many respondents then may not have perceived the sensitive questions in the survey as sensitive, thus the respondents did not change their speaking pace. Future research should examine questions that are more typically considered as "sensitive" to a broader range of the target population (e.g., sexual behaviors, drug and alcohol use).

The position of the question in the interview was not associated with respondent speaking pace. This was a surprising finding as many previous studies have found that respondents exhibit shorter response latencies, which is a measure of silence between the end of the interviewer question-asking and the start of the respondent's response, and shorter turn durations on questions closer to the end of the survey (Galesic and Bosnjak 2009; Holbrook et al. 2020). It may be that respondent speaking pace truly does not vary by the position of the question in the survey but rather that other response behaviors such as response latencies and response durations vary instead.

In research question three, I asked if interviewer question-asking pace was associated with respondent speaking pace. I found that respondents spoke on average 0.013 words per second faster for every one-word-per-second increase in interviewer speaking pace. Yet the size of this effect is modest – a 0.013 word-per-second change in speaking pace is extremely small in comparison to the range of 3.83 to 4.66 words-per-second as the "average" speaking pace and is likely an unnoticeable change in speaking pace (Tauroza and Allison 1990; Quené 2007). The small size of effect of interviewer speaking pace on respondent speaking pace means that the suggestion that interviewers speak at a slow speaking pace may not yield a meaningful decrease in respondent speaking pace. However, this does not necessarily mean that survey organizations should stop training interviewers to speak at a slow question-asking pace; a slow interviewer speaking pace may improve response quality in terms of reduction of "don't know" responses and other indicators of poor response quality. For example, Vandenplas and colleagues found that a faster interviewer speaking pace was associated with a higher rate of satisficing behaviors (2018). Therefore, future research should further examine how interviewer speaking pace is associated with response quality and other respondent behaviors.

Finally, research question four asks how the association between interviewer question-asking pace and respondent speaking pace is moderated by question complexity. I found that questions that have a higher linguistic complexity, as indicated by both the number of QUAID-identified problems and by a higher Flesch-Kincaid Grade Level, yielded a faster respondent speaking pace, on average, when the interviewer also spoke at a faster pace. Respondents may have found the complexity of the question combined with a fast asking pace to be too burdensome; respondents with a greater burden may then choose to satisfice and thus respond at a faster pace rather than slowly and carefully considering their response (Krosnick 1991). Therefore, it may be beneficial for interviewer trainings to emphasize the benefit of speaking at a slower pace particularly on complex questions to reduce respondent burden.

As with all observational studies, the current study has many limitations. First, this thesis only examined *initial* interviewer and respondent speaking pace. That is, the analyses were limited to examine only the first time the interviewer spoke and the first time the respondent spoke on a given question. It is possible that these initial conversational turns on a survey question do not capture the final response for a question, especially if the respondent's initial conversational turn is an expression of confusion about the question. Therefore, future research would benefit by exploring the relationship between question characteristics on interviewer and respondent speaking pace for *all* conversational turns in interviewer-administered surveys.

Another limitation of this study is that question characteristics co-occur. Because this study is observational in nature, question characteristics were not independent of one another; for example, the majority of battery questions asked in the WLT2 survey were attitudinal questions and all of the demographic questions in the survey appeared at the end of the questionnaire. Therefore, it is difficult to make generalizations about question characteristic effects on interviewer and respondent speaking pace without considering how the question characteristics are associated with one another. It would be beneficial for future work examining interviewer and respondent speaking pace to deliberately vary sets of question characteristics to disentangle some of the question characteristics that could not be considered here.

One other limitation in this thesis is the ambiguous meaning of respondent speaking pace. Because I only examine speaking pace in this thesis, and not measures of response quality, I cannot determine that a faster respondent speaking pace means that the respondent provided a lower quality or higher quality response. Therefore, even if a slower interviewer speaking pace decreases respondent speaking pace on average, this does not necessarily mean that a slower interviewer speaking pace increases the response quality. In order to make these associations, future research should seek to identify the relationship between respondent speaking pace and response quality.

While this study has limitations, it additionally has many unique strengths. For one, this thesis is one of the first studies examining both interviewer and respondent speaking pace together in survey interviews. The vast majority of previous studies on speaking behaviors in survey interviews are limited to either the speaking behaviors of interviewers or that of respondents, but very few examine both simultaneously. Furthermore, this study examines speaking *pace* rather that speech duration or other measures of speaking behaviors that are commonly used. The findings of this study provide implications for how fast both interviewers and respondents speak in telephone interviews while considering both the duration of the speech and the number of words spoken. Additionally, the speech behaviors analyzed in this thesis occur at the conversational turn level, which is also a relatively rare type of data. Rather than generalizing about speaking pace at an aggregate level such as the average number of questions asked per minute across the entire survey interview, I was able to explore how question characteristics can influence speaking pace question-by-question.

In sum, this study found that question linguistic complexity is associated with both interviewer and respondent speaking pace, but that the indicators of question linguistic complexity do not necessarily affect speaking pace identically. Additionally, question cognitive complexity, battery items, question sensitivity, and the position of the question in the survey interview were not associated with either interviewer or respondent speaking pace. Interviewer speaking pace was positively associated with respondent speaking pace, but the magnitude of the effect is weak. Finally, respondents speak faster on linguistically complex questions that were asked at a faster interviewer speaking pace, suggesting that the association between interviewer speaking pace and respondent speaking pace is modified by question linguistic complexity.

The findings in this thesis indicate that some question characteristics may affect interviewer and respondent speaking pace, but not all question characteristics do.

Additionally, a slower interviewer speaking pace can influence respondents to speak slower, but this effect is not large. These findings suggest that questionnaire designers should consider how question characteristics such as the reading level of the question stems could influence both interviewers and respondents. Subsequently, writing questions at a lower reading level and with fewer QUAID-identified problems may improve the interviewer's ability to read the question and improve the respondent's ability to provide a well-thought-out response, thus possibly increasing response quality on survey questions.

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