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Predicting Participation from the Call Opening

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Abstract

Although researchers have used phone surveys for decades, the lack of an accurate picture of the call opening reduces our ability to train interviewers to succeed. Sample members decide about participation quickly. We predict participation using the earliest moments of the call; to do this we analyze matched pairs of acceptances and declinations from the Wisconsin Longitudinal Study using a case-control design and conditional logistic regression. We focus on components of the first speaking turns: acoustic-prosodic components and interviewer's actions. The sample member's "hello" is external to the causal processes within the call and may carry information about the propensity to respond. As predicted by Pillet-Shore (2012), we find that when the pitch span of the sample member's "hello" is greater the odds of participation are higher, but in contradiction to her prediction, the (less reliably measured) pitch pattern of the greeting does not predict participation. The structure of actions in the interviewer's first turn has a large impact. The large majority of calls in our analysis begin with either an "efficient" or "canonical" turn. In an efficient first turn, the interviewer delays identifying themselves (and and thereby suggesting the purpose of the call) until they are sure they are speaking to the sample member, with the resulting efficiency that they introduce themselves only once. In a canonical turn, the interviewer introduces themselves and asks to speak to the sample member, but risks having to introduce themselves twice if the answerer is not the sample member. The odds of participation are substantially and significantly lower for an efficient turn compared to a canonical turn. It appears that how interviewers handle identification in their first turn has consequences for participation; an analysis of actions could facilitate experiments to design first interviewer turns for different target populations, study designs, and calling technologies.

Introduction

Although survey researchers have used phone surveys for decades, we lack an accurate picture of the opening of the call, and this reduces our ability to train interviewers to succeed from the beginning of the contact. In this study we use features of the first two turns of the call to predict whether or not a sample member will participate in a telephone survey. We consider two types of components of each turn: acoustic-prosodic components (such as pitch) and interviewers' actions. We begin with the sample member's first turn, "hello." The prospect of making predictions from the sample member's "hello" is tantalizing: (1) Some contacts with sample members provide little information about the sample member other than "hello," so analysts might like to exploit any information "hello" conveys. (2) The "hello" could potentially provide, for all sample members who answer the phone, information about propensity to participate that has not been influenced by the interviewer, and this information could be used to manage field efforts and measure response propensity in analysis. (3) If the sample member's "hello" provides cues about response propensity, interviewers might be trained to use these cues appropriately.

We then consider the interviewer's initial opportunities for "tailoring." Although "tailoring" originally referred to "changes in interviewer behavior…shaped by real concerns revealed by householders" (Groves and Couper 1996; Couper and Groves 2002), it has been broadened to include other types of responsiveness, including the exchange of greetings (Groves and Benkí 2006; Schaeffer et al. 2013). We examine the other actions in the interviewer's first turn, which concern "identification/recognition" (Schegloff 1979) and combine self- and institutional identification and a request to speak to the sample member. In the first turn the interviewer can display competence in projecting and meeting (1) an answerer's plausible concern with the caller's identity and purpose and (2) a plausible expectation that the caller will address these issues (Schegloff 1979) and thereby prevent identification becoming a concern for the answerer and a matter for repair.

We build on earlier investigations but differ in (1) recognizing that actions of the interviewer in the first turn are so structured that the turn as a whole must be considered, (2) documenting the limited structures interviewers actually use in their first turn, (3) comparing turn structures that do ("canonical") and do not ("efficient") accomplish identification, (4) using an analytic sample that includes sample members regardless of where they exit,[1] and (5) predicting participation from features of the turn of each actor that is least affected by the other. We aim for findings with practical implications and to provide grounding for future experiments about how to begin the call by identifying components of opening turns.

We use the Wisconsin Longitudinal Study (WLS), a panel study of those who graduated from high school in Wisconsin in 1957. We examine digital audio recordings from the 2004-2005 wave, when participants were approximately 65 years old. We expect that the greetings and actions of the sample members will reflect the following: Expectations for those of their background and cohort (e.g., about how a stranger who is calling should address them); experience with prior rounds of the WLS (most recently 1992-93 for most); review of the

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[1]For example, of our 257 declinations, 89 declined immediately after the turn with the interviewer's identification, and a total of 158 declined before the request for participation. Sample members who continue long enough to hear attempts at persuasion are a select group (e.g., Sturgis and Campanelli 1998; De Leeuw and Hox 1996).

advance letter in the current wave (for most); and the sample member's observation of attempts to contact them on caller ID or answering machine messages (for some). It is consequential for the interaction that the interviewer can ask for the sample member by name and does not need to select someone from the household.

Our sample, design, and analytic approach could limit or strengthen generalizations. If the content or structure of the turns we study occur only with this study design or population, then our results might be most relevant for panel studies in which sample members can be asked for by name or for studies of older adults--of which there are important instances.

Background and motivation

Because the motivation of hypotheses is somewhat different for the sample member's "hello," the interviewer's greeting, and the actions in the interviewer's first turn, we introduce each separately.

The Sample Member's "Hello."

We ask whether the sample member's "hello" forecasts the outcome of the call. "Hello" is highly conventional (Schegloff 1986), but may communicate nonetheless. For example, if the sample member does not know the caller's identity or reason for calling, their "hello" may communicate that. There is evidence that speakers project stances and relationships with listeners (e.g., Schegloff 1998; Pillet-Shore 2012; Kockelman 2004) and that listeners perceive these and other characteristics.[2] Drawing on Pillet-Shore's (2012:383) analysis of how greetings display stance in face-to-face interactions, we hypothesize that the following features of a "large" greeting will predict participation: longer duration, higher pitch (the best operationalization we have available for "smile voice"), a pattern of falling pitch (pitch pattern), and wider pitch span.

First Opportunity for "Tailoring": The Interviewer's Greeting.

Unlike our hypotheses for the sample member's greeting which focus on its absolute qualities, our hypotheses about the interviewer's greeting focus on its responsiveness, although we report findings about both. We hypothesize that a responsive greeting by the interviewer will increase the likelihood of participation, for example, by displaying competence as an interactional partner. In acoustic terms, a responsive greeting could either mirror or complement. The literature does not provide guidance about the forms of acoustic tailoring, so we explore several. The interviewer's first turn also offers an opportunity for lexical tailoring: With the WLS cohort, we expect the reciprocal "hello" to be more successful than the standard casual greeting, "hi," used by many interviewers.[3]

Actions in the Interviewer's First Turn.

The interviewer's first turn begins with a greeting and continues until the sample member

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[2]Listeners make varied (reliable or accurate) judgments based on small acoustic samples (e.g., Banse and Scherer 1966; Dykema, et al. 2012; McAleer, Todorov, and Belin 2014; McCulloch 2012; McCulloch, Kreuter, and Calvano 2010; Purnell et al. 1999; Scharinger et al. 2011; Scherer et al. 1991; Schweinberger et al. 2014; Tartter and Braun 1994).

[3]Schaeffer et al. (2013) report this comparison with a slightly different operationalization.

speaks again. As described in our interactional model of the recruitment call (Schaeffer et al. 2013), the interviewer's first turn potentially includes a number of crucial actions. A "canonical" first turn for the interviewer would look much like the sample script that appeared on the screen. The script included greeting, self-identification, institutional identification, and request to speak to the sample member; interviewers were trained to use first and last names: *Hello. My name is (NAME). I am calling from the University of Wisconsin Survey Center at the University of Wisconsin-Madison. May I please speak to (NAME)?* Interviewers were authorized to adapt the script to sound more conversational (Morton-Williams 1993; Houtkoop-Steenstra and van den Berg 2002). When a sample member is called to the phone by a third party who answered the call, a canonical turn includes a greeting, self- and institutional identification by the interviewer, and an optional acknowledgement or confirmation by the interviewer of the sample member's identity.

We use several perspectives to predict consequences of the construction of the interviewer's first turn. First, a call recipient may expect a stranger who is calling to identify themselves in their first turn (Schegloff 1979). Such conventions help manage social exchange, identification, footing, and such. The predictability of conventional practices lets participants assess each other's interactional competence and, perhaps, make other inferences. Second, social exchange theory suggests that by offering identity in their first turn the interviewer (1) generates an obligation for the sample member to confirm their identity in return, and (2) builds trust (Gouldner 1960, Dillman 1978; Dillman, Smyth, and Christian 2014). Finally, "footing" (Goffman 1979) describes how speakers and listeners align; the everyday concept of "footing" refers to the basis of information or trust on which an interaction proceeds. The footing of these actors differ: in a list sample or panel study, the interviewer knows the name, telephone number, and other facts about the sample member, but the sample member has no information about the interviewer.

In a canonical introduction, the interviewer completes "identification/recognition" and then asks for the sample member; this makes the sample member's confirmation of their identity an act of reciprocity. By contrast, in an "efficient" introduction, the interviewer first verifies that they have reached the sample member. This "efficiency" conspicuously betrays the interviewer's privileged knowledge, establishes an unequal footing, and may make the interviewer's interactional competence questionable. Thus, we expect lower likelihood of participation if the interviewer begins with an efficient turn. This implies that we do not expect individual actions–such as asking to speak to the sample member–to have the same effect regardless of how the turn is constructed.

We focus on actions, but we are able to examine other qualities of the interviewer's first turn. Opportunities for politeness in the first turn are limited, but we expect polite turns to be more successful, particularly with the WLS cohort. A polite turn acknowledges (1) the sample member's power in the interaction by mitigating the interviewer's request (e.g., "please" and mitigating language like "may I"), and (2) the social distance between the actors (e.g., use of titles and polite words) (Brown and Levison 1987; Holtgraves and Yang 1992; Stephan, Liberman, and Trope 2010). (The conventions for acknowledging relative power and mitigating a request probably vary for different populations.) To complete our analysis of the first turn, we include measures of disfluency (e.g., Conrad et al. 2013), which may affect a sample member's perception of the interviewer as a competent interactional partner.

Previous Research.

Most previous research about acoustic or perceived properties of speakers during the opening of the recruitment call focus on the interviewer and not specifically on “hello” (e.g., Oksenberg and Cannell 1988; Oksenberg, Coleman, and Cannell 1986; van der Vaart et al. 2006; Groves et al. 2008; Conrad et al. 2013). For example, Benkí et al. (2011) considered the interviewer’s average median pitch and variability in pitch over the first 13 turns, not just “hello.”

Two analyses examined “hello” with a study design quite different from ours. Groves and Benkí (2006) found that the relationship between the rated “friendliness” of the householder’s “hello” and the likelihood of an interview, appointment, or callback was in the predicted direction but was not significant. For the interviewer’s first turn, they examined acoustic properties, but not actions. In later work, Benkí et al. (2013, p. 13) compared “pitch change” for “hello” (using an operationalization that incorporated information after the first turns) for answerers and interviewers within different outcome groups. Our studies differ in operationalizations (we use only information in the first turn of each actor) and analytic approach (we predict outcome from the first turns), so our results are difficult to compare.

With respect to the impact of the interviewer’s actions, Campanelli, Sturgis, and Purdon (1997) report that participation is more likely when interviewers introduce themselves in face-to-face interviews, but they do not examine where the “introduction” is located or the structure of the first turn. Maynard, Freese, and Schaeffer (2010), Schaeffer et al. (2013), Maynard and Hollander (2014), and Nolen and Maynard (2013) analyzed various actions and features of action during the recruitment call for WLS but do not focus on the first turns.

In summary, we examine whether acceptance is associated with (1) a “large” greeting or other acoustic properties of the sample member’s “hello,” (2) the acoustic properties and possible acoustic or lexical reciprocity of the interviewer’s greeting. We then consider whether acceptance is less likely when the interviewer uses an efficient first turn in which they do not identify themselves; we also look at other features of the turn, such as its politeness.

Data

Sample.

We use digital recordings from the 2004 round of the Wisconsin Longitudinal Study (WLS). WLS began with a one-third sample of 1957 Wisconsin high school graduates who have been followed in the intervening decades: 1964 (mail to parents), 1975 (telephone), 1992 (telephone and mail), and 2004 (telephone and mail). Response to the main mode of data collection during follow-up was 87, 90, 87, and 80 percent of those who were still living, respectively. When original sample members known to be deceased are included in the denominator, the 2004 round interviewed 70 percent of the original sample. We have considerable information about all sample members fielded in 2004 and audio recordings of contacts with the sample member by the interviewer.

We use information from the WLS (Hauser 2005) to construct a case-control study. We constructed 257 pairs of cases (the maximum number of pairs we were able to make). In the first contact with a WLS interviewer, one pair member declined to be interviewed, and the other pair member accepted. Pair members are matched on gender, past participation, and estimated propensity to participate.[4] For the analysis of actions, we use all 257 pairs. For the acoustic

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[4] The impact of clustering within interviewer is limited by the large number of interviewers in our analytic sample compared to the number of sample members. We have 138 interviewers, and the mean number of cases per interviewer is about 3.7 for both acceptances and declinations.

analysis we drop a pair if one sample member in the pair did not say "hello" or one sample member's greeting token was too poorly recorded to analyze. Of the 514 cases, 436 have usable "hello" recordings from the sample member; after eliminating pairs in which one sample member did not have a usable recording, 187 pairs (374 cases) remain. Because of the case-control design, the analytic sample is not a probability sample of the larger WLS sample, and calculations from our analytic sample (e.g., frequencies of a particular action) do not describe the WLS sample more generally.

We are interested in the consequences of each actor's first turn. In most calls the sample member answers the telephone. A third party answers the telephone and calls the sample member to the telephone in 95 of the 374 calls in the acoustic analysis and 135 of the calls in the full analytic sample of 514 cases. For these "third-party calls," we use the sample member's greeting

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Analytically, we expect that interviewer effects would be conveyed primarily via the interviewer's actions, actions that are usually unobserved but that we are able to measure. Schaeffer et al. (2013) give details about the sample, estimated propensity scores, matching, and reliability of coding of actions. The model estimating the propensity to participate included education, high school class rank, high school cognitive assessments, self-reported health, sex, and past participation. In addition to being matched on estimated propensity to participate, pairs were matched on gender and past participation to try to control influences on current participation. Details about response rate can be found at (http://www.ssc.wisc.edu/wlsresearch/documentation/retention/cor1004_retention.pdf). All interviews were conducted in English and most on a landline.

when they come to the telephone and the interviewer's subsequent first turn. We discuss later how these calls differ from those in which the sample member answers.

Greeting Tokens and Acoustic Measures.

The acoustic analysis includes only pairs in which the sample member began with "hello" (over 94 percent of the sample). Interviewers' greetings were more variable, and many used "hi." Measures analyzed include pitch (mean, minimum and maximum pitch (Hz)); pitch span (Hz); pitch pattern; duration of each actor's greeting; and the latency between the end of the sample member's greeting and the beginning of the interviewer's turn (see Table 1). Our project is necessarily exploratory, and many of our measures of pitch or duration are correlated. Because we lack *a priori* justification for specific measures of acoustic reciprocity, we examine several (correlated) possibilities: mirroring (e.g., both in the upper, both in lower, or both in same extreme of their respective distributions) or complementarity (e.g., one in each extreme). This lets us assess whether our findings depend on details of the operationalizations and identify the most interpretable version. We examine lexical reciprocity by comparing "hello" to other greeting tokens by the interviewer.

Standardization and Adjustment.

Our method of standardizing measures of pitch and duration adopts the point of view of the participants. We speculate that interviewers would compare the sample member's "hello" to that of other adults of the same age and gender, and we use the sample members to approximate this comparison group. We apply the same logic for the comparisons made by the sample members (although without as strong a justification). For duration we also standardize within actor and gender, and for interviewers we first adjust to make "hello" and "hi" comparable. (Details about adjustments and standardization are in Table 1 and the appendix.) These procedures let us examine the qualities of the greeting regardless of the type of greeting or actor. We operationalized reciprocity similarly for both pitch and duration, by examining the relative positions of the actors in the distribution, for example, both in the top third of that actors' distribution of pitch.

Interviewer's Actions.

The coding of actions in the interviewer's first turn extended codes previously developed (Schaeffer et al. 2013; Maynard and Hollander 2014). Table 2 summarizes these measures, some of which are complementary or dependent in other ways.

Analysis

The analysis uses bivariate conditional logistic regressions of participation on the individual independent variables. For each dummy variable, the comparison is to all other cases in the analysis. As a result, some contrasts are not independent of each other, but our approach is exploratory and allows for flexible description of the results. We used a conditional logit (clogit in Stata). The following likelihood function for clogit with groups (that is, pairs of observations) is based on Chamberlain (1980):[5]

$$L = \sum_{\{i \in I_1\}} \left(\sum_{\{j\,:\,y_{ij}=1\}} \left[(\mathbf{x}_{i2} - \mathbf{x}_{i1}) \left[(-1)^{I(j=2)} \boldsymbol{\beta} \right] - ln \left(1 + e^{(\mathbf{x}_{i2} - \mathbf{x}_{i1})[(-1)^{I(j=2)}\boldsymbol{\beta}]} \right) \right] \right)$$

where

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[5] The likelihood function minimized by clogit is described on the Stata clogit page (http://www.stata.com/manuals14/rclogit.pdf). This section references several other sources, including Chamberlain (1980), which is the basis for the likelihood function above (Mark Banghart, personal communication). The first beta is a multiplier to the difference in the x values in the ith group. The bold font for the x and betas in the formula are to represent that there may be more than one regressor in the model.

- i is the group identifier
- ij, where $j \in \{1,2\}$, is the jth observation of the ith group
- $I_1 = \{i \mid y_{i1} + y_{i2} = 1\}$
- x_{ij} is the row of covariates associated with the jth observation of the ith group
- $I(j = 2)$ is the indicator function for $j = 2$

The outer summation is over all pairs in which the pair's responses contain one 0 and one 1. The inner summation is over the single observation within the pair in which the response is 1.

Conditional logit is similar to a fixed effect logit in which the matching characteristics are used as categorical regressors in the model. The analysis thus adjusts for characteristics that the pairs are matched on and anything else that they have in common. A conditional logistic regression estimates the association between the within-pair action of interest and participation; it "conditions" the intercept for each pair out of the analysis. The intercepts for the pairs are nuisance parameters and not of substantive interest but can bias estimates if not accounted for. Because our sample size is small, and we want to identify avenues for future investigation, we report specific p-values; we discuss relationships that are significant with the relatively generous α=0.10, but note when results are marginal by conventional standards (α=0.05).

Results

For mean and minimum pitch there are no statistically significant associations between continuous measures for either actor or for indicators of reciprocity by the interviewer and subsequent participation (not shown, every $p>0.17$), and we do not discuss these measures further. The key prediction for pitch pattern, that falling pitch would predict participation compared to other patterns, is not supported for either actor nor were our measures of ways the interviewer might reciprocate pitch pattern (i.e., both the same pattern or both opposite) (results for pitch pattern not shown, each p>0.24); however, we note that for sample members pitch pattern is less reliable than our other pitch measures (see appendix).

The Sample Member's "Hello."

Table 3 presents results for the sample member's "hello." The continuous measure of maximum pitch does not predict participation (p=0.21); but, as predicted, sample members in the upper 30 percent of the distribution (our approximation to "smile voice") are more likely to participate than those in the lower 70 percent (OR=1.69, p=0.03). Maximum pitch is also a component of pitch span, but the pattern of results is clearer for the sample member's pitch span: The odds of participation are higher when the sample member's pitch span is greater (OR=1.24, p=0.05). The results for sections of the distribution are consistent with a linear relationship: those with a pitch span in the upper 30 percent of the distribution have a higher odds of participation than those in the lowest 70 percent (OR=1.74, p=0.02), and those whose pitch span is in the lowest 30 percent of the distribution have a lower odds of participation than those in the upper 70 percent (OR=0.62, p=0.04). The duration of the sample member's greeting is not associated with participation (p=0.57).

The Interviewer's Greeting.

Table 4 presents results for the interviewer's greeting. The continuous measure of maximum pitch is not associated with participation (p=0.22), but interviewers whose pitch is in the top 30 percent of their distribution may have lower odds of participation than those in the lower 70 percent (OR=0.64, p=0.07), suggesting that a greeting with "smile voice" may not be appropriate for a stranger who is calling. There is no evidence that the odds of participation are greater if the interviewer reciprocates the sample member's maximum pitch by being in the same or opposite extreme of the distribution as the sample member (these results not shown, every p>0.57). None of the measures of the interviewer's pitch span or the way in which it reciprocates the sample member's pitch span are significant predictors of participation (these results not shown, all $p>0.30$).

The continuous measure of duration of the interviewer's greeting is not associated with participation ($p=0.75$). For reciprocity, when the interviewer mirrors either a long or short greeting token from the sample member (versus others), the relationship is marginally significant but not in the predicted direction (OR=0.63, $p=0.09$). This finding appears to be driven by the negative effect of reciprocity when both actors provide short greetings (OR=0.44, $p=0.06$). It is plausible that a short token from the sample member projects "hurry," but a reciprocation by the interviewer conveys "curt" or "unfriendly."

The continuous measure of the latency between the end of the sample member's greeting and the beginning of the interviewer's is not associated with participation ($p=0.15$), although interviewers with the longest latency have higher odds of success (OR=1.41, $p=0.08$), possibly because they use this time for processing or for "planning" their first turn.

Interviewer's Actions.

Although interviewers were authorized to use a "flexible" introduction, the vast majority of both acceptances (81 percent) and declinations (84 percent) used a canonical or efficient first turn; 95 percent used one of these constructions or the variants. This strong patterning means that we do not have sufficient variation to estimate the impact of each action (e.g., presence or absence of a self-identification) on the outcome.

Table 1. Summary of acoustic measures[a]

Property	Actor[b]	Concept	Measurement	Notes about Analytic Variable
Pitch	SM & INT	Pitch of greeting token (mean, minimum, or maximum)	Mean, minimum, or maximum fundamental frequency of the greeting token (“hello” for SM, "hello" or "hi" for INT) in Hertz.	Each measure standardized using mean and standard deviation of other sample members of same gender.
	SM & INT	Pitch span of greeting token	Maximum and minimum fundamental frequency of the greeting in Hertz.	Computed as maximum frequency of the greeting token divided by the minimum frequency. Span of greeting token was the minimum-maximum ratio converted from Hertz to semitones.
	SM & INT	Pitch pattern of greeting token	The pattern of rising, falling or constant pitch during the delivery of the greeting token.	Comparison across these categories (e.g., falling vs. all others).
Duration	SM	Duration of greeting token	Duration of the greeting token in seconds. Boundaries of the token ("hello") were identified. Duration is the time between the boundaries.	Standardized using mean and standard deviation of other sample members of same gender. Duration of entire token was used (rather than just the final vowel, /o/) to allow for analysis that included interviewers who say “hi.”
	INT	Duration of greeting token	Duration of the greeting token in seconds. Boundaries of the token ("hello" or "hi") were identified. Duration is the time between the boundaries.	Because “hi” and “hello” are of different lengths, the duration was first adjusted by the ratio of the mean duration of “hello” to the mean duration of “hi” for interviewers of the same gender. The adjusted duration was then standardized using the mean and

			standard deviation of other interviewers of same gender.
INT	Latency as transition delay	Time in seconds between end of sample member's last utterance in the response-to-summons turn and the onset of the interviewer's subsequent turn. Latency ends with first utterance from the interviewer, even if that utterance is a token. Measured in Audacity.	Standardized using mean and standard deviation of other sample members of same gender.

[a]Technical details for all variables are in the appendix. Acoustic variables measured in *Praat* (Boersma and Weenink, 2012, http://www.fon.hum.uva.nl/praat/).
[b]"SM" indicates "sample member;" "INT" indicates "interviewer."

Table 2. Concepts and operationalizations for actions in interviewer's first turn[a]

Panel A. Construction of Interviewer's Turn

Concept	Conceptual Definition	Type of Call	Actions in Interviewer's First Turn after Sample Member Greeting[b]
Efficient turn: strict	This structure confirms sample member's identity efficiently but displays unequal information footing of actors and delays identification/recognition. Interviewer asks to speak to sample member without self-identifying.	The sample member answers	Greeting + request to speak to sample member Example: "Hello. May I please speak to Mr. Smith?"
		A third party[c] answers and calls the sample member to the phone	Greeting + at least one of these actions: address to sample member in greeting, confirmation of sample member's identity Example: "Hello. Is this Mr. Smith?" or "Hello, Mr. Smith."
Efficient turn: variants	This structure confirms sample member's identity efficiently but displays unequal information footing of actors and delays identification/recognition. Interviewer confirms sample member's identity. In the few cases in which turn includes one form of identification, it also includes an intrusive action[d] that displays unequal footing of actors.	The sample member answers	Greeting + at least one of these: self-identification, institutional identification + confirmation of sample member's identity Example: "Hello. I'm calling from the University of Wisconsin Survey Center. Is this Mr. Smith?"
		A third party[c] answers and calls the sample member to the phone	Confirmation of sample member's identity Example: "Is this Mr. Smith?"

Canonical first turn: strict	This structure performs identification/recognition in the first turn and equalizes information footing between interviewer and sample member. Turn has self- and institutional identifications and request to speak to sample member.	The sample member answers	Greeting + self-identification + institutional identification + request to speak to sample member Example: "Hello. My name is Emily Jones. I'm calling from the University of Wisconsin Survey Center. May I please speak with Mr. Smith?"
		A third party[c] answers and calls the sample member to the phone	Greeting + self-identification + institutional identification + *one of these actions: address to sample member in greeting, confirmation of sample member's identity*[b] Example: "Hello. This is Emily Jones calling from the University of Wisconsin Survey Center. Is this Mr. Smith?"
Canonical first turn: variants	This structure performs identification/recognition in the first turn and equalizes information footing between interviewer and sample member. Turn includes either self-identification or institutional identification, with optional request to speak to sample member.	The sample member answers	Greeting + any two of these actions: self-identification, institutional identification, request to speak to sample member Example: "Hello. I'm calling from the University of Wisconsin Survey Center. May I please speak with Mr. Smith?"
		A third party[c] answers and calls the sample member to the phone	Greeting + one of these actions: self-identification, institutional identification + *one of these actions: address to sample member in greeting, confirmation of sample member's identity*[b] Example: "Hello. I'm calling from the University of Wisconsin Survey Center. Is this Mr. Smith?"

Panel B. Other Characteristics of Interviewer's First Turn

Concept	Definition	Measures	Actions and Qualities of Actions Counted
Politeness	Polite elements acknowledge the social distance between actors and the sample member's power in the interaction and mitigate the request.	Polite first turn: Number of polite elements in first turn	Greeting is polite: "Hello" OR "Good morning/afternoon/evening" Request to speak to sample member is mitigated by asking permission: "May I speak to" Request to speak to sample member includes "please" Self-identification uses "My name is" rather than "This is" Self-identification uses full name: "My name is <first and last name>" OR "This is <first and last name>" Address to sample member uses last name in greeting and request to speak to sample member Address to sample member uses title: "Ma'am/Sir" OR "Mr./Mrs./Ms." in greeting and request to speak to sample member
		Polite greeting: Number of polite elements in greeting	See "Number of polite elements in first turn"
		Very polite first turn: Interviewer incorporates a polite element in 4 or more locations (out of 6 possible locations in up to 3 actions)	See "Number of polite elements in first turn"
Disfluency	Disfluent speech is characterized by tokens and may communicate that the interviewer is not a competent interactional partner.	Disfluent opening: Interviewer's first utterance is a token or broken off greeting token	Tokens are: Uh Um Ah Oh Huh Hm Mm Hmm Mmm Eh Aw Er Nn Ya

	Disfluent first turn: Interviewer's first turn includes at least one token regardless of location.	See “Disfluent opening”

[a]In a small number of cases (30 out of 514) the interviewer’s first turn took place over more than one turn. In almost all of these 30 cases, the sample member asked for a repetition due to a hearing problem, and the interviewer then restarted the first turn. In a few cases the sample member issued a token or similar minor utterance and the interviewer continued their turn. In all these cases the interviewer's completed turn was evaluated in classifying the case.

[b]Actions shown in italics sometimes occurred, but their presence or absence did not affect the classification of the interviewer’s turn.

[c]For third-party calls, we considered the interactional context in analyzing the turn construction. Because a third-party brought the sample member to the phone, actions in the turn included an acknowledgement of the sample member in the greeting (“Mr. Smith?”) or, in some cases, a repetition of the request to speak to the sample member.

[d]The most common intrusive action was the “sample member identity confirmation” in sample member calls and the “sample member verification,” which required verifying the high school of the sample member, in calls in which a third-party answered. Both actions revealed interviewer’s privileged knowledge about the sample member. These actions were rare in the first turn, but when present disqualified the turn from being “canonical.”

Table 5 presents results for the interviewer's actions. What the interviewer can accomplish in the first turn depends in part on the cooperation of the sample member; nevertheless, the number of actions in the first turn is not associated with participation (p=0.26). The analysis of turn construction addresses our principal hypothesis. When the interviewer's turn is efficient (compared to canonical and other), the odds of participation are substantially and significantly lower (OR=0.65, p=0.02 for strict and OR=0.69, p=0.05 including minor variants). Panel A of Figure 1 illustrates how an efficient introduction could affect studies under different assumptions about the base response rate for the study; for example, if a study to which our odds ratio applied would obtain a 50 percent response rate with an equal number of efficient and canonical introductions, the predicted difference in the response rate with an efficient as compared to a canonical introduction would be between 10 and 11 percent.[6] In our study, if sample members expect identification in the interviewer's first turn, the efficient introduction should lead them to initiate repair with questions such as "Who is this?" or "What

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[6] See Long (1997, pp. 75-79). Because our independent variable is categorical, we estimate the change in predicted response rate varying the response rate of the study for which the prediction is being made. Our matched pairs design does not allow us to estimate the relative proportion of, say, efficient and canonical introductions in our sample, so we calculate the estimated difference in their impact on the response rate assuming that we have equal numbers of both. This approach simulates the impact one might see in an experiment in which an equal number of cases were assigned to each type of introduction. We particularly thank Mark Banghart and Russell Dimond for their help.

is this about?" And when the sample member asks "wh-" questions (in contrast to length-of-interview questions) before the request to participate, the odds of acceptance decrease substantially (Schaeffer et al. 2013).[7]

We examined several operationalizations of politeness; only for the indicator of a very polite first turn are the odds of participation significantly higher (OR=1.75, p=0.07) (see also Schaeffer et al. 2013). Panel B of Figure 1 illustrates the impact of being very polite; if a study to which our odds ratio applied would obtain a 50 percent response rate with an equal number of a very polite and not very polite first turns, the predicted difference in the response rate with a very polite introduction is just under 14 percent. In addition, "hello" is associated with increased odds of participation compared to "hi" (OR=1.49, p=0.06), perhaps because "hello" reciprocates the sample member's token, because "hi" is casual in a way that these older sample members do not like, or because "hello" indexes other features of the turn, such as its politeness (see also Schaeffer et al. 2013).

We also examined the implications of disfluency in the interviewer's first turn. Only 25 percent of the first turns in our analytic sample included a disfluency token and in only 7 percent of the turns was that disfluency in an initial position. The odds of participation are

[7]Canonical and efficient calls have different trajectories; nevertheless, the proportion of our cases that exit by key turning points (e.g., before the request to participate) is the same for both. In our analytic sample, "wh-" questions immediately follow the interviewer's first turn in 1.9 percent of cases with canonical (or variant) openings and 6.7 percent of cases with openings that are efficient (or variants) (p=0.01, one-sided). "Wh-" questions also occur later, of course.

lower if the interviewer begins with a disfluency token (OR=0.55 at the marginally significant level of p=0.09),[8] but are not affected if there is a disfluency anywhere in the first turn (p=0.39).

Discussion

Although telephone surveys have been conducted for decades (e.g., Tourangeau 2004), studies of interaction during recruitment have focused on refusals and the response to them (e.g., Maynard and Schaeffer 1997). The specific actions in the opening turns, their features, and sequential placement have not been previously described to our knowledge, but interviewers must be trained for this key moment when sample members are contacted by phone.

Our analysis of the sample member's "hello" emphasizes the positions of the participants in the first moments of the call. Although we could not fully operationalize Pillet-Shore's "large" greeting (2012), the sample member's pitch span and a related measure, a relatively high maximum pitch (smile voice), predicted participation in a way consistent with her analysis; pitch pattern (which was challenging to operationalize and less reliably measured) did not. If our operationalization of "pitch span" is perceived as friendliness, our finding is consistent with the direction of the (nonsignificant) result reported by Groves and Benkí (2006); pitch span may be

[8] Here are illustrative canonical and efficient introductions that begin with a disfluency, both from calls that end in a declination: "***Uh*** good afternoon. I'm calling from University of Wisconsin uh for the Wisconsin Longitudinal Study for Mr. (FIRST AND LAST NAMES). Is he available?" and "***Uh*** hello. May I please speak with (FIRST NAME)?"

Table 3. Bivariate conditional logistic regressions of acceptance of the request to participate on features (pitch, duration) of the sample member's "hello."

Measure	Definition	N[b]	Odds Ratio	p (2-tailed)	95% CI Lower	95% CI Upper
Pitch[a]						
Maximum	Maximum of standardized pitch (continuous)	374	1.14	0.21	0.93	1.41
	Top 30% of maximum pitch (=1, 0=all others)	374	1.69	0.03	1.04	2.75
	Lowest 30% of maximum pitch (=1, 0=all others)	374	1.24	0.33	0.81	1.90
Span	Span of standardized pitch (continuous)	374	1.24	0.05	1.00	1.55
	Top 30% of pitch span (=1, 0=all others)	374	1.74	0.02	1.08	2.79
	Lowest 30% of pitch span (=1, 0=all others)	374	0.62	0.04	0.39	0.98
Duration	Standardized duration of greeting token in seconds (continuous)[a]	374	1.06	0.57	0.87	1.30

[a]Measures of pitch are standardized using the mean and standard deviation of sample members of the same gender in the sample. See appendix for details.
[b]Sample (n=374) includes pairs in which both sample members in the pair said "hello" and had recordings for which acoustic analysis could be conducted.

Table 4. Bivariate conditional logistic regressions of acceptance of the request to participate on features (pitch, duration of token, response latency) of the interviewer's greeting token

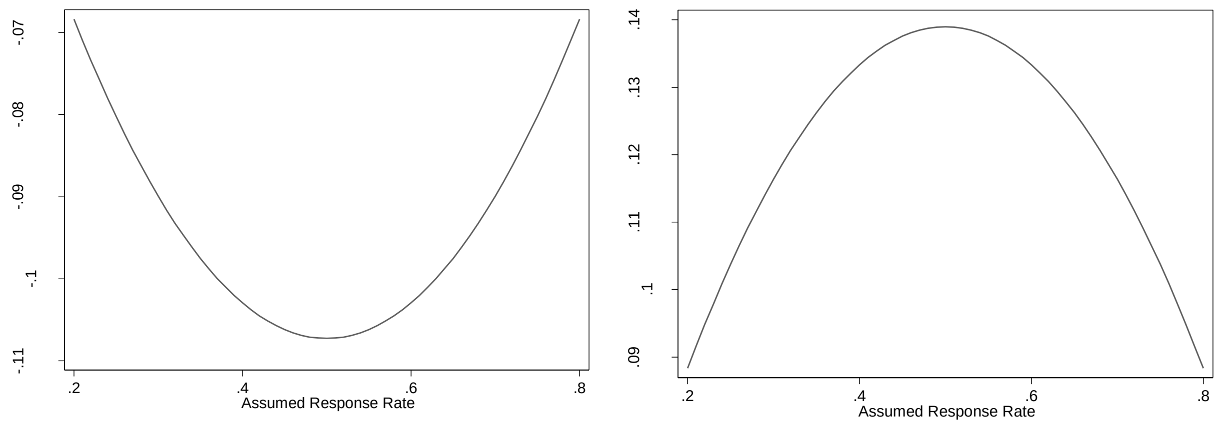
Measure	Definition	N	Odds Ratio	p (2-tailed)	95% CI Lower	95% CI Upper
Maximum pitch[a]	Maximum of standardized pitch (continuous)	374[c]	0.88	0.22	0.72	1.08
	Top 30% of maximum pitch (=1, 0=all others)	374[c]	0.64	0.07	0.40	1.03
	Lowest 30% of maximum pitch (=1, 0=all others)	374[c]	0.93	0.74	0.60	1.44
Duration[b]	Standardized duration of greeting token (adjusted) in seconds (continuous)	340[d]	1.04	0.75	0.84	1.28
Duration: Reciprocity	Both in top 30% of duration of greeting token (=1, 0=all others)	340[d]	0.83	0.60	0.42	1.65
	Both in top or both in bottom 30% of duration of greeting token (=1, 0=all others)	340[d]	0.63	0.09	0.37	1.07
	Both in bottom 30% of duration of greeting token (=1, 0=all others)	340[d]	0.44	0.06	0.19	1.02
	Complementary extremes (vs. not)	340[d]	1.00	1.00	0.57	1.76
Latency	Standardized response latency in seconds	514[e]	1.14	0.15	0.95	1.36
	Long latency (1=longest 30%, 0=all others)	514[e]	1.41	0.08	0.96	2.07
	Short latency (1=short 30%, 0=all others)	514[e]	0.74	0.12	0.50	1.08

[a]Measures of pitch are standardized using the mean and standard deviation of interviewers of the same gender in the sample. See appendix for details.
[b]Duration is standardized using the mean and standard deviation of the interviewers of the same gender in the sample. In addition, interviewer greetings are first adjusted to account for the different lengths of "Hello" and "Hi." See appendix for details.
[c]Sample includes pairs in which both sample members in the pair said "hello" and had recordings for which acoustic analysis could be conducted.
[d]Analysis omits from sample in footnote "c" pairs in which interviewer used a greeting other than "hello" or "hi."
[e]Analysis includes all available analytic pairs, because acoustic details for the sample member were not required and no restrictions on greeting were required.

Table 5. Bivariate conditional logistic regressions of acceptance of the request to participate on actions of the interviewer in the first turn

Measure and Definition	N[a]	Odds Ratio	p (2-tailed)	95% CI Lower	95% CI Upper
Turn construction					
Number of actions in first turn (1-5)	514	1.11	0.26	0.93	1.32
Efficient turn (=1, 0=efficient variants + canonical + canonical variants + other)	514	0.65	0.02	0.46	0.93
Efficient turn and variants (=1, 0=canonical + canonical variants + other)	514	0.69	0.05	0.48	0.99
Politeness					
Number of polite elements in first turn (0-9)	514	1.04	0.51	0.93	1.16
Number of polite elements in greeting (0-3)	514	1.23	0.20	0.90	1.70
Greeting includes polite element (=1, 0=absent)	514	1.28	0.21	0.87	1.87
Very polite first turn (1=5 or more out of 9, 0=all others)	514	1.75	0.07	0.95	3.23
Greeting token (1=Hello or good (morning/afternoon/evening, 0=all others)	502	1.36	0.12	0.92	2.01
Greeting token (1=Hello, 0=Hi)	458	1.49	0.06	0.98	2.26
Disfluency					
Turn begins with disfluency token (=1, 0=absent)	514	0.55	0.09	0.27	1.10
Disfluency token present in first turn (=1, 0=none)	514	1.09	0.39	0.89	1.34

[a]Analysis includes pairs in which both sample members or interviewers had relevant actions.



Panel A. Decrease for Efficient Compared with Canonical Introduction, OR=0.65

Panel B. Increase for Very Polite Compared to Other Introductions, OR=1.75

Figure 1. Difference in Predicted Response Rate for Characteristics of Introduction for Values of Response Rate between .2 and .8, Assuming That the Characteristics Are Used with Equal Frequency

more reliable than ratings of friendliness and so more likely to yield significant results. It is difficult to compare our results for pitch span with those of Benkí et al. (2013) because our measures are constructed in very different ways, and we predict outcome from pitch span, rather than describing the reverse.

Our results potentially inform measurements of propensity to participate. Kennickel (2012) found that ratings by field interviewers of the likelihood that a case would be ultimately interviewed in the Survey of Consumer Finances were too noisy to be useful. Eckman, Sinibaldi, and Möntmann-Hertz (2013) found that telephone interviewers have a modest ability to predict whether or not a sample member will ultimately be interviewed, but interviewer effects were large. In both these studies, the interviewers made the rating at the end of the contact, when considerably more information than “hello” was available. Because a high maximum pitch and the related pitch span of the sample member’s greeting predict participation, their potential as (relatively) external and reliable measures of propensity to participate could be explored. If recordings of the sample member's "hello" could be analyzed at the speed required during field efforts, acoustic results could potentially be compared to or combined with other sources of information about the sample member's propensity to participate, such as interviewers' ratings, in responsive designs (e.g., Groves and Heeringa 2006; Sinibaldi and Eckman 2015; Wagner et al. 2012). Another potential application might be to train interviewers to recognize "large" and "small" greetings and to have a lower threshold for a "graceful exit" (as suggested by Schaeffer et al. 2013) from the latter type of call, in the hope of maximizing the chance of success on a later attempt.

We examined many acoustic properties of the interviewer's greeting token: mean, minimum, and maximum pitch; pitch span; pitch pattern; duration; and latency. We operationalized acoustic reciprocity in several ways. Relationships were few and some of those unexpected. One finding for interviewers suggests that a "large" greeting or "smile voice" might not be appropriate for a stranger calling: Odds of participation are lower for interviewers in the top 30 percent of the distribution of maximum pitch. For acoustic reciprocity, we found that odds were lower when the interviewer mirrored a short greeting token. The relationship for latency is easier to explain: Odds of participation are higher for interviewers with the longest delay before speaking, which may provide an extra moment of processing or preparation.

Lexical reciprocity–the use of "hello" by the interviewer–had a positive effect on participation, but we cannot select among possible explanations for this (reciprocity, politeness, or fit to the expectations of older sample members). Our analysis of canonical introductions is consistent with a preference for a caller identifying themselves in their first turn (Schegloff 1979) and is similar to the observation by Campanelli et al. (1997) in face-to-face interviews in a different population and to the judgment of experienced Dutch interviewers that it is important to “start by identifying yourself” (Snijkers, Hox, and De Leeuw 1999, pp. 192, 194).

Our findings might seem counter to suggestions that “conversational” introductions might be more effective than a script in recruiting survey participation (Houtkoop-Steenstra and van den Bergh 2002; also Morton-Williams 1993). However, the list of elements interviewers were required to include in that experiment (interviewer’s name, company name, research topic, phone number check, recipient selection, and number in the household – in any order) (Houtkoop-Steenstra and van den Bergh 2002, p. 207) is longer than the number of elements that our interviewers, using a “flexible introduction,” placed in the canonical turn. Moreover, that experiment did not include a manipulation check, so we do not know whether or how interviewers followed instructions, what interviewers actually included in the first turn, or what specific actions accounted for the observed effects.

Our study might imply that interviewers be trained and monitored on the content of a first turn modeled on the canonical turn examined here. However, other turn constructions not examined here may be at least as effective with this or other populations, so caution is called for in making such a recommendation. It is possible that the negative impact of an efficient introduction or the positive impact of the polite elements (minimal though they are) we observe are specific to the cohort and study design represented by the WLS; a sample of younger people or a sample contacted on cell phones might have different sensibilities or prefer less polite formality. Still, for many studies a household member of any age could be a gatekeeper, household informant, or selected sample member; moreover, caller identification must be accomplished in every population, and preferably before the sample member must ask “Who’s calling?”

Our design strengthens our predictions, but it has limitations. We can match pairs on estimated propensity to participate because we use data from a longitudinal study. But the overall response rate for the WLS is high enough that our small number of cases exhausts the pairs we could make with usable recordings, and so we cannot increase our sample size. The sample is homogeneous in race, origin, and age; most of our interviewers are considerably younger than the sample members; and these calls were made to landlines. Our sample members all have experience with the survey, most have received an advance letter, and interviewers could be fairly sure if the person who answered was not the sample member they sought. Because this was a panel study, the interviewer did not have to select a respondent from the household, and the placement of a selection procedure would have important consequences for the structure of the call opening; we could expect the opening sequence to be different in a cold call without a designated sample member (e.g., Maynard and Schaeffer 1997). All these features could affect which actions by the interviewer have consequences for participation.

However, our analysis of interviewers' actions could facilitate experiments to design first turns for different target populations and emerging technologies. Study design (e.g., advance letters) and technology (e.g., caller identification) perform some aspects of "identification." Although footing and social exchange theory provide ways of thinking about the interviewer's first turn, that turn follows conventions for talk between strangers on the phone, conventions that continue to develop for cell phones and other modes of communication (Arminen and Leinonen 2006; Hutchby and Barnett 2005).

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Appendix

For Schaeffer, Nora Cate, Bo Hee Min, Thomas Purnell, Dana Garbarksi, and Jennifer Dykema, *Greeting and Response: Predicting Participation from the Call Opening*

Acoustic Measures

Pitch (measured by fundamental frequency, F0), loudness (measured by intensity), and timing of linguistic elements (measured by duration) have been shown to be related to accommodation and reciprocity (see De Looze et al. 2014 for a summary of the findings). The technology used when the recordings were made does not allow us to make useful measures of the intensity, or volume, of the greeting. Based on past acoustic findings, we hypothesize that when a sample member-interviewer pair displays reciprocity by the interviewer, the sample member is more likely to participate.

Preparation of Audio File.

To prepare each audio call for analysis, we first excised the sample member's greeting using Audacity (V. 1.2.6, available through http://audacity.sourceforge.net). Each sound file for analysis consists of the audio recording beginning just before the sample member's greeting and ending after the end of the interviewer's first turn as signaled by the reappearance of the voice of the sample member. Audio files were normalized in Praat (Boersma andWeenink 2012) to a new absolute peak of 0.99. In a number of the unnormalized audio files, either the sample member or interviewer has clipped speech (i.e., the amplitude reached or exceeded the absolute maximum peak) due to a number of factors that affected the collection of the audio (e.g., speakers talking too loudly, recorders with input volume set too high, etc.). Such audio distortion cannot be fixed and resulted in our search for more individualized measurement techniques working around the distortion with global and individualized methods (explained below).

We then created a Praat annotation file for each audio clip in which temporal boundaries of linguistic units, such as “hello” or “hi,” are saved. Separate annotation tiers are used to mark phones, vowel nuclei and offglides (e.g., [ow] at the end of “hello”), syllables, greetings, and the boundaries of the interviewer’s first turn. The Praat tiers are used to identify the duration of the interviewer’s greeting token, any fillers or tokens between the sample member’s “hello” and the beginning of the interviewer’s first turn, and the entire first turn by the interviewer before overlap or a new turn by the sample member. The transcription of the interviewer’s first turn is also recorded on an annotation tier. A pair is omitted from analysis if the greeting by the sample member omitted a first syllable, or if the initial consonant or initial vowel was not included. We could not set boundaries for the interviewers in the way we did for the sample members, because interviewers used a variety of greetings (“hello,” “hi,” “good morning,” etc.) with different phonemes and internal structure, so that internal boundaries are not comparable across greetings for interviewers.

During the process of labeling the linguistic segments in the audio in Praat, we attended to optimal settings of frequency range and number of formants for each speaker. If settings were used other than the standards in Praat, we recorded these settings in a reference file that Praat scripts accessed when measuring formant or spectral information.

Technical Specifications for Measurement of Pitch.

We calculated most measures of pitch in Praat, using a cross-correlation method, which measures fundamental frequency across the frequency spectrum rather than temporally (period to period), as in the autocorrelation method; we used the autocorrelation method only if cross-correlation resulted in an undefined frequency measure. The cross-correlation method improves consistency across a wide range of audio qualities, voice types and pitch ranges, such as those encountered in the WLS recordings. To facilitate the measurement of fundamental frequency in such inconsistent audio qualities, we use a number of parameters, relativized for each speaker. A speaker's fundamental frequency can be measured across a broad number of speakers by using some of the lowest values for all recordings (e.g., "voicing threshold," discussed below). The pitch floor and ceiling for the WLS corpus varied by gender (male=60 Hz, 300 Hz; female=75 Hz, 450 Hz, respectively), consistent with settings that other researchers have used in Praat to account for these gender differences in frequency (Vogel et al. 2009; Manson et al. 2013). Attending to post-normalized voice loudness improves the measurement of frequency. Consequently, the Praat settings for the silence threshold, the voicing threshold and the voiced/unvoiced cost were all scaled based on the intensity of the signal; while the default values in Praat for these three settings (0.04, 0.3 and 0.17, respectively) are considered appropriate for the "general case," they are not necessarily effective for WLS recordings which are not uniformly acoustically clean recordings. Instead, we calculated the appropriate settings on a case-by-case basis using the observed relation between pitch and intensity levels. The scaling formulas are:

Silence threshold=0.04 + ((0.46/32) * (I–67)),

Voicing threshold=0.3 + ((0.25/32) * (I–67)),

Voiced/unvoiced cost=0.17 + ((0.08/32) * (I–67)),

where "I" for the sample member is the average intensity (dB) of the recorded material between the end of the sample member's "hello" and the beginning of the interviewer's turn, and for the interviewer is the average intensity of the greeting. Variations in the raw frequency profile were smoothed by killing octave jumps and smoothing, and we took measures from this smoothed frequency profile. When the frequency could not be measured using this protocol, we used set values (pitch method=autocorrelation, silence threshold=0.03, voicing threshold=0.4, voiced cost=0.21, minimum pitch=50 Hz, maximum pitch=600). We used smoothing, without removal of octave jumps to assist in measuring and viewing pitch traces.

We standardized measures of pitch, which is known to vary by age and gender. Torre and Barlow (2009; see also Harnsberger et al. 2008) report that older and younger speakers have differences in fundamental frequency (which gives rise to the perception of pitch). In the WLS, most sample members are older than most interviewers, they may perceive interviewers as younger than they are based on the interviewers' voices, and this may contribute to a perception of social distance. In addition, Peterson and Barney (1952), Klatt and Klatt (1990) and many others have observed a difference in the fundamental frequency of male and female voices. To take age and gender differences into account, we standardized each fundamental frequency measure for the sample members and interviewers using the mean and standard deviation of other actors of same type and gender. The standardized mean pitch (STD_MEANPITCH) of the greeting token for an individual male sample member (MSM_i) is:

$$STD\_MEANPITCH_{MSM_i} = (MEANPITCH_{MSM_i} - \overline{MEANPITCH}_{MSM})/SD_{MEANPITCH_{MSM}}$$

It is common for analyses of pitch to refer to pitch patterns in part because listeners attend to relative changes in frequency rather than absolute frequencies (Liberman and Pierrehumbert 1984). Sharf and Lehman (1984) and Oksenberg and Cannell (1988) found that listeners responded more positively to a "hello" spoken in a falling rather than rising voice.

Accordingly, we developed a classification for the pitch pattern for the sample member's and interviewer's greetings. Initially, we identified pitch patterns based on the relation of the maximum and minimum pitch in the greeting. Using "H" to mean (relatively) high and "L" to mean (relatively) low, we labeled the greeting HLH or HL if the maximum pitch occurred before the minimum and used the label LHL or LH if the minimum pitch followed the maximum. If there were three tones–HLH or LHL--the final tone change reflects a rising or falling tone, respectively. Moreover, the tone pattern sometimes extended past the word even after the word had officially ended (as indicated by low but audible energy after the end of the /o/). Frequency tables of the measures produced by using a Praat script programmed to find one of these four patterns on each word suggested that the number of pattern categories could be reduced by not considering the first tone in each pattern (which was usually for the less consequential first syllable of 'hello'). Using this rule, HLH became LH, HL became L, LHL became HL, LH became H. When we listened to every greeting while visually observing the narrow band spectrogram, three perceptual patterns appeared. Because the greetings are in focus and turn-initial position, the pitch is elevated and flat tones H and L were perceived to be flat. Consequently, in our analysis we examined three patterns—rising, falling and constant – but our final analysis focused on the falling pitch versus others comparison suggested by our hypotheses.

We measured pitch span for both the sample member and interviewer by converting Hertz values to semitones (Pillet-Shore 2012; De Looze et al. 2014). This conversion facilitates comparison across speakers with different frequencies and avoids influence from other extrinsic and intrinsic factors (Ladd 1996). Four known methods of using pitch span appear in the literature on pitch span and range. The first is an impressionistic label (Knight and

Nolan2006:22 used ‘compressed,’ ‘neutral’ and ‘expanded’). The second way of treating pitch span is by just reporting the fundamental frequency and the standard deviation (De Looze et al. 2014). The third method is to treat span as synonymous with range (subtracting the minimum fundamental frequency from the maximum; Ladd 1996: 260). The fourth approach to span is to treat it as a relative ratio (dividing the maximum fundamental frequency by the minimum; Knight and Nolan 2006: 28). To avoid issues related to gender and age, the method for pitch span we use in the present paper, pitch span combines the relative ratio method with the known conversion of hertz into semitones (Pillet-Shore 2012; De Looze et al. 2014). As such, we used the following formula for pitch span: $12 * \ln(F0_{MAX}/F0_{MIN})/\ln(2)$.

Technical Details of Measurement and Standardization for Duration.

Boundaries of the token ("hello") were identified and recorded on a Praat TextGrid per audio recording. Duration is the time between the boundaries, which may identify vowels, syllables, words, turns, etc. The durational focus for this paper is on greeting and turn durations. We standardized the duration of the sample member’s greeting using mean and standard deviation of other sample members of same gender. The duration of the entire token was used (rather than just the final vowel, /o/) to allow for analysis that included interviewers who say “hi.”

The duration for each measure in the interviewer’s greeting was first adjusted (using a ratio of means) and then standardized (using the mean and standard deviation). To include both “hi” and “hello,” which are of different durations, we first adjusted the duration of “hi” to that of “hello” based on the ratio of the mean duration for the two greeting tokens spoken by other interviewers of the same gender in the sample. The adjusted duration is then standardized. The standardization used the means and standard deviations calculated for interviewers of the same gender. For example, the duration of “hi” of a female interviewer is multiplied by 1.2383594[9], the ratio of the mean duration of “hello” by female interviewers (.3582669) to the mean duration of “hi” for female interviewers (.2893077). After the adjustment, the duration of “hi” could be compared to that of “hello” and was standardized using the mean and standard deviation of other female interviewers.

Latency is the time in seconds between the end of the sample member’s last utterance (whether greeting or other token) in the response-to-summons turn and the onset of the interviewer’s subsequent turn. Latency ends with first utterance from the interviewer, even if that utterance is a token. We standardized latency using the mean and standard deviation of other sample members of same gender.

Reliability.

To estimate reliability, 42 cases were randomly selected, duplicated, and added to the set of cases for acoustic processing; duplicate cases were assigned a new case number to mask the identity of the case that it duplicated. Cases were randomly assigned to student research assistants to prepare for processing using Audacity and Praat. Cases were assigned to research assistants in random order. Four different assistants worked on preparing recordings, but most cases (27 out of 42 originals and 28 out of 42 duplicates) were processed by a single assistant. For 19 of the original-reliability pairs, both recordings were processed by the same assistant.

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[9] For comparison, the ratio used to adjust duration of greeting by male interviewer is close, which is 1.2553767.

Resulting reliabilities for sample members were as follows: For mean, minimum, and maximum pitch, reliabilities ranged from .98 to 1.00. We had slightly lower reliabilities for durations of the sample member's "hello," from .93 to .94. Categorical pitch patterns had the lowest reliability and 74 percent of the cases have the same pitch pattern in the original and duplicate recording. Reliabilities of acoustic measures of the interviewer's greeting were similar and ranged from .97 to 1.00 for measures of pitch and .95 to .97 for durations. Estimated reliability for latency was .99. The reliability of pitch patterns in interviewer's greeting was .90. See Appendix Table 1 for details.

Other Quality Control for Acoustic Measures.

We conducted a range of additional quality control procedures to check for data reliability. All TextGrid labels and boundaries of all the files were verified to be present. All boundaries for interviewer's "hello" were examined for consistent placement (relative low energy at the word onset and offset). The first author reviewed every tenth token manually for boundary alignment with acoustic landmarks for consistency with student assistants. In order to determine if speech occurred between the sample member's "hello" and the beginning of the interviewer's turn, we examined tokens with excessive noise (>23 dB, or an energy standard deviation greater than or equal to 11 dB) in that region of the waveform (N=18). Eleven of these tokens had additional speech (e.g., name of sample member's household). This additional speech in the sample member's turn affected the latency measure because it reduced the lag time between the end of the sample member's turn and the beginning of the interviewer's turn.

The sample member's and interviewer's first turns were transcribed twice, once for the acoustic analysis and once for the analysis of actions. The two transcripts were compared and inconsistencies corrected by making comparisons of the text to the audio file. All discrepancies were examined and the transcriptions fixed upon review. Finally, outliers in critical measures for duration and pitch were reviewed manually, and boundary placement and usability of tokens were verified.

Appendix Table 1. Reliability of acoustic measures

	Actor	Measure	N[a]	Reliability[b]
Duration				
	Sample member	Duration of greeting	42	0.94
		Duration of 2nd syllable in hello	42	0.93
		Duration of /o/ in hello	42	0.94
	Interviewer	Duration of greeting	42	0.95
		Duration of first turn	42	0.97
Pitch				
	Sample member	Mean pitch in hello	42	1.00
		Maximum pitch in hello	42	0.98
		Minimum pitch in hello	42	1.00
	Interviewer	Mean pitch in greeting	42	1.00
		Maximum pitch in greeting	42	1.00
		Minimum pitch in greeting	42	0.97
Pitch Span[c]				
	Sample member	Pitch span in hello	42	0.96
	Interviewer	Pitch span in greeting	42	0.94
Latency[d]			42	
	Interviewer	Latency including filler[e]	42	0.99
Hello Pitch Pattern				
	Sample member	Pitch pattern in hello	42	0.74
	Interviewer	Pitch pattern in greeting	42	0.90

[a]Reliability pairs are composed of the original recording and duplicate of the original.

[b]Reliability is calculated by the Pearson correlation coefficient between acoustic measures of the original and duplicate for quantitative measures and by the proportion of congruent values for categorical measures

[c]Pitch span is calculated as the difference between maximum and minimum pitch. It is compared with the pitch span calculated by Praat and two pitch spans are virtually identical.

[d]If there is no filler by sample member after hello this is the time between the end of sample member's hello and the beginning of interviewer's first utterance. If there is a filler by sample member after hello this is the time between the end of sample member's filler and the beginning of interviewer's first utterance

[e]There is only one case in the reliability sample that has a filler, so reliability is reported only with filler.

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