Conversation Transition Times: Working Memory & Conversational Alignment

Julie E Boland
University of Michigan

Abstract

Fluent conversation is a marvel of multi-tasking within the language domain: listeners must simultaneously comprehend the speaker, predict a turn transition point, and plan a response. Experiment 1 used spontaneous conversation to investigate the apparent demands of conversation on working memory by manipulating the difficulty of a secondary task. The experiment found support for Load Theory's (e.g., Lavie et al. 2004) prediction that both conversational fluency and performance on a secondary task would decrease as working memory load increased. However, there was also some support for Pickering and Garrod's (2004, 2013) proposal that dialogue is facilitated by a collection of automatic cognitive operations when interlocutors are well-aligned (i.e., using the same words, phrases, and structures to discuss the same topics). Experiment 2 tested two claims motivated by this account: alignment is necessary for fluent turn transitions, and lexical repetition between speakers is an essential component of the alignment advantage. We found support for the former claim, but not the latter.

Keywords: Conversation, Dialogue, Working Memory

Introduction

When a conversation is fluent, the shift from one speaker to the next proceeds rapidly, usually with little or no overlap. In fact, the silent pauses between speakers (i.e., turn transitions) average less than 500ms across cultures, and around 200ms for English speakers in two-party conversations (e.g. Sacks, Schegloff, & Jefferson, 1974, Wilson & Wilson, 2005; Stivers et al, 2009). Levinson and Torreira note that it takes about 600ms to name a picture using a single word, and 425ms of that time is estimated to be necessary for the lexical retrieval and phonological encoding processes for a single word (Indefrey & Levelt, 2004). Thus, it is clear that the signal to begin preparing one's response cannot be the end of the current speaker's utterance, because turn transition times would be on the order of seconds, not milliseconds.

Current theories of conversation explain short transition times by positing multiple processing streams that allow the listener to prepare her response while simultaneously comprehending the current speaker and anticipating a turn transition point (Garrod & Pickering, 2015; Levinson & Torreira, 2015). This multi-tasking burden would seem to induce a heavy working memory load.

Many studies have reported a relationship between working memory and language processing (e.g., Danenman & Carpenter, 1980; DeDe, Caplan, Kemtes, & Waters, 2004; Lewis, Vasishth, & Van Dyke, 2007; Martin & Slevc, 2014). For example, Fedorenko, Gibson, and Rohde (2006) found that participants had difficulty comprehending complex sentences when they had to simultaneously remember three words that were semantically related to the words in the sentence, presumably because comprehending the sentence and remembering the words competed for the same working memory resources. In contrast, conversational participants manage to simultaneously comprehend the current speaker, predict when he will end his turn, and plan a response. All three tasks presumably use the same language system with no apparent interference and surprising efficiency. Thus, conversational fluency presents an interesting puzzle in light of established theories for how working memory supports language comprehension and language production.

If conversation places high demands on working memory, it should be difficult to converse while simultaneously doing another task. For example, Load Theory (Lavie, Hirst, de Fockert & Viding, 2004) predicts a decrease in processing fluency as working memory load is increased. The predictions of Load Theory, as applied to conversation, were supported by Boiteau, Malone, Peters, and Almor (2014), who found that conversation interfered with a simultaneous mouse-tracking task. In turn, the mouse-tracking task modulated speaking rate slightly, but did not increase the rate of disfluencies. Boiteau et al. did not examine fluency variables, such as turn transition time and turn length, nor did they manipulate the difficulty of the secondary task. Several other papers examined the relationship between language production and a secondary task, and also found trade-offs between the language and non-language tasks (Becic et al., 2010, Kemper, Herman, & Nartowicz, 2005; Sjerps & Meyer, 2015).

The literature supports the view that conversation carries a substantial working memory load, but in practice, people often converse while doing something else. In fact, Pickering and Garrod's (2004, 2013) Alignment account suggested that conversational fluency is attained via many automatic mechanisms, at least when interlocutors are well-aligned (i.e., using the same words, phrases, and structures to discuss the same topics). We test three claims from this account:

(i) Well-aligned conversation makes minimal demands on central resources

(ii) Topic alignment enhances conversational fluency

(iii) Lexical repetition enhances conversational fluency

Experiment 1 investigated (i) by manipulating the difficulty of a secondary task. Experiment 2 investigated claims (ii) and (iii) using a picture-description paradigm. The primary focus is on transition time, but speech rate, utterance length, turn type, and the occurrence of disfluencies were measured and analyzed as well, because there may be tradeoffs among these fluency measures.

Experiment 1

If the multi-tasking required for fluent conversation strains the working memory system, adding a secondary task should decrease conversational fluency. To test this, we had participants perform a letter version of the n-back task (Smith & Jonides, 1997) while carrying on a casual conversation with an experimenter. For the n-back task, participants saw a sequence of letters on a computer screen. Both lower-case and upper-case forms of a letter counted as the same letter, to encourage verbal encoding of the stimuli. In the 1-back condition, participants pressed a key if the current letter matched the previous letter. In the 2-back condition, participants pressed a key if the current letter matched the one two letters back. The Load Theory predicts a greater impact on conversational fluency in the 2-back condition, compared with the 1-back condition, and compared with conversation alone.

Method

Participants Forty undergraduates (9 male) received course credit for participation. All were native English speakers.

Procedure The experiment consisted of five experimental blocks: Conversation-Only, 1-back alone, 2-back alone, Conversation with 1-back, and Conversation with 2-back. Stimuli in the n-back consisted of upper and lower case tokens of 8 letters: A, F, J, K, L, O, S, U. The order of the blocks was rotated across five groups, so that each block occurred equally often in each serial position.

Participants were greeted by one of four native English speakers (two male, two female), who conducted the experiment and served as the other interlocutor in conversation blocks. Each experimenter ran two participants on each of the five block orders. The experimenter and the participant were separated by a cubicle barrier for all blocks. Before beginning the experiment, participants were first trained on the 1-back and 2-back tasks. After training, participants completed the experimental blocks. The conversation topics were always in the same order, regardless of block order: 1. life in a college town, 2. pop culture, 3. personal background. Each of the three conversation blocks was 8 minutes long.

The conversation blocks were audio-recorded. The middle 5 minutes were transcribed, with the onset and offset of each turn marked. These transcription records were used to code turn type and disfluencies, and to compute turn transition time, turn length, and speech rate. Alignment was (very roughly) estimated using Latent Semantic Similarity (LSS, Landauer and Dumais, 1997, online pairwise comparisons tool http://lsa.colorado.edu, settings: document to document, general reading up to 1st year college, maximum dimensions).

Results

Small differences in the participants' transition times were found as a result of the secondary tasks (see Figure 1). Interestingly, the longest transition times were observed for the experimenter, who had no secondary task other than to keep the conversation going.

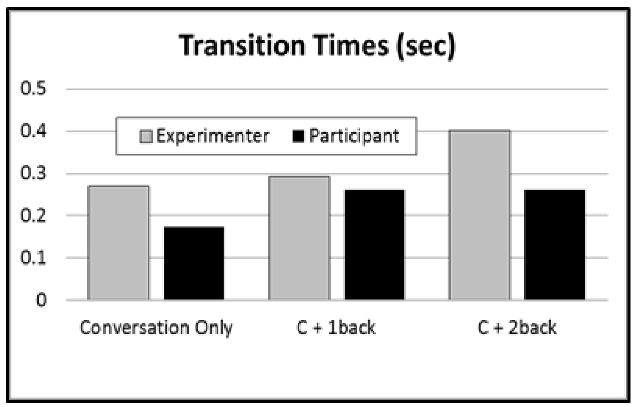

Figure 1: Transition time (in seconds) by task condition, for both participant and experimenter.

Table 1 summarizes the results of a linear mixed effects model on the participants' turn transition times: lmer(trans_time ~ Experimenter + Order + Turntype + Block + LSS + (1 + Block |subj)). The four experimenters, five block orders, and four most common turn types were used as control variables. To save space, only significant effects for control variables are included in Table 1.

Table 1. Analysis of Participant's Transition Time

	Estimate	t	p
Block C vs C1	.06	1.61	.11
Block C vs C2	.08	2.14	.04
Exp1 vs Exp4	-.23	-4.83	.00
Ord1 vs Ord3	.19	3.49	.00
Agree vs Answer	.23	6.92	.00
Agree vs Quest	.23	4.13	.00

There was no effect of the secondary task on participants' speech rate, but the task manipulation did impact both utterance length and the probability of a turn-initial filled pause. As predicted by Load Theory, participants took longer turns and made fewer turn-initial filled pauses in the Conversation-Only block compared with blocks that combined conversation with the n-back task.[1]

Across all four dependent measures, the strongest predictor of the participant's conversational fluency was turn type, overshadowing the secondary task manipulation. The four most common turn types (agreement, answering a question, asking a question, or making a comment) made up 98% of the participant turns. As shown in Figure 2, type of utterance was a strong predictor of both transition time and utterance length.

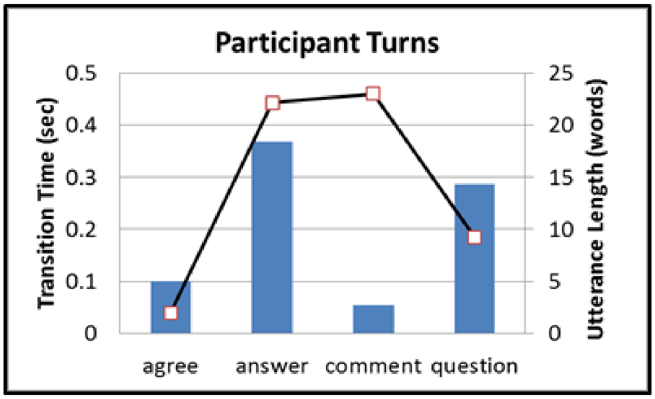

Figure 2: Participant's transition time (bars) and utterance length (line) by turn type.

As predicted by Load Theory, performance on the n-back task was worse in the blocks that required simultaneous conversation, especially in the 2-back condition (see Table 2). Participant means were submitted to a 2 (n-back level) by 2 (alone or w/conversation) by 5 (order) repeated measures ANOVA, with the third factor as a between-participants variable. Robust effects of n-back level [$F(1,35) = 139.23$, $p < .01$], conversation [$F(1,35) = 280.02$, $p < .01$], and their interaction [$F(1,35) = 98.54$, $p < .01$] were observed. No effect of order or interactions with order approached significance [all F's less than 1.9].

Table 2: Percent Correct (w/standard error) on n-back.

	alone	w/conversation
1-back	99 (.2)	91 (.8)
2-back	97 (1.5)	79 (1.1)

One-minute clips from the conversations were presented to 108 naive listeners, who judged whether the participant (always the first speaker in the clip) had been under no load, low load, or high load from a secondary task. As shown in Table 3 with correct responses highlighted, listeners were highly inaccurate. Their bias was to guess "none" or "low." This suggests that participants in the primary experiment were largely successful at maintaining fluency, despite the extra load from the secondary task.

[1] See Appendix for statistical support.

Table 3. Percent load judgments by audio clip condition.

	C only	C+1-back	C+2-back
None	50	47	41
Low	40	37	42
High	10	16	17

Consistent with the Alignment hypothesis, there was some evidence that participants were more fluent when the alignment between speakers was highest, as illustrated in Figure 3: The higher the Latent Semantic Similarity (LSS) between speakers, the faster the participant's speech rate. The LSS was also a marginal predictor of transition time. To be sure, all of the conversations were at the high end of the LSS scale, which ranges from -1 to 1. Thus, there may have been insufficient variance to find a stronger correlation.

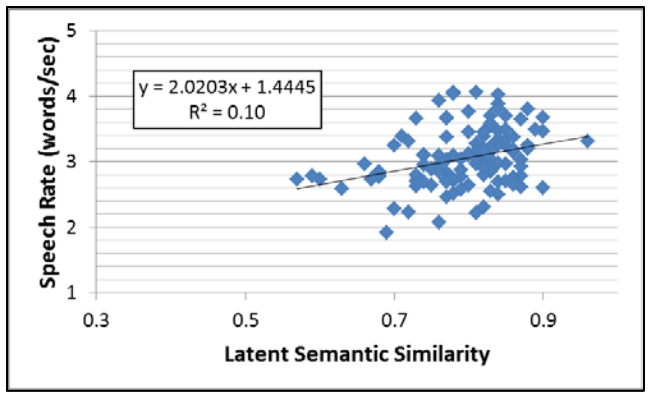

Figure 3: The relationship between participant speech rate and Latent Semantic Similarity.

Discussion

Load Theory was supported by the decrease in accuracy on the n-back task when it was paired with conversation, and by the increase in transition times with n-back load, While transition times remained within the normal range of around 200ms cited by Stivers et al. (2009) and others, participants seemed to use compensatory measures, such as shortening their turns and beginning their turns with a filled pause, in order to maintain short transition times when faced with a challenging secondary task.

While the experiment was not a clear test of Pickering and Garrod's (2004, 2013) Alignment account, the apparent robustness of conversational fluency to a secondary task (albeit with some modulations) is consistent with their account. Furthermore, the modest correlation between LSS and speech rate is suggestive. Unfortunately, there are no established, objective measures of conversational alignment, making it difficult to rigorously test Pickering and Garrod's predictions. Nonetheless, the strong effect of turn type (see Figure 2) seems problematic for their account. Turn type determines how quickly participants can begin planning their responses and how much planning is required. The robust turn-type effects suggest that the cognitive operations supporting utterance planning are less automatic than maintained by strong versions of the Alignment account (e.g., Pickering & Garrod, 2013).

Experiment 2

Because alignment can't be manipulated in spontaneous conversation, Experiment 2 used a picture description paradigm to test the effects of two aspects of alignment (shared topic and shared vocabulary). Topic was manipulated within-participants, such that each of the participant's picture descriptions was preceded by a pre-recorded sentence that was either a description of the same picture or a description of a different picture. Shared vocabulary was measured by counting the number of content words from the pre-recorded sentence that were repeated in the participant's picture description.

While it may seem odd to treat pre-recorded stimuli as a speaker in a conversation, this approach was successful in a recent experiment. Corps, Crossley, Gambi, and Pickering (2018) found that participants answered pre-recorded yes/no questions faster when the final word was predictable, with transition times averaging around 400ms. Participants were encouraged to respond quickly, answering "as soon as you expect the speaker to finish the question" (p. 83). While these transition times are slower than typical transition times in dyadic English conversations and the responses were very simple, the finding demonstrates that participants were actively predicting the content of the pre-recorded stimuli and using those predictions to prepare their own response during the other speaker's turn, analogous to conversation.

We encouraged participants to time their utterances to coincide with the offset of the pre-recorded stimuli through a scaffolded training procedure. However, this study did not use question/answer pairs, making the link to conversation somewhat more tenuous.

Method

Participants Twenty-nine undergraduates participated for course credit and were randomly assigned to one of two lists. All were native English speakers

Procedure On each of 36 trials during the experiment, participants looked at a line drawing of a complex scene while listening to an auditory sentence. Participants were instructed to describe the scene as soon as the auditory sentence ended. The participant was instructed to refer to the entity indicated by the arrow in their description of the picture (see Figure 4). In the Match condition, the auditory sentence was about the current image; in the Mismatch condition, an auditory sentence for a different image was substituted. Across the two lists, every picture occurred in both the Match and Mismatch conditions, and each participant received half of each type. After the participant finished their utterance, the next screen presented a printed word and participants judged whether it had been in the auditory sentence of the current trial (50% had been). This recognition probe encouraged attention to the auditory sentence. For the image in Figure 4, the matching sentence was “William was very pleased with himself for surprising his wife with an anniversary gift”, and the probe word was "pleased".

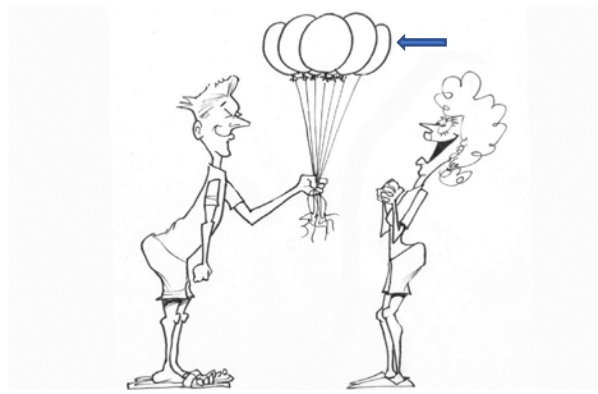

Figure 4: Example line drawing.

Prior to beginning the experiment, participants practiced each component of the task: describing the pictures while referring to the entity indicated by the arrow, timing their response to commence as closely as possible to the end of the auditory sentence, and answering yes/no to the recognition probe word.

Both the pre-recorded auditory stimuli and the participant’s picture descriptions were audio-recorded and transcribed as in Experiment 1, with the participant and the pre-recorded stimuli treated as different speakers.

Results

The participants' utterances were coded for transition time, speech rate, utterance length, the presence of disfluencies, and the number of content words repeated from the pre-recorded stimulus (see Table 4).

As predicted by the Alignment account, fluency was higher in the Match condition. There were shorter transition times and more succinct descriptions when the auditory stimulus sentence described the same image as the participant's sentence. The effect on transition time was confirmed in linear mixed effect model, summarized in Table 5: lmer(trans_time ~ Condition +RepeatWords.C +Accuracy + Utt_words.C + (1 + Condition|subj) + (1 + Condition|trial)). Accuracy on the recognition probe and the number of words in the participant's utterance were included as control variables[2].

Table 4. Means (standard error) for Experiment 2

	Matched	Mismatched
Transition Time	515 ms (22)	575 ms (25)
No. of Words	10.01 (.17)	9.56 (.16)
Speech Rate	3.23 w/s (.04)	3.15 w/s (.04)
Disfluent %	33 (2)	33 (2)
No. Repeated Words	1.42 (.05)	0.12 (.02)
Probe Accuracy %	87 (1)	77 (2)

Table 5. Transition Time Analysis for Experiment 2

	Estimate	t	p
Intercept	.51	7.83	.00
Condition	**.08**	**2.55**	**.01***
RepeatWords.C	.03	1.25	.21
Accuracy	-.02	-.87	.38
Utt_words.C	**.14**	**4.51**	**.00***

Participants were more accurate overall on the recognition probe in the Match condition than in the Mismatch condition [2-tailed paired t-test: $t(29) = 4.54$, $p < .001$]. This could be because greater alignment eased overall processing load. Alternatively, higher accuracy on Match trials could reflect participants having produced the probe word themselves when describing the picture. This occurred on 9% of Match trials with a "yes" probe word and less than 1% of the time on Mismatch trials with a "yes" probe word. Not surprisingly, participants never used the probe word themselves on "no" trials, in which the probe word was not in the pre-recorded sentence. When analyzing only the "no" probe trials, the effect of Match remained robust [95% Match, 84% Mismatch condition, $t(28) = 4.15$, $p < .001$], consistent with the hypothesis that greater alignment eased overall processing load.

Contrary to the Alignment prediction, repetition of words did not increase fluency. Instead, the numerical trends went in the opposite direction (see Figure 5): the more content words the participant repeated from the auditory stimulus sentence, the longer the transition time and the more wordy the image description. This surprising pattern might arise if participants used a lot of pronouns in the Match condition, rather than repeating referring expressions from the auditory stimulus. This pattern was not found. Although, there was a slight numerical difference in pronoun usage (.66 pronouns per utterance in the Match condition, .60 in the Mismatch condition), it was not significant in a 2-tailed, paired t-test ($t(29) = 1.41$, $p > .10$), nor was there an effect of pronouns or an interaction between pronouns and Match/Mismatch, when pronoun usage was added to the statistical model used for Table 5.

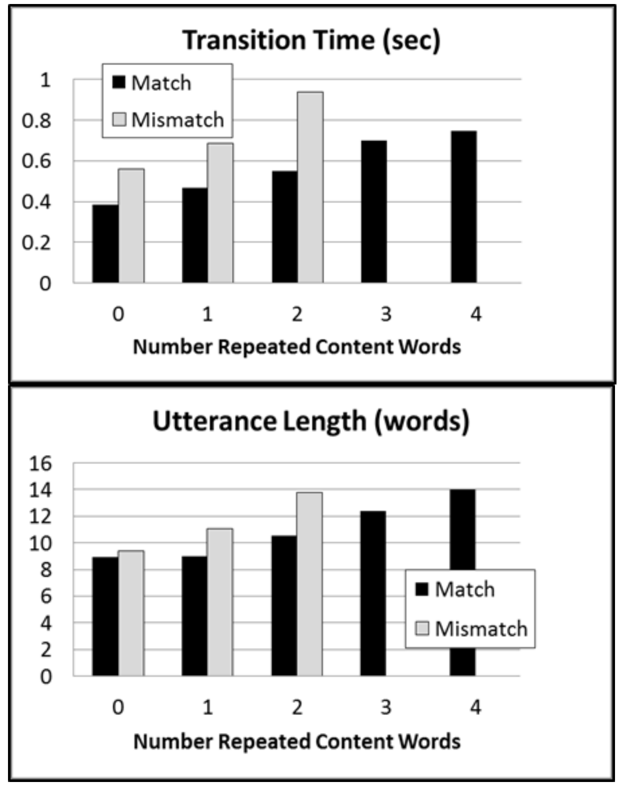

Figure 5: Transition times (upper bar graph) and utterance length (lower) in the Matched and Mismatched condition, when controlling for number of repeated words.

Discussion

Despite the artificiality of the paradigm, a shared topic decreased transition time, as predicted. This effect suggests that participants planned their utterance during the auditory stimulus, analogous to spontaneous conversation.[3] Furthermore, it provides some direct support for the Alignment account. However, the topic alignment advantage did not come from the most obvious source--lexical repetition of words in the auditory stimulus. Rather, the Match advantage in this paradigm must be due to other phenomena, such as more accurate prediction of the end of the auditory stimulus and semantic priming. It remains possible that lexical repetition plays a more important role in natural conversation than it did in this paradigm, but the

[2] To verify that the results remained the same when including only trials on which participants attended to the recorded sentence, an additional statistical model was run, including only trials on which participants responded accurately to the probe word. It was identical to the original model, except that accuracy was excluded. As expected, the same pattern of effects reported in Table 5 was obtained.

[3] In an earlier version of the experiment that did not include the pre-experiment training, mean transition time was well over a second, with no effect of match. Thus, participants may not multi-task in this paradigm (i.e., plan their utterance during the auditory stimulus while predicting its endpoint) unless explicitly encouraged to do so.

current experiment found no support for the lexical repetition prediction, motivated by the Alignment account.

General Discussion

Prior research indicated that conversation competes for central resources when paired with a secondary task from another domain, such mouse-tracking, walking with groceries, or driving (Becic et al., 2010; Boiteau et al., 2014, Kemper et al., 2005; Sjerps & Meyer, 2015). However, except for Boiteau et al., this research did not use natural, spontaneous conversation and examined relatively few measures of conversational fluency. Experiment 1 used spontaneous conversation to extend this finding to a secondary task (mixed-case letter n-back) that uses resources within the language domain. Consistent with prior research and with Load Theory, we found interference effects for both conversation fluency and the secondary task. We also found that turn type was a strong predictor of multiple conversational fluency variables, reflecting the differential processing demands of agreeing, questioning, answering, and commenting.

In addition, we explored some predictions of the Alignment theory using a picture description paradigm with pre-recorded stimuli instead of a live interlocutor. To increase the similarity with natural conversation, we trained participants to time their utterances to coincide with the offset of the auditory stimulus, while obeying other task-specific constraints. In this paradigm, participants initiated their own utterance closer to the offset of the auditory stimulus when both utterances shared the same topic (a co-present image). This finding is consistent with the Alignment account. However, the number of content words shared between the auditory stimulus and the participant's picture description was not related to conversational fluency in the direction predicted by the Alignment account.

In sum, we found considerable support for theories in which conversation consumes processing resources, such as working memory and attention. At the same time, we were surprised that participants were able to maintain typical transition times as working memory load increased. Our results from the two experiments suggest that this feat was possible because of shared topics across adjacent turns and due to compensatory mechanisms, such as making turns shorter or beginning turns with a filled pause.

Acknowledgments

This research was made possible by a team of undergraduates who helped create the experiments, collect the data, and participate in the conversations for Experiment 1. They and additional students transcribed coded the data: Kelly Kendro, Jocelyn Brickman, Meher Sabri, Madylin Eberstein, Yaozong Huang, Olivia Shulman, Maxwell Recknagel, Thinh Nguyen, Lindsey Harris, Katherine Hall, Hussam Hashem, Luciana Rosania, and Natalie Jackson.

References

Becic, E., Dell, G. S., Bock, K., & Garnsey, S. M. (2010). Driving impairs talking. *Psychonomic Bulletin & Review*, *17*, 15-21.

Boiteau T. W., Malone, P. S., Peters, S. A., & Almor, A. (2014). Interference between conversation and a concurrent visuomotor task. *Journal of Experimental Psychology: General. 143, 295-311.*

Corps, R. E., Crossley, A., Gambi, C., & Pickering, M. J. (2018). Early preparation during turn-taking: Listeners use content predictions to determine what to say but not when to say it. *Cognition*, *175*, 77-95.

Daneman M and Carpenter PA (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior*, *19*, 450-466.

DeDe, G., Caplan, D., Kemtes, K., & Waters, G. (2004). The relationship between age, verbal working memory, and language comprehension. *Psychology and Aging*, *19*, 601-616.

Fedorenko, E., Gibson, E., & Rohde, D. (2006). The nature of working memory capacity in sentence comprehension: Evidence against domain-specific working memory resources. *Journal of Memory and Language*, *54*, 541-553.

Indefrey, P. & Levelt, W.J.M. (2004). The spatial and temporal signatures of word production components. *Cognition*, 92, 101–144.

Kemper, S., R. Herman, R., & Nartowicz, J. (2005). Different Effects of Dual Task Demands on the Speech of Young and Older Adults. *Aging, Neuropsychology, and Cognition, 12, 340-258.*

Landauer, T. K., & Dumais, S. T. (1997). A solution to Plato's problem: The latent semantic analysis theory. *Psychological Review*, *104*, 211-240.

Lavie, N., Hirst, A., de Fockert, J. W., & Viding, E. (2004). Load Theory of Selective Attention and Cognitive Control. *Journal of Experimental Psychology: General*, *133*, 339-354.

Levinson, S. & Torreira, F. (2015). Time in turn-taking and its implications for processing models of language. *Frontiers in Psychol*ogy, *6*, 371.

Lewis, R. L., Vasishth, S., & Van Dyke, J. A. (2007). Computational principles of working memory in sentence comprehension. *Trends in Cognitive Sciences*, *10*, 447-454.

Martin, R. C. & Slevc, L. R. (2014). Language production and Working Memory. In *The Oxford Handbook of Language Production* (M. Goldrick, V. Ferreira, & M. Miozzo, Eds). Oxford University Press, pp 437-447.

Pickering, M. J. & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral & Brain Sciences*, *27*, 169-190.

Pickering, M. J. & Garrod, S. (2013). An integrated theory of language production and comprehension. *Behavioral & Brain Sciences*, *36*, 329-347.

Sacks. H., Schegloff, E. A., Jefferson, G. (1974). A simplest systematics for the organization of turn taking for conversation. *Language, 50*, 696–735.

Sjerps, M. J. & Meyer, A. S. (2015). Variation in dual-task performance reveals late initiation of speech planning in turn-taking. *Cognition*, *136*, 304-324.
Smith, E. E. & Jonides, J. (1997). Working memory: A view from neuroimaging. *Cognitive Psychology, 33,* 5-42.
Stivers, T., Enfield, N. J., Brown, P., Englert, C., Hayashi, M., Heinemann, T., Hoymann, G., Rossano, F., de Ruiter, J. P., Yoon, K-E, Levinson, S. C., & Kay, P. (2009). Universals and Cultural Variation in Turn-Taking in Conversation. *Proceedings of the National Academy of Sciences of the United States of America, 106* (26), 10587-10592.
Wilson & Wilson (2005). An oscillator model of turn-taking. *Psychonomic Bulletin & Review, 12,* 957-968.

Appendix

Linear mixed effect analyses for additional dependent variables from Experiment 1. The same statistical model was used for each: lmer(DV ~ Experimenter + Order + Turntype + Block + LSS + (1 + Block |subj)).

Table A1. Utterance length (words per turn)

	Estimate	t	p
Block C vs C1	-6.01	-3.25	.00
Block C vs C2	-7.70	-4.18	.00
Ord1 vs Ord3	-8.49	-2.36	.02
Agree vs Answer	21.37	19.35	.00
Agree vs Quest	6.80	3.72	.00
Agree vs Comm	19.09	16.97	.00

Table A2. Speech rate (words per second)

	Estimate	t	p
Block C vs C1	.00	0.02	.98
Block C vs C2	.09	1.54	.13
Exp1 vs Exp2	-.28	-2.11	.04
Exp1 vs Exp 3	-.31	-2.40	.02
Ord1 vs Ord3	-.47	-3.39	.00
Ord1 vs Ord5	-.33	-2.41	.02
Agree vs Answer	.36	6.76	.00
Agree vs Quest	.99	11.28	.00
Agree vs Comm	.80	14.87	.00
LSS	.18	2.85	.01

The probability of a sentence-initial filled pause not analyzed using the above statistical model due to the large number of 0's (no filled pause) across trials. Instead, the probability of a sentence initial filled pause for each participant, in each condition, was analyzed using repeated measures ANOVA. There was a main effect of block [$F(2, 76) = 6.79$, $p < .01$], with a probability of .09 in the Conversation-Only condition, .14 in the Conversation with 1-back condition, and .15 in the Conversation with 2-back condition.