



Striving for optimal relevance when answering questions

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Abstract

When people are asked “Do you have the time?” they can answer in a variety of ways, such as “It is almost 3”, “Yeah, it is quarter past two”, or more precisely as in “It is now 1:43”. We present the results of four experiments that examined people’s real-life answers to questions about the time. Our hypothesis, following previous research findings, was that people strive to make their answers optimally relevant for the addressee, which in many cases allows people to give rounded, and not exact, time responses. Moreover, analyses of the non-numeral words, hesitations, and latencies of people’s verbal responses to time questions reveal important insights into the dynamics of speaking to achieve optimal relevance. People include discourse markers, hesitation marks, like “uh” and “um”, and pauses when answering time questions to maximize the cognitive effects (e.g., a rounded answer is adequate) listeners can infer while minimizing the cognitive effort required to infer these effects. This research provides new empirical evidence on how relevance considerations shape collaborative language use.

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1. Introduction

Even simple conversational exchanges, such as question and answer sequences, are constrained by rich pragmatic knowledge. Consider a situation where a person on the street, who is wearing a watch, is approached by a stranger who stops and says, “Excuse me, do you have the time?” An ideal answer to any question should provide the requested information accurately and without undue delay. But answering questions may be delayed because respondents (a) could not understand the implied request, (b) could not easily retrieve the requested information, or (c) had difficulty formulating the most appropriate response. For example, respondents answering time questions must at a minimum decide whether to provide an exact (e.g., “It is 1:57”) or rounded answer (e.g., “It is 2:00”, when their watches really indicate that it is 1:57).

Imagine that a respondent correctly understands the speaker’s implied request for the time when hearing the question “Do you have the time?” One proposal for how people respond to this question assumes that speakers aim to be optimally relevant in saying what they do (Sperber & Wilson, 1995), or adhere to a principle of least joint effort (Clark, 1996), by which speakers select from the available methods the ones that they think take the least effort for them and their addressees jointly. Optimizing relevance is a fundamental tenet of relevance theory (Sperber & Wilson, 1995). Under this “optimally relevant” view, every act of ostensive behavior communicates a presumption of its own optimal relevance, that is, a presumption that it will be relevant enough to warrant the addressee’s attention and as relevant as compatible with the communicator’s own goals and preferences (the Communicative principle of relevance). Speakers design their utterances to maximize the number of cognitive effects listeners infer while minimizing the amount of cognitive effort to do so. Newly presented information is relevant in a context only when it achieves cognitive effects in that context, and other things being equal, the greater the cognitive effects, the greater the relevance. Answering questions about the time requires respondents to determine what is most relevant for the addressee given the context, which in most cases entails that speakers only need give rounded, and not exact, replies (e.g., “It’s almost two”).

Indeed, research shows that when people on the street are asked, “Do you have the time?” they typically provide rounded answers, even when wearing digital watches (van der Henst, Carles, & Sperber, 2002). The fact that respondents tend to round their answers to time questions, even when wearing digital watches, suggests that conversational exchanges are not guided by an egocentric bias to state what is easiest, or to follow a maxim to always speak truthfully (cf. Grice, 1989), both of which would predict that digital watch wearers should invariably give the exact time. Rather, people aim to provide answers to questions that are optimally relevant for the circumstance.

Our goal in the research reported here is to provide additional evidence on how relevance considerations constrain question answering by examining the full contents of what people say in reply to different time requests. Consider the following interaction between two strangers, who meet on a university campus, where one person goes up and asks another for the time.

Mary: “Excuse me, do you have the time?”

John (who is wearing an analog watch): “uh, it’s like five...ten after four”.

Mary: “Thanks”.

This simple exchange from our corpus provides a nice example of a respondent (John) overtly rounding his reply to meet the questioner’s (Mary) presumed abilities and preferences, enough so as to be worth her processing effort. However, there is additional information in what John utters that, in our view, indicates his desire to provide an optimally relevant response, beyond whether or not he provides the exact time. For instance, John says “uh” at the beginning of his reply, and inserts the discourse marker “like” before initially rounding to “five”, but then settling on “ten after four”.

We argue that respondents’ introduction of disfluencies (e.g., “uh” and pauses) and words (e.g., “like” in “it’s like five”), which seem to matter little to the particular semantic content of their messages (e.g., the time is 4:10), vary depending on their presumptions of what is optimally relevant in a specific context. Speakers include various linguistic and paralinguistic cues in their responses to time questions to alert addressees about how they should interpret what is uttered (e.g., the speaker may be providing only an approximate, or rounded, as opposed to an exact, time answer). Speakers talk this way in order to provide adequate cognitive effects for no gratuitous effort.

In general, speakers balance the trade-off between maximizing cognitive effects (i.e., meanings) and minimizing the cognitive effort for addressees to recover those effects by making certain choices about both what they say and how they say it. For example, consider three ways that people could respond to the question “My watch stopped. Do you have the time?”

- (a) “It is almost 4”.
- (b) “It is 3 minutes before 4”.
- (c) “It is um...3:57”.

All three of these responses are vaguely relevant to answering the original question. But statement (c) is most optimally relevant, because it allows the addressee to know the exact time in an easily understandable way that can be used to set her own watch, given the presumption that one purpose for asking for the time was to exactly reset the stopped watch.

Although statement (b) provides the same cognitive effect as does (c), it requires more cognitive effort to comprehend than (c), given the extra mental computation needed to derive the exact time of 3:57 from the statement “It is 3 minutes before 4”. Statement (b) is therefore less optimally relevant because greater effort is expended than what is required to understand statement (c). At the same time, the filled pause in (c) may work to signal that an answer is forthcoming which is indeed worth the addressee’s continued attention. In this manner, statement (c) may convey an additional cognitive effect over that seen in (b), namely that a highly relevant answer is forthcoming, which clearly benefits the addressee and may facilitate her understanding of the speaker’s communicative intention. Of course, statement (a),

“It’s about 4”, may provide sufficient cognitive effects with little cognitive effort in a situation where a questioner did not first mention the need to reset her watch. In that case, the approximator “almost” supplies a highly relevant cognitive effect that the following numerical answer is just good enough.

Several linguistic and psycholinguistic theories have attempted to describe the interaction between the semantic content of what speakers state and the information they provide listeners on how to interpret their messages. One advantage of relevance theory is that it offers a framework for making predictions about the inclusion of various linguistic and paralinguistic cues during speech in a way that other pragmatic theories are simply unable to do (but see Clark, 1996). For instance, relevance theory distinguishes between the use of “conceptual” and “procedural” meanings in verbal communication (Blakemore, 2002; Sperber & Wilson, 1995). Conceptual meanings map linguistic expressions to encoded concepts that help convey a speaker’s thought. For instance, in the response (d), “Yeah, the time is...well, 4”, the word “time” refers to an encoded concept that can be defined in terms of various truth-conditions and contributes directly to the proposition expressed by the utterance. However, the word “well” does not enter into the construction of the proposition expressed by (d), but contributes a form of procedural meaning that provides instructions to addressees about the inferential processes they should engage in to determine an utterance’s optimally relevant interpretation. Similarly, the use of “um” in (c) “It is um...3:57” does not contribute to the proposition expressed by the speaker’s utterance, yet has the procedural function of alerting addressees to the relevance of upcoming information (i.e., the numerical time) that is worthy of the listeners’ continued attention despite the delay in the speaker providing that information.

Striving for optimal relevance in this manner does not imply that people formulate their complete utterances in mind before speaking. Instead, as speakers aim to achieve optimal relevance by what they say, they will incrementally employ subtle combinations of conceptual and procedural meanings to produce the most cognitive effects while trying to minimize addressees’ cognitive effort in deriving those meanings. Our experiments systematically examined the idea that responding to time questions differ depending on what people presume to be optimally relevant at any one moment, by measuring how speakers crafted their utterances given different types of requests for the time and whether responders wore digital or analog watches. People should generally use more procedural cues (e.g., “well”, “about”, and “like”, and filled pauses like “um” and “uh”) when providing rounded answers. They do so mostly unconsciously, not merely because of production problems, but also to reduce listeners’ processing effort by limiting the range of potential hypotheses generated online about the speaker’s intended meaning (e.g., whether the speaker is providing a rounded, as opposed to an exact, answer). At the same time, the speed with which speakers produce their responses should also vary depending on the kinds of meanings they presume are most relevant for addressees and the amount of effort they believe addressees will need to understand those meanings. We expect that including procedural cues in their responses should in many cases increase the time it takes people to formulate their answers to time questions.

2. Experiment 1

Participants in Experiment 1 were members of the University of California, Santa Cruz community who were approached by an experimenter (an undergraduate student) as they walked on campus and asked “Excuse me, do you have the time?” We expected that digital and analog watch wearers would differ in how they formulated their answers. There is nothing in the simple case of a stranger asking “Do you have the time?” that creates a presumption that an exact reply is optimally relevant to the original questioner. For this reason, both types of watch wearers should give rounded answers to a significant degree, with analog participants providing more rounded responses than digital participants. Second, in their attempt to optimize their answers for addressees, analog respondents should generally include more acknowledgments, approximators, filled pauses, and so on than do digital respondents.

But the speed with which people produce their responses may differ depending both on the types of watches they wore and the type of answer they provide (i.e., rounded vs. exact, and amount of procedural information). If respondents simply do what is easiest, without regard for their addressees, then digital watch wearers should find it easier to give exact as opposed to rounded answers. Analog watch wearers would, under the same view, find it easier to produce rounded as opposed to exact replies. However, while striving for optimal relevance, digital watch wearers may actually find it easier to produce rounded replies than exact ones, precisely because a rounded answer may be most optimally relevant. Digital watch wearers who decide to give exact replies may find this more difficult to do, because of their possible indecisiveness as to whether this type of response was really required. Analog watch wearers may provide rounded answers somewhat faster than exact ones, particularly given the extra burden associated in reading their watches exactly.

2.1. Methods

2.1.1. Participants

Seventy-six members of the University of California, Santa Cruz community participated in this study. Forty-one participants were female and 35 were male. The vast majority of the participants were students, while others were likely to be staff members or faculty at the university.

2.1.2. Stimuli, design, and procedure

An experimenter approached people at random places on the University of California, Santa Cruz campus and said to them, “Excuse me, do you have the time?” The experimenter took note of the type of watch worn, while the entire conversation was secretly tape-recorded (the experimenter had a small tape-recorder in her pocket connected to a small microphone attached to the label of her jacket). People who used their cell phones to answer the question were not included in the data analysis, primarily because of the additional effort needed to retrieve these from pockets, purses, and backpacks. The experimenter in this study, as well as studies 2 and 3, did not know the exact time, and did not look at the participants’ watches to see

if they were being accurate in their responses. Following each participant's response, the experimenter thanked him or her, and said "Good-bye". There were two experimenters in this study, both female, who did not know the purpose of the experiment, or our various hypotheses, and they were instructed to ask their question in the same manner for each participant. Informal analysis of the experimenters' tape-recorded questions revealed that they closely followed this instruction.

2.2. Results and discussion

We transcribed the entire responses to each question by noting every vocalization, including ordinary words and phrases, interjections, pauses and filled pauses, and self-corrections. These detailed transcripts allowed us to conduct the following analyses. Comparisons of frequencies between conditions were done with difference of proportions tests.

2.2.1. Rounded analysis

First, we examined transcripts of the conversational exchanges to calculate the proportion of times that people provided exact times or gave rounded answers. The experimenters in this study did not know exactly what time the respondents' watches indicated when these people gave their verbal responses. Consequently, we estimated the proportion of times people gave rounded answers by following the method used by van der Henst et al. (2002). They assumed the following theoretical distribution of rounded times. Out of a random sample of times expressed to the minute, 20% should end in a multiple of five and 80% should not. Participants' responses could be sorted into two types: those given in multiples of five, and those in which the time given is not a multiple of five (these are the exact, or non-rounded, answers). By chance alone, then, 20% of the people should give time responses that were multiples of five. Therefore, the percentage of responses given as multiples of five above 20% provides the best estimate of how often people stated rounded answers. This percentage, or proportion, of rounded is given by means of the following formula (van der Henst et al., 2002: 461):

$$\text{Percentage of rounders} = (\text{percentage of } 5 \times \text{responses} - 20)/80$$

This formula suggests, then, that when only 20% of the people give time responses in multiples of five, the percentage of rounders is zero.

Participants wearing analog watches provided significantly more rounded responses (90%) than did digital watch participants (63%), $z = 2.81$, $\phi = 0.39$, $p < .001$. These results are quite similar to those reported by van der Henst et al. (2002), and suggest that even people wearing digital watches, who are easily able to provide the exact time, frequently give rounded answers.

In fact, the 63% of rounded answers for the digital watch wearers is significantly different from what one would expect by chance alone (20%), $z = 3.20$, $\phi = 0.43$, $p < .001$, as is, obviously, the percentage of analog participants (90%), $z = 6.94$, $\phi = 0.70$, $p < .001$. These latter findings demonstrate that people are not just rounding because of laziness, or to spare themselves cognitive effort, because even those most

easily able to give exact responses (i.e., the digital group) tended to round. Instead, people aimed to reduce the cognitive burden on the addressees' parts by giving rounded answers, which presumably were most relevant for the situation.

2.2.2. *Acknowledgment analysis*

We analyzed the transcripts to calculate the number of times that participants provided responses that included the words “yeah” or “yes”. The question “Do you have the time?” literally asks the listener whether he or she is in possession of some information. People reply “Yes” when presented with indirect requests to acknowledge what was literally stated (Clark, 1979), and/or to indicate that they should be able to comply with the implied request (Gibbs, 1983). An analysis of the times participants included “yes” or “yeah” in their responses showed that they did this significantly more often when they wore analog (61%) than digital (26%) watches, $z = 2.95$, $\phi = 0.34$, $p < .01$. A separate analysis again indicated that people included “yes” or “yeah” in their rounded responses more so when wearing analog (58%) than digital (26%) watches, $z = 2.1$, $\phi = 0.28$, $p = .018$. The greater inclusion of “yeah” or “yes” in the analog condition suggests that speakers may be stalling for time as they formulate the more optimally relevant response. Yet the fact that a high percentage of people include “yes” and do not subsequently round, indicates that saying “yes” or “yeah” is not just done for purposes of holding the floor as speakers figure out how best to round their answers.

2.2.3. *Approximator analysis*

We analyzed the times that people produced “almost”, “about”, or “around”. These approximators are additives that denote imprecision about quantity, or more specifically for the present studies, a more or less symmetrical interval around the exemplar number (Channell, 1994). Speaking vaguely in this way, such as saying “It’s about ten past three”, possibly saves effort for the speaker by not having to determine the exact time, but also saves the listener processing resources that might otherwise be devoted to trying to figure out the exact time within the respondent’s reply (Jucker, Smith, & Ludge, 2003). A separate analysis of the times that participants said “almost” or “about” when giving rounded responses showed that they did this more often when they wore analog watches (23%) than digital watches (13%), but that this difference was not statistically reliable, $z < 1$.

2.2.4. *Filled pauses analysis*

We also analyzed the transcripts to calculate the percentage of times participants produced filled pauses, such as “uh” or “umm” when answering time questions. “Uh” and “um” not only indicate a problem for the speaker, because they are also specific signals that offer an account to addressees as to why the speaker is delayed in responding (Fox Tree, 2002). Participants frequently included “uh” and “um” in the responses, but the percentage of these did not differ between the analog (39%) and digital (33%) participants, $z < 1$. Similarly, participants did not utter “uh” or “um” significantly more often when they provided rounded answers in the analog (40%) and digital (47%) conditions, $z < 1$.

2.2.5. Latency analysis

We analyzed the time it took participants to respond to time questions in the following way. The audio recordings were digitized (44.1 kHz, 16 bit) and then all interactions were isolated and individually edited using Cool Edit Pro (Syntrillium Software). Each interaction included the experimenter's question and the complete response provided by the participant. For each response, two segments were identified: *pre-answer* and *answer*. See Fig. 1. Pre-answer was measured as the length of time from the offset of acoustic energy of the confederate's question (e.g., the end of "time" in the question, "Do you have the time?") to the onset of acoustic energy of an actual number in a participant's answer to the time question (e.g., in Fig. 1, the onset of the word "eleven"). In the cases where participants provided an alternative to an integer in their answer (e.g., "quarter to two"), the word was treated as a number (e.g., answer begins at "quarter").

Acoustic boundaries were not always entirely obvious due to various factors (e.g., external noise, co-articulation, etc.) in which case an estimate was made based on a visual analysis of the waveform and listening to the speech. In approximately 15% of the cases an estimate was made with an error no greater than 20 ms. Fig. 1 presents the waveform of one sample interaction with illustration of *pre-answer* and *answer* segments.

Our primary interest with the latency analysis was with the pre-answers as these best reflected the relative ease of response formulation, given that this time period encompassed all that occurred from the offset of the speaker's question to the very beginning of the actual numerical response. For this reason, we only report the data from the pre-answer analysis. We were, however, interested to see if any difference in the pre-answer latencies had a significant effect on the answer length given that people sometimes gave exact replies in different forms (e.g., "seventeen minutes before one" versus "twelve forty three"). Stating the same time responses in different forms may require different articulation times due to the number of syllables. To control for this possibility, we analyzed whether answer lengths differed as a function of

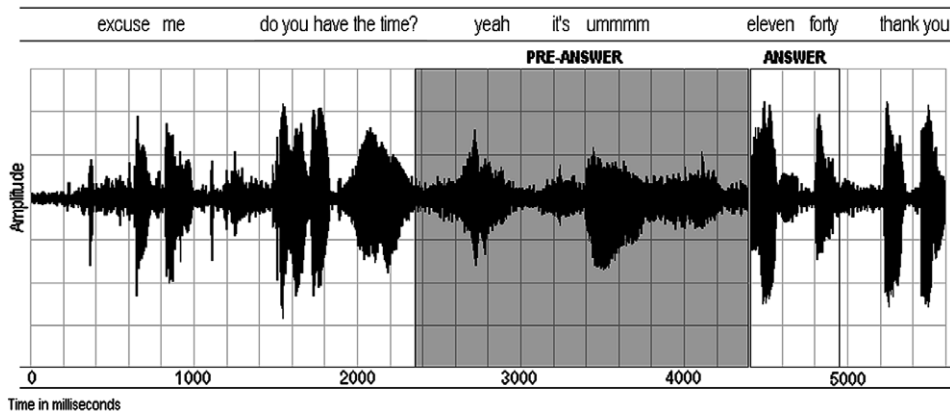


Fig. 1. Waveform view of an interaction illustrating pre-answer and answer segmentation.

answer forms (minute–hour versus hour–minute replies) and whether these varied between any of our conditions, but there were no significant differences (all $F_s < 1$) (in Experiment 1 there were no digital responses of the minute–hour form). This analysis suggests that differences in pre-answer latencies are not likely attributable to speech production effort related to different answer forms, and instead are related to cognitive effort in striving for optimal relevance.

Table 1 presents the mean latencies for the pre-answers when people gave either rounded or exact replies. For the pre-answers, a two-way analysis of variance indicated that people were faster to give rounded as opposed to exact responses, $F(1, 69) = 4.40$, $p < .05$, and that the rounded/exact variable interacted with whether participants wore digital or analog watches, $F(1, 69) = 4.17$, $p < .05$. Specific comparisons using protected t -tests revealed that digital watch wearers gave faster pre-answers when they rounded than did analog watch wearers, $p < .05$, but that digital watch wearers took longer to give pre-answers when they provided exact time responses than did analog watch wearers, $p < .01$. Digital watch wearers also took much longer to give exact pre-answers than they did rounded ones, $p < .01$.

The time it took people to produce their pre-answers may be related to the amount of procedural information they also include when responding to speakers' questions. We calculated the number of spoken syllables including all procedural cues in respondents' pre-answers and found that this correlated positively with the latencies to produce the pre-answers, $r = .30$, $p < .01$. Thus, at least some of the extra time respondents took to produce their pre-answers was devoted to including procedural cues that possibly enhanced listeners' understanding of the actual time information that followed.

The result that people actually take longer to begin providing exact numeral information about the time when they wear digital watches may seem counterintuitive. Previous research showed that reading the exact time from clocks is accomplished significantly faster when people are presented with digital rather than analog clock faces (Bock, Irwin, Davidson, & Levelt, 2003). In our study, if respondents wearing digital watches wanted to give exact times, they could simply read off what their watches literally indicated. Determining the exact time from analog watches presumably demands more mental calculation. But providing exact times may take longer to set up for digital watch wearers precisely because they were ambivalent as to what response is most optimally relevant in the present situation. In this way, determining

Table 1
Mean response times (milliseconds) for Experiment 1 ($N = 76$)

	Pre-answers	
	Watch	
	Analog	Digital
<i>Response</i>		
Rounded	1976 (905) 58%	1712 (1213) 22%
Exact	1991 (1235) 7%	2993 (1018) 13%

Note: standard deviations in parentheses; percentage of total in italics.

that an exact answer may possibly be most appropriate requires extra effort and delays when digital watch wearers provide the exact time.

One alternative possibility is that the additional time needed to formulate an exact response for digital watch wearers is given toward figuring out the precise form of the answer. Thus, digital watch wearers may believe that a response such as “It is twelve past three” is more relevant to the addressee than is a reply like “It is 3:12” (i.e., the time actually given on all digital watches). But all of the digital exact replies in Experiment 1 were of the hour–minute form, such as “It’s 3:12”, suggesting that the extra time digital watch wearers took to formulate their answers is not due to the additional effort to convert the hour–minute indication on their watches to minute–hour replies. Moreover, although 100% of the exact replies by digital watch wearers were of the hour–minute form, only 65% of the rounded answers given by digital watch wearers were in the hour–minute form, $z = 2.47$, $\phi = 0.33$ $p < .01$. It appears, then, that it is sometimes appropriate, and indeed optimally relevant, to give minute–hour responses when people are rounding.

The time that participants took to produce their replies is not simply a function of the difficulty in reading their watches and deciding what time to report. Part of the latency between the end of a questioner’s time request and the first vocalization of the response is dedicated to locating the watch and bringing it into a position to read. Responders may certainly be drawing assumptions about what type of answer may be most optimally relevant in the situation before looking right at their watches. Some of the acknowledgements and filled pauses introduced by responders may be produced while they were getting their watches into position to read. Yet even so, people’s knowledge of what type of watch they wore may from the beginning shape the content and speed of their response.

2.2.6. Summary

The results of this first study replicate the earlier finding from [van der Henst et al. \(2002\)](#) showing that people have a strong tendency to give rounded answers to time questions, especially when wearing analog watches, but still significantly more so when wearing digital watches. People did not aim to speak truthfully in answering questions, but attempted to formulate responses that were optimally relevant to addressees. Furthermore, people who gave rounded answers to time questions indicated that they were doing so to a higher degree by including “almost” or “about”, as well as “yeah” or “yes”. Finally, people took more time to formulate exact answers when they wore digital watches than when they wore analog ones, and digital watch wearers took longer to respond with exact answers than they did to give rounded answers. These latency results reflect people’s attempts to make optimally relevant responses, even if doing so often requires additional effort.

3. Experiment 2

The context in which one asks a question changes the answers people provide. For example, when strangers were approached on a street in downtown Boston and

asked, “Can you tell me how to get to Jordan Marsh?” (a local department store), they gave significantly longer responses when the request was preceded by the statement “I’m from out of town” or if the question were uttered in a Midwestern (e.g., Missouri) accent, as opposed to a Bostonian accent (Krauss & Fussell, 1996). Once more, the way people answer questions differs depending on their presumptions of what is optimally relevant for the specific addressee.

Experiment 2 examined the role that additional information offered by a questioner had on respondents’ answers to time requests. We specifically replicated one of van der Henst et al.’s (2002) studies by having people respond to the question “Excuse me, my watch has stopped. Do you have the time?” Unlike van der Henst et al., however, we included a condition where people wearing digital watches were also asked the above question. We expected that both digital and analog watch wearers would provide rounded answers to a far less degree than found in Experiment 1 because of the different pragmatic circumstances suggested by the statement “My watch has stopped” which may imply that the speaker wishes to reset her watch or, more generally, that this is the excuse for asking the time of a passerby. Although it is not exactly clear what respondents may have inferred when hearing the pre-request “My watch has stopped”, we expected that hearing this statement would enhance the degree to which people believed that an exact reply is optimally relevant. Digital watch wearers should now actually take comparatively less time to provide exact answers than rounded ones, because an exact reply was more likely to be relevant to the addressees’ needs.

3.1. *Methods*

3.1.1. *Participants*

Sixty-one members of the University of California, Santa Cruz community participated in this study. Thirty-nine participants were female and twenty-two were male.

3.1.2. *Stimuli, design, and procedure*

The design and procedure for this study was identical to Experiment 1. The only difference here is that the experimenter now approached strangers and said “Excuse me, my watch has stopped. Do you have the time?”

3.2. *Results and discussion*

The participants’ responses were transcribed and analyzed in the same manner as done in Experiment 1.

3.2.1. *Rounded analysis*

Participants wearing analog watches provided significantly more rounded responses (66%) than did digital watch participants (25%), $z = 3.00$, $\phi = 0.38$, $p < .005$. The proportion of rounded answers for the analog watch wearers was significantly different from chance, $z = 3.01$, $\phi = 0.39$, $p < .001$. Most importantly, the situation in Experiment 2, where the implication was that the speaker needed the

exact time to set her watch, differed from that in Experiment 1 where no such expectation existed. As predicted, people rounded off less often in Experiment 2 both when people wore analog watches (90–66%, $z = 2.83$, $\phi = 0.30$, $p < .01$) and digital watches (63–25%, $z = 2.58$, $\phi = 0.38$, $p < .01$).

3.2.2. Acknowledgment analysis

Participants did not significantly differ between the two conditions in the number of times they included “yeah” or “yes” in their answers (34% for analog and 25% for digital), $z = 0.72$, $p = \text{ns}$. However, people included “yes” or “yeah” in their rounded responses more so when wearing analog (32%) than digital (0%) watches. The low number of rounded responses in the digital condition ($n = 5$) minimizes statistical power ($z = 1.06$, $p = .14$) but the difference is worth noting.

3.2.3. Approximator analysis

Participants said “almost” or “about” when giving rounded responses more often when they wore analog watches (28%) than digital watches (0%). Again, due to minimal statistical power, this difference only approached marginal significance, $z = 1.16$, $\phi = 0.22$, $p = .12$. But only analog watch wearers ever gave the hint (through procedural cues) that they were giving less than exact answers when they were rounding, which is not surprising given the high percentage of exact answers given by digital watch wearers.

3.2.4. Filled pauses analysis

Participants included “uh” and “um” in their responses more often when they wore analog watches (49%) than with digital watches (30%), and this difference was marginally reliable, $z = 1.39$, $\phi = 0.18$, $p = .08$.

3.2.5. Latency analysis

The mean latencies for the pre-answers are presented in Table 2. These data represented corrected means in which the data from four participants, distributed across the different experimental conditions, were eliminated because they began their responses before the experimenter had finished asking her time question. Although we did not further analyze these participants’ data, it is interesting to note that no subjects in the first experiment began their answers before the experimenter finished

Table 2
Mean response times (milliseconds) for Experiment 2 ($N = 61$)

	Pre-answers	
	Watch	
	Analog	Digital
<i>Response</i>		
Rounded	1712 (1357) <i>44%</i>	2873 (1518) <i>8%</i>
Exact	1511 (1518) <i>23%</i>	2911 (2252) <i>25%</i>

Note: standard deviations in parentheses; percentage of total in italics.

her question. Thus, the introduction of the statement “My watch has stopped” immediately implicated a directive for the time, such that participants knew what was optimally relevant to provide even before the questioner had completed her request.

An overall analysis of variance on the pre-answer latencies indicated a significant main effect of watch type with analog watch wearers generally taking less time to respond than digital ones, $F(1, 57) = 6.30, p < .05$. However, there was no interaction between the type of watch and the type of answer provided. Once again, we also found a positive correlation between the number of syllables in the pre-answers and the amount of time it took people to provide their pre-answers, $r = .25, p < .05$. As in Experiment 1, to control for the possibility that stating the same time responses in different forms may require different articulation times, we tested whether answer lengths in the two response forms (minute–hour versus hour–minute) differed between analog and digital conditions as well as between rounded and exact replies, and found no significant effects (all F s < 1).

Unlike in Experiment 1 where digital watch wearers took much longer to utter pre-answers when giving exact responses than rounded ones, there was no difference in the time needed to formulate pre-answers in giving rounded and exact responses in Experiment 2. This lack of difference is due primarily to the lengthening of time needed for digital participants to provide rounded answers, perhaps because of the ambiguity as to whether the experimenter wanted to reset her watch, as opposed to just noting that her watch had stopped as a justification for making the request. Of course, our original prediction was that digital participants should take less time to respond than analog participants given the assumption that an exact response was now far more obviously relevant than was the case in Experiment 1. A closer look at the data showed that two participants in the digital/exact condition took an extraordinarily long time (6 s and almost 10 s) to provide their pre-answers. When these data were removed from the analysis, the average latency for the digital exact respondents goes from 2911 to 2217 ms, and the standard deviation drops dramatically (2252–1110 ms). Removing these data does not make the difference between digital rounded (2873 ms) and digital exact (2217 ms) responses statistically reliable (likely due to low power), but it does reveal a pattern opposite to that of Experiment 1, as we would expect.

We still do not know exactly why digital exact responders take longer than analog watch wearers when the more appropriate response in Experiment 2 would appear to be simply reporting the time that the watch displays. Our data suggest, nonetheless, that digital watch wearers do not merely read off the exact time without consideration of what is relevant for addressees, and apparently put additional mental effort into determining whether the exact time that they see on their watch is indeed a relevant response. Analog watch wearers, on the other hand, must derive an exact time regardless, given the analog format (i.e., they cannot just “read” a number), and so likely go through a different process of retrieving the time and turning that information into a relevant response. Bock et al. (2003) found that clock format and answer type interact with speech latencies but that digital clock readers were consistently faster than analog ones. They did not, however, examine how these processes

manifest in communicative contexts. Our results suggest that an interpersonal component plays an important role in telling the time.

3.2.6. Summary

Changing the pragmatic context for a speaker's question by adding a qualifying remark such as "My watch has stopped" created a different set of presumptions of what is optimally relevant for addressees, which altered how people answered time questions. Thus, one implicit message possibly understood by addressees was that the experimenter may wish to reset her stopped watch, requiring that participants should give exact responses, which they did 75% of the time when they wore digital watches. This constraint on what is most optimally relevant for addressees dramatically reduced the ambiguity in what respondents should say in their responses, which resulted in a different pattern of pre-answer latencies than was found in Experiment 1. Of course, people may also have interpreted the pre-request "My watch has stopped" as a polite justification for making the time request of a stranger, which may have also worked to elicit more exact time responses in order for the responder to be additionally polite in return. But regardless of which expectation respondents inferred when hearing the pre-request, the presence of this additional piece of information clearly altered the speed with which participants planned their responses.

4. Experiment 3

Experiments 1 and 2 demonstrated that responding to time questions depend on what participants presume is most relevant to addressees in the situation. Following van der Henst et al. (2002), Experiment 3 asked analog participants the question "Do you have the time?" but also noted beforehand the time of an upcoming appointment for the experimenter. For instance, imagine that the time is 3:38 PM and that a speaker says to a passerby, "Excuse me. I have an appointment at 4:00. Do you have the time?" In this case, responding "It is 3:40" or "It's twenty till four", is optimally relevant, because the time between 3:38 and 3:40 does not have significant consequences for the addressee, while also being easier to produce for analog watch wearers. But if the present time were 3:52, and the same question was asked, including mention of the 4:00 appointment, then an answer "It's 3:50" or "Ten till four", implies, incorrectly, that the addressee has more time than she really does till her appointment and so would be less than optimally relevant. Speaking optimally, in this case, requires that the exact time be provided, as in "It's 3:53" or "You have seven minutes".

Experiment 3, therefore, had two groups of participants: an earlier group who answered the time question between 30 and 16 min before the stated appointment time, and a later group who answered between 14 min before the appointment and the actual time of the appointment. Again, following van der Henst et al. (2002), we expected that participants in the later group would provide more exact answers than the earlier group. Moreover, the later group should produce more acknowledgements, while the earlier group should provide more approximators

given their greater number of rounded answers. For the latency data, we expected an interaction between answer type and time condition. Thus, people who choose to give exact replies in the later group should take more time to do so compared to exact responders in the earlier group because of the relatively greater importance of being more accurate as one approaches the mentioned appointment time. Moreover, this attention to providing exact answers in the later condition suggests that people should also take longer to provide exact rather than rounded answers.

4.1. *Methods*

4.1.1. *Participants*

One hundred and eight members of the University of California, Santa Cruz community participated in this study. Sixty-four participants were female and 56 were male. Following van der Henst et al. (2002), 21 participants were eliminated (13 from the earlier group and 8 from the later group) who responded with a time that was 15 min prior to the stated appointment time (e.g., answering “a quarter till one” when the appointment was at one). This was done so the two groups would each have three intervals to round to (30, 25, and 20 for the earlier group and 10, 5, and 0 min for the later group). Four additional participants were eliminated because their answer began before the confederate’s question ended. Only analog watch wearers were included in this study.

4.1.2. *Stimuli, design, and procedure*

Participants were either part of the later (30–16 min before the appointment time) or earlier (14 min to a few minutes before the appointment) groups. The experimenter approached each participant, noting the time beforehand, and said, “Excuse me, I have an appointment at (some 30 min interval). Do you have the time?” All else in the experiment was identical to that done in the previous studies.

4.2. *Results and discussion*

The participants’ responses were transcribed and analyzed in the same manner as done in the previous studies.

4.2.1. *Rounded analysis*

Participants in the earlier group rounded significantly more often (79%) than did those in the later group (62%), $z = 1.60$, $\phi = 0.17$, $p < .05$, a finding that parallels what was obtained by van der Henst et al. (2002). The percentage of rounded answers in both the earlier and later groups differed significantly from chance (33%), $z = 3.97$, $\phi = 0.44$, $p < .001$ and $z = 2.57$, $\phi = 0.28$, $p < .01$, respectively. These findings overall showed that even when the need to have the exact time was not specifically stated, as alluded to by the question used in Experiment 2, people still tried to infer what would be most relevant to addressees, such as knowing how many minutes there are until the appointment, and adjusted their responses accordingly.

4.2.2. Acknowledgment analysis

Participants included “yeah” or “yes” in their responses more often in the later group (43%) than the earlier one (30%), a marginally reliable difference, $z = 1.25$, $\phi = 0.14$, $p = .10$. However, people who gave rounded answers did not include “yeah” or “yes” significantly more often in the later (41%) than earlier (29%) group, $z < 1$.

4.2.3. Approximator analysis

Participants in the earlier group included “almost” or “about” in their responses more often (25%) than did people in the later group (9%), $z = 1.95$, $\phi = 0.21$, $p < .05$. This suggests that participants realized less of a need to be completely accurate when the time was further away from the experimenter’s stated appointment, because an exact reply was not optimally relevant.

4.2.4. Filled pauses analysis

Participants did not significantly differ overall in the extent to which they included “uhs” or “ums” in their responses between the earlier (50%) and later (39%) groups ($z < 1$). But when people specifically gave rounded replies, they uttered “uh” or “um” somewhat more often in the earlier (55%) than later (37%) groups, $z = 1.36$, $\phi = 0.18$, $p = .08$.

4.2.5. Latency analysis

Table 3 presents the mean latencies for the pre-answers. The pre-answers were overall much quicker in Experiment 3 than in either Experiments 1 or 2, most likely due to the justification comment, “I have an appointment at X”. This additional statement was clearly being processed as people searched for and began to look at their watches. Knowing something specific about the questioner’s needs narrowed down the type of answer speakers provided, which enhanced the speed with which they could figure out what was most optimally relevant to provide when answering the experimenter’s question.

An analysis of variance showed that people took somewhat less time to give pre-answers in the earlier rather than the later group but this difference was not reliable, $F(1, 79) = 1.74$, $p > .10$. However, the main effect of answer type, $F(1, 79) = 3.66$, $p = .06$, and the interaction of group and answer types, $F(1, 79) = 3.77$, $p = .056$,

Table 3
Mean response times (milliseconds) for Experiment 3 ($N = 83$)

	Pre-answers	
	Group	
	Earlier	Later
<i>Response</i>		
Rounded	963 (495) 36%	876 (449) 34%
Exact	959 (596) 10%	1417 (777) 20%

Note: standard deviations in parentheses; percentage of total in italics.

were marginally reliable. Specific comparisons using protected *t*-tests indicated that people in the later group took significantly longer to give pre-answers when providing exact answers than when offering rounded ones, $p < .01$. People in the later group giving exact responses also took longer to utter pre-answers than did exact responders in the earlier group, $p < .01$. There was also a positive correlation between the number of syllables in respondents' pre-answers and the time needed to give these replies, $r = .40$, $p < .001$. Again, we tested whether the length of answers differed as a function of response form across our conditions and found no significant effects (all F s < 1).

It is important to note that the enhancement in the speed with which people responded to the implied request in this study was not simply due to the questioner producing more words for her justification that enabled participants to begin formulating their responses sooner. Unlike the other experiments, the questioner's statement "I have an appointment at two" implies a need for a more rapid response, compared to just asking for the time (Experiment 1) or a need for the time to perhaps reset a watch (Experiment 2). Thus, it is likely the meaning of the additional words and not just their number that has an overall facilitation in the speed with which participants responded.

4.2.6. Summary

Once again, changing the pragmatics of the situation alters people's presumptions of what is optimally relevant to say in answering time questions. As found by van der Henst et al. (2002), participants in the earlier group rounded significantly more often than those in the later group. Moreover, the early group participants produced significantly more approximators along with their greater number of rounded answers. Also as predicted, people who provided exact answers in the later group took longer to do so than exact responders in the early group, probably due to the greater need for accuracy as the appointment time drew closer. The increased attention people devoted to being appropriately accurate was also likely responsible for the relatively longer response times to give exact answers than rounded answers within the later group, an effect not observed in the early group. When there was some perceived need on the part of the experimenter for more accurate information, people gave more exact time responses, and took extra time to formulate these answers in an effort to provide the relatively more crucial, and optimally relevant, precise time information in that context.

5. Experiment 4

The experimenter in the previous studies never knew exactly what respondents' watches indicated when they answered questions about the time. One possibility is that participants' rounded answers to the questions may be affected by a combination of factors including speakers' beliefs that (a) a rounded answer was optimally relevant given the situation, and/or (b) the addressee will never know if the answer is exact or not given that she could not see what the watch specifically indicates.

Experiment 4 further examined this issue by asking participants to answer a time question in a situation in which the experimenter could easily find the exact time by looking at the same clock that respondents observed when answering the question. The fact that the questioner could soon see if the respondent gave a rounded or exact answer, and furthermore the mutually manifest belief that the participant was there at an appointed time to serve in another experiment, constrained the pragmatics of the question–answer sequence by altering the presumption of what information is optimally relevant. We expected that both groups of participants (i.e., those observing digital clocks and those observing analog clocks) would consequently give exact replies to a high degree. Nonetheless, people should still give rounded answers more often in the analog than in the digital condition, and give a higher proportion of discourse cues that suggest the relevance of the rounded answers when people see analog clocks more so than when they read digital clocks. Participants should also be faster formulating their replies when they give exact answers in the digital rather than in the analog clock condition.

5.1. *Methods*

5.1.1. *Participants*

Forty-four University of California, Santa Cruz undergraduate participated in this study. Twenty-three students participated in the digital clock condition and 21 participated in the analog clock condition.

5.1.2. *Stimuli, design, and procedure*

The experiment took place in a laboratory room, with a smaller room adjoining. Participants entered a laboratory room to serve in an unrelated experiment. They sat down in a chair 12 feet away from a wall with a mounted clock, approximately 14 inches in diameter, which was either analog or digital. The experimenter then went into an adjoining room, waited for ten seconds, and then said, “There is a clock on the wall in front of you. Can you tell me the time?” We included the statement “There is a clock on the wall in front of you” to insure that participants answered the question by looking at the clock, which all participants later reported doing, rather than their own watches. We recorded participants’ responses using a tape-recorder hidden under a backpack on the table. The experimenter immediately entered the room after the participant’s response, noted the exact time, and asked the participant if he or she actually looked at the clock before answering. All participants replied that they had looked at the clock. Following this, the participants were introduced to the main experiment that they originally had signed up for that was unrelated to the present study.

5.2. *Results and discussion*

The participants’ responses were transcribed and analyzed in the same manner as done in the previous experiments.

5.2.1. Rounded analysis

Participants observing analog clocks provided significantly more rounded responses (39%) than did digital clock participants (5%), $z = 2.79$, $\phi = 0.42$, $p < .01$. The proportions of rounded answers for both the analog and digital clock observers were significantly less than that seen in Experiment 1 (90% for analog and 63% for digital) when participants were asked a slightly different question: “Do you have the time?” instead of “Can you tell me the time?”, $z = 4.55$, $\phi = 0.54$, $p < .001$ for analog comparison, and $z = 4.22$, $\phi = 0.60$, $p < .001$ for digital.¹ Thus, the main obstacle to overcome in fulfilling the time request in the present experiment concerned participants’ ability to provide the information instead of having possession of the information. Moreover, unlike Experiments 1, 2, and 3, the participants in this study knew that the questioner could move to see what time it was, which clearly constrained participants to provide more exact answers.

5.2.2. Acknowledgment analysis

Participants included “yeah” or “yes” in their answers slightly more often when they observed analog clocks (14%) than when seeing digital ones (5%), but this difference was not reliable, $z = 1.05$, $\phi = 0.16$, $p > .10$.

5.2.3. Approximator analysis

All the approximators produced occurred when people gave rounded replies, but participants did not produce approximators significantly more often in the analog condition (5%) than digital condition (0%).

5.2.4. Filled pauses analysis

Participants included “uh” and “um” in their responses more often when they observed analog clocks (73%) than seeing digital clocks (32%), $z = 2.72$, $\phi = 0.41$, $p < .01$.

5.2.5. Latency analysis

The mean latencies for participants’ responses are presented in Table 4. Because there was only one rounded answer when people read the time off digital clocks, we excluded this condition from these analyses. Separate *t*-tests were conducted to examine the differences in latencies between the other conditions. These analyses revealed that participants took significantly less time to utter pre-answers when observing digital clocks than analog ones, $t(43) = 3.97$, $p < .001$. Analog clock watchers took less time to utter pre-answers when they gave exact as opposed to rounded responses, but this difference was not statistically significant, $t(21) < 1$, $p = \text{ns}$. As was the case in the previous studies, there was a positive correlation between the number of syllables in the pre-answers and the time it took people to

¹ It is not strictly speaking appropriate to conduct cross-experiment statistical analyses when participants are not randomly assigned to the different experimental conditions. Nonetheless, we still believe that this analysis is informative of how different pragmatic situations give rise to different linguistic performances.

Table 4
Mean response times (milliseconds) for Experiment 4 ($N = 44$)

	Pre-answers	
	Clock	
	Analog	Digital
<i>Response</i>		
Rounded	2519 (1396) 21%	2018 ($N = 1$) 2%
Exact	2377 (1177) 32%	1218 (1410) 45%

Note: standard deviations in parentheses; percentage of total in italics.

articulate these replies, $r = .32$, $p < .01$. The length of answers also did not differ as a function of response form across any of the conditions (all F s < 1).

5.2.6. Summary

Altering the pragmatic context in which a question is asked creates a different presumption of what is optimally relevant for addressees, which influences how people answer time questions. The mutually manifest assumptions that the experimenter knew what kind of clock participants were looking at (i.e., given the statement “There is a clock on the wall in front of you”), and was supposed to be in an experiment at a specific time, constrained the answers given to the time question, such that people gave far more exact, and far fewer rounded answers, in the present situation than seen in the other experiments.

6. General discussion

Answering questions requires that respondents provide the required information in a manner that is both understandable and appropriate to the questioner’s ongoing plans and goals. In interactions between strangers, such as studied in the present experiments, inferring what information is most appropriate for addressees depends upon a general presumption of optimal relevance that is tailored to the exact pragmatic situation, including what respondents perceived about the questioner and her presumed preferences.

The four experiments reported here replicate and expand in significant ways upon the work of van der Henst et al. (2002). We show that answering questions is not guided by a desire to say what is most truthful by giving the exact time or done egocentrically given what is easiest to produce. Instead, people aim to speak in an optimally relevant manner, and do so, depending on the conversation, by providing rounded, as opposed to exact, answers to questions about the time.

Our unique contribution has been to demonstrate that speakers plan their answers to time questions in specific ways by often including acknowledgments, approximators, filled pauses, and corrections that procedurally encode a guarantee that the utterance containing them is indeed relevant. These linguistic and paralinguistic cues do not simply indicate that the speaker is experiencing production problems, but

function as a green light for the addressee to continue with the process of deriving relevant cognitive effects. More specifically, speakers include various procedural cues to alert addressees to the fact that the time provided may only be approximate, or rounded, as opposed to exact. Of course, striving for optimal relevance does not require speakers to include procedural cues in their answers to questions in an obligatory manner. Yet the general systematic trends that we have observed across the four experiments presented here, where speakers frequently produce procedural cues in some cases but not others, illustrates one important way by which speakers aim to achieve optimal relevance. This view contrasts with the traditional notion that speakers include filled pauses, acknowledgements, approximators and so on only because they are being vague or experiencing production difficulties.

Formulating answers to a stranger's questions about the time adheres to a communicative principle of relevance in which every utterance conveys a presumption of its own optimal relevance. The present studies give several indications of the trade-off between cognitive effects and effort in the attempt to speak in a manner that is optimally relevant. In many cases, speakers take longer to produce their answers to time questions, but this additional talk is worth the addressee's attention because of the special cognitive effects that can be derived from the processing of different acknowledgments, approximators, and filled pauses, such as that the time mentioned is only rounded and not exact. We do not believe that it is easy to determine whether speakers' procedural cues were generated intentionally for the listeners' benefit, or just indications of production problems. One possibility is that many procedural cues originated from production problems that speakers typically experience, but have now evolved to serve communicative purposes. Thus, procedural cues in spontaneous speech may have been shaped in a manner similar to how signals evolve in animal communication. If a particular cue consistently reflects a cognitive problem, such as a speaker's production of "um" or "well" to mark his or her indecision of whether to give an exact reply to a time question, and this cue can then be used by listeners to infer upcoming aspects of the speech signal, then this cue could be transformed into an intentional signal. Tinbergen (1952) called such cues "derived activities", which are non-communicative behaviors that become ritualized for communicative purposes. An evolved response bias in listeners to particular kinds of procedural cues, such as "ums" and "uhs" could shape their eventual produced form in a manner that facilitates their use as an intentional signal of upcoming errors, for example. This notion is well aligned with the assumption of relevance theory in that speech characteristics should be designed in ways that aim to optimize relevance.

Participants in our studies sometimes took particularly long to reply to time questions without providing many relevant cognitive effects via procedural cues. Recall that digital watch wearers in Experiment 1 who gave exact replies took longer to plan these than the same group of people who gave rounded answers. We suggest that the longer unfilled pauses for the digital participants giving exact answers can be attributed to these speakers' ambiguity about whether an exact answer was warranted given the experimenter's simple "Do you have the time?" question. The fact that digital watch wearers did not take longer to produce exact replies, compared to rounded ones, in Experiment 2, where the original question included the statement "My

watch has stopped”, shows the effect of removing the ambiguity as to what is optimally relevant for the addressee has on the process of formulating answers to questions.

The data from the first two experiments may suggest that giving a rounded reply to a time question is the default answer, and that providing more exact time information is generally more effortful and only done in specific situations. But it makes little sense to believe that a person looking at a digital watch always interprets what is seen in a rounded form (e.g., 3:30) if the display is actually more precise (e.g., 3:27). As noted in other research, people find it easier to give exact times when they read digital clocks than when reading analog ones (Bock et al., 2003), which also implies that perceiving the exact time on a digital watch is easier to achieve than figuring out a rounded time. Determining what the rounded time really is when reading either digital or analog watch also requires people to figure out which rounded time is most appropriate (e.g., the time say 3:27 on a digital watch – does the person say it is 3.25 or 3:30). For these reasons, we do not believe our data indicate an automatic bias toward providing rounded answers with digital answers only be done in special circumstances. Instead, considerations of what is optimally relevant for addressees in a specific context shape the entire process of interpreting a person’s question and providing an appropriate verbal response.

Experiment 4 was included to examine whether people gave rounded or exact answers to time questions when observing an analog or digital clock that participants knew the questioner could easily see. We showed that people in both conditions tended to give more exact replies than found, for example, in Experiment 1 where the experimenter was not in a position to check whether the participant was really providing a rounded answer or not. Our data analyses, both the inclusion of various linguistic and paralinguistic cues, and the latency analyses, were based on an estimate of how often people should generally provide rounded time answers by chance alone. But we wanted to confirm our estimate of how often people give rounded and exact answers to time questions, especially in the case when they were wearing digital watches, as well as better understand the reasons for why digital participants gave one type of answer as opposed to another. Furthermore, we wanted to see if ordinary people wearing digital watches had any intuitions related to why giving exact answers took longer than to give rounded ones, as was found in Experiment 1.

To explore these issues further, we conducted a final informal study where an experimenter approached people wearing digital watches, and said either “Do you have the time?” (as in Experiment 1) or “My watch has stopped. Do you have the time?” (as in Experiment 2). The experimenter noted the participant’s response, then asked to see the watch to check whether the reply was accurate or not, and finally questioned the participant as to why he or she gave an exact or rounded answer. Twenty people were simply asked the simply “Do you have the time?” question and 20 others were asked, “My watch has stopped. Do you have the time?”

Not surprisingly, as found in Experiments 1 and 2, people gave far more exact replies to questions proceeded by the statement “My watch has stopped” (90%) than when this statement was omitted (60%), $z = 2.19$, $\phi = .35$, $p < .05$. These proportions

of exact replies were roughly close to what we estimated to be the number of exact answers for Experiments 1 and 2. At the very least, this suggests that the earlier estimates of how many people gave rounded answers were reliable.

But the most interesting part of this study concerned the reasons for why people gave either exact or rounded answers given that they were wearing digital watches. Thus, several participants explicitly stated that they always gave only “approximate” times when asked for the time, because they thought that such answers were usually more than sufficient. Two participants, in particular, noted that a rounded answer was “reasonable” given the inconvenience that they had to deal with when stopped and asked the question, as well as their belief that a rounded answer was “good enough” for a passerby. Of course, people were certainly aware of the experimenter’s greater need for accuracy when she asked, “My watch has stopped. Do you have the time?” Moreover, while several participants replied that they always gave exact answers when asked for the time, a few noted that they sometimes had to think twice as to whether the exact time was “too much information” for the questioner, given her presumed needs, especially when she only said “Do you have the time?” This latter impression on the part of some participants in this informal study is consistent with the greater latencies to produce exact times in Experiment 1 for people wearing digital watches.

Finally, several participants who gave rounded answers in both conditions of this informal experiment said that they did so because of a concern with the accuracy of their digital watches. This concern was also noted in some, but not all, of our experiments. Thus, people never mentioned anything about accuracy in Experiment 1, but did this sometimes in Experiment 2 (10%) and Experiment 3 (2%). Predictably, the greater concern with providing accurate time information was more critical in Experiments 2 and 3 precisely because exact times were seen as being more optimally relevant to the addressee than was the case in Experiment 1.

Our empirical findings do not imply that speakers always succeed in stating what is most optimally relevant for addressees. Speakers often fail to be relevant and sometimes do not put much effort into being optimally relevant in saying what they do. For instance, we informally noted that in cases where a speaker made her time request quite rapidly, such as in Experiment 3, addressees responded quite quickly in turn (i.e., note the faster latencies in Experiment 3 compared to those in Experiments 1 and 2). People may have provided rounded, and not exact, responses in the later group in Experiment 3 given the pressure they felt to respond quickly to a person in a hurry (see [Barr & Keysar, 2004](#) for a discussion of how cognitive pressure pushes people to interpret language in a more egocentric manner).

But the overall effectiveness of most communication suggests that speakers are, at the very least, mostly striving to be optimally relevant, with listeners drawing sufficient cognitive effects, given a minimum of processing effort for successful conversational coordination. Even in cases when people fail to speak in optimally relevant ways for their addressees, the failure is not necessarily a matter of a person not trying to be relevant, but alternatively reflects that individual’s misunderstanding of what is most compatible with an addressee’s abilities and preferences. A wonderful example of this is seen in the following conversational exchange, from our corpus (not

Experimenter:	"Excuse me, do you have the time?"	[I have an appointment at two" "It's quarter till"
Person 1:		
Person 2:	"Um, it's twenty till two"	
Person 1:	"Oh, never mind"	
Experimenter:	"Thank you"	

Fig. 2. Conversational exchange with overhearer interruption.

included in the data analysis) (see Fig. 2). An experimenter asked a person for the time, but a nearby overhearer jumped in, and began responding before the experimenter had completed her turn (i.e., overlapping speech), with an answer that she subsequently realized was not optimally relevant to warrant the listener's processing effort.

Thus, person 1 produced an answer that she recognized was not optimally relevant for the addressee, and acknowledged this by denying the relevance of what she had said (e.g., "never mind"), especially in light of Person 2's more optimally relevant reply.

Previous cognitive science accounts of question answering have typically emphasized the importance of understanding the questioner's plans and goals when formulating appropriate replies (Golding, Graesser, & Hauselt, 1996; Graesser, McMahan, & Johnson, 1994; Lehnert, 1978). However, these models of question answering only describe the rough conceptual content of answers, and do not specify the psychological processes involved in articulating answers. On the other hand, relevance theory provides a cognitive and communicative framework for explaining how people explicitly formulate their answers to questions by aiming to achieve optimal relevance in terms of maximizing cognitive effects and minimizing cognitive effort. In this way, relevance theory offers a more comprehensive account of the cognitive processes involved in both speaking and listening, given that both are shaped by a communicative principle of relevance. The present work adds to the growing body of empirical evidence on how considerations of relevance shape psycholinguistic theories of language use (e.g., Gibbs & Moise, 1997; Gibbs & Tendahl, 2006; Hamblin & Gibbs, 2003), and more concretely illustrates the importance of both conceptual and procedural meanings in speaking to achieve optimal relevance.

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