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Does time pressure help or hinder oral fluency?

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Oral fluency is a goal in many second language courses. Although Rossiter et al. (2010) have given suggestions for fluency-enhancing instructional techniques, very little research is available that has tested their effectiveness. One type of practice that has been studied is the commonly used 4/3/2 task. In this task, learners speak about a topic for four minutes and repeat their speech in three and two minutes, respectively. During the first delivery, the speakers generate content and activate words and grammatical structures. This allows them to speak more fluently during the second and third deliveries. This effect was first shown by Nation (1989). Although it is important to show that fluency can increase across retellings, de Jong & Perfetti (2011) showed that the 4/3/2 task can also have longer-term effects that transfer to speeches about new topics. More specifically, they argued that repetition enables learners to repeatedly use certain words and structures, which leads to more efficient processing (proceduralization). This study shows that repetition in the 4/3/2 task has a positive effect on fluency development, but it is still an open question whether increasing time pressure is beneficial as well. Such time pressure can be expected to compel learners to avoid pauses and speak faster, thus increasing fluency. Whether this is the case, is investigated in the present study.

To study the effect of fluency practice, it first needs to be clarified what processes are involved in oral speech production, and what points in the speech production process can result in dysfluencies. According to Levelt (1989; 1999) speech is produced in several stages. The production of an utterance starts with conceptual preparation in which relevant information is retrieved and transformed into propositions. In the next stage, word information is retrieved (lemma retrieval) and syntactic structures are built (syntactic encoding). In the last stages, the word forms (their sounds) are retrieved and transformed into a speech plan that is then articulated into audible speech. Speakers can monitor their speech—before or after it is articulated—and decide to reformulate. Although each stage needs information from the previous stage, and thus requires serial processing, several stages can work on different parts of the message simultaneously. In this respect the model involves parallel processing. Dysfluencies can be caused by any of the stages. For example, when speakers need to search for the right words or (morpho-)syntactic structures, they may pause (*I ... saw him*), produce a form and then correct it (*I seed ... saw him*), or lengthen sounds in order to buy time to find the right form (*I sssaw him*). In other words, dysfluent processing can result in pausing, reformulation, and slow articulation (cf. breakdown fluency, repair fluency, and speed fluency; Skehan 2003).

All stages after conceptual preparation proceed mostly automatically for native speakers, but are more effortful for second language learners (Kormos 2006). Because attention is limited, not all stages of speech production can receive full attention simultaneously. Consequently, when one of the stages needs more attention—for instance, because the task requires advanced vocabulary or complex structures—processing slows down, giving rise to dysfluencies. Or when a speaker chooses to prioritize fluency, less time and attention can be allocated to using complex structures accurately or producing advanced vocabulary fluently. This is why Skehan (2009) argues that there is often a trade-off between

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fluency on the one hand and accuracy and complexity on the other. The current study will therefore also see if such a trade-off occurs in the 4/3/2 task.

A speaker's choice to prioritize fluency over accuracy and complexity is affected by time pressure. Time pressure is particularly expected to affect the processes of lemma retrieval and syntactic encoding because under time pressure these processes need to rely on fast, automatic processing. Conversely, in the absence of time pressure speakers have more time for online planning, and are able to devote more attention to lemma retrieval and syntactic encoding (Skehan 2009) and to microplanning (Ellis & Yuan 2005). Three studies have examined the effect of time pressure on oral task performance. Ellis and Yuan (2005) showed that under time pressure (their "pressured planning" condition), speakers spoke as fluently but with less syntactic complexity and syntactic variety than without time pressure (their "careful planning" condition). Similar findings based on the same data had already been presented by Yuan and Ellis (2003). Finally, Ahmadian and Tavakoli (2011) found that under time pressure (their "pressured online planning" condition) fluency was higher but syntactic complexity lower than without time pressure (their "careful online planning" condition). Overall, in these three studies time pressure did not negatively affect fluency but it did negatively impact syntactic complexity. Speakers used the available time to construct more complex sentence structures (more sentences containing subordinate clauses, and more varied grammatical verb forms). This did not slow down speech (e.g., fewer syllables per minute). It is important to note, however, that the instructions in the three studies discussed encouraged speakers in the non-time pressure conditions to make corrections, thus favoring complexity and de-emphasizing fluency.

Ahmadian and Tavakoli (2011) not only examined the effect of time pressure, but also of task repetition, which is another characteristic of the 4/3/2 task. When a task was performed for the second time—one week after the first performance—fluency and complexity were higher than when the task was performed only once. This confirmed Bygate's (2001) findings, where tasks were repeated ten weeks apart. Interestingly, the effects of task repetition and time pressure in Ahmadian and Tavakoli's study seemed to be independent and additive: complexity was higher under the combined condition of task repetition and absent time pressure than under each of these conditions separately. In addition, task repetition more than compensated for the negative effects of time pressure on complexity. These findings suggest that in the 4/3/2 task, time pressure may reduce the effect of repetition, while repetition without time pressure may be the most beneficial condition for fluency and complexity.

The reviewed studies show that time pressure and task repetition—both characteristics of the 4/3/2 task—have an effect on task performance, but there are a number of crucial differences between these studies and the 4/3/2 task. In the reviewed studies, repeated task were one to ten weeks apart, whereas in the 4/3/2 task, repetition is immediate. Immediate repetition makes it more likely that benefits of conceptualization and formulation persist into the repeated deliveries.² Time pressure is also different in the 4/3/2 task as compared to the planning studies reviewed above. Time pressure—and the opportunity for online planning—is not constant in the three deliveries of the 4/3/2 procedure. In the first delivery, speakers generate the amount of information they feel is sufficient to narrate the story. In the second delivery, they can include the same information and leave out any information they find redundant because they need to compress their narrative by 25% (cf. Nation 1989). The third delivery, where only 50% of the original time is available, is where the speakers are expected to experience most time pressure, having generated an amount of content that may be more than they can express comfortably in the available amount of time. The effects of repetition

² Lynch and Maclean (2000, 2001) examined oral performance in a task that involved immediate repetition (a poster carousel), but presented little information about fluency.

and time pressure may therefore be stronger in the 4/3/2 task than in the studies described above.

The present research project is inspired by an interest in the long-term effects of the 4/3/2 task on fluency in language learners at intermediate proficiency level. Before studying those effects, however, it is important to examine performance during the 4/3/2 task itself. Therefore, our first research question is whether fluency increases when the available time to retell a story decreases across deliveries. It is expected that, under time pressure, most speakers would prioritize fluency over accuracy and complexity, so they can express all the content they need to. This leads to greater fluency but lower complexity, because less time is available for microplanning and formulating. Because it is the speaker's choice to prioritize fluency or complexity, we expect a trade-off between fluency and complexity: more fluent speeches will be less structurally complex. On the other hand, when speakers retell a story several times without time pressure, they are less pressured to prioritize either fluency or complexity. The second research question, therefore, is whether there is indeed a trade-off between fluency and structural complexity only when the available time decreases. Accuracy is not addressed in the current study.

1. Method

1.1 Participants

Participants were 40 adult ($M = 27.5$ years) learners of English as a second language in high-intermediate speaking class in the intensive English program at a university in the United States. This institution typically places students at this level who have a score of 60-79 on the Michigan Test of English Language Proficiency (MTELP, Corrigan, et al. 1979). They came from mixed first language backgrounds: Arabic (16), Chinese (4), Japanese (3), Korean (5), and Spanish (4), and single speakers of French, Italian, Czech, Russian, Thai, and Turkish. Two participants chose not to disclose any personal information. The number of years of studying English varies widely, ranging from less than one year to over five years, but was similar across conditions. Although the students in this institute are in an immersion setting—in that the target language is the dominant language and all classes are taught in the target language—a large part of the students' language learning takes place in the classroom.

1.2 Materials

The speaking prompt was a six-panel picture story from a wordless picture story book (Heaton 1966). The story is about a boy on a bicycle who is pushed off the road by an angry driver. In the end, the driver's car breaks down and the boy passes him on his bike. The story has a tight sequence, meaning that rearrangement of the individual frames of the prompt would disrupt the narrative. Also, the storyline could be considered moderately complex, in that the narrative had some background information (cf. Tavakoli & Foster 2008). A pilot study reported by de Jong and Vercellotti (2011) showed that the pictures and the storyline were clear, and the story was reasonably interesting and enjoyable. These findings were confirmed by data from the current study.

1.3 Procedures

The participants were randomly assigned to one of two conditions: Decreasing Time and Constant Time. In the Decreasing Time condition, speakers narrated the story three times in 180, 135, and 90 seconds, respectively. Thus, there was less time available for each consecutive retelling. This task is essentially the 4/3/2 task as described by Nation (1989) and de Jong and Perfetti (2011), but the available time per retelling was reduced by 25% to make it more likely that the speakers would indeed experience time pressure. In a pilot study

reported by de Jong and Vercellotti (2011), it was shown that the prompt used in this study was able to elicit a mean of 218 seconds of speech ($SD = 29$, $n = 25$) when 240 seconds of speaking time were provided. In addition, in the 2003 and 2005 studies by Ellis and Yuan, and based on a similar six-panel story, the online planners used 4.1 minutes on average, while the non-planners used 3.1 minutes. In the present study, the first delivery was three minutes, which seemed to be sufficient time to tell the story comfortably, but would most likely result in time pressure in the final retelling of 1.5 minutes. In the second condition, Constant Time, speakers also narrated the story three times, but for 135 seconds each time. This may have resulted in some time pressure, but it remained constant across retellings. Overall speaking time was six minutes and 45 seconds in both conditions.

A computer program was specifically developed for this study using Runtime Revolution (Shafer 2006). It displayed the prompts and recorded the participants' speech. Three minutes of planning time were given during which the speakers saw the pictures along with four specific questions about the story to focus on (see below). The participants could zoom in and out on individual pictures by clicking on them. During the recording, the pictures were visible but the zooming feature was disabled and the questions were not shown.

Questions provided during planning time:

- In picture 1, what is the driver of the car doing? Why is he honking the horn?
- Why can't the car pass the boy on the bicycle?
- In picture 2, how is the boy responding?
- Think about how each person feels during the story.

After each retelling, speakers were asked several questions to reflect on their performance and to assess whether they had experienced time pressure. One week before data collection, there was an introductory session in which the participants practiced with a different but comparable prompt to familiarize them with the procedures. The speakers were assigned to the reverse condition of the main session. Any practice effects were deemed minor compared to the immediate effects of the time available for narrating during the task itself.

1.4 Analysis

The goal of this study was to examine the effects of time pressure. Therefore, data of four speakers from the Decreasing Time condition were removed because it was unlikely that they experienced time pressure. Two of these participants produced less than 135 seconds of speech on the first delivery, which is less than the amount of time available for the next delivery. Two other participants produced—on both the first and the second delivery—about as many seconds of speech as was available for the next delivery (e.g., producing 139 seconds on the first delivery while 135 seconds were available for the second delivery). Four speakers in the Constant Time condition were removed: three of them produced 97 seconds or less on one of the deliveries, and one more spoke for less than 35% of the available time (phonation/time ratio) on two deliveries.

Three measures of fluency and two measures of structural complexity were calculated (cf. De Jong & Perfetti 2011; Norris & Ortega 2009; Skehan 2003; Tavakoli & Foster 2008; see Table 1). The measures of fluency reflected three different types of fluency: breakdown of fluency (phonation/time ratio), repair fluency (number of reformulated words per 100 words), and speed fluency (articulation rate). The two measures of complexity reflected phrasal complexity (words per clause) and complexity by subordination (clauses per AS unit³).

³ An AS unit is the 'analysis of speech' unit proposed by Foster, Tonkyn, and Wigglesworth (2000) that is specifically designed to be used with spoken language. It is "a single speaker's utterance consisting of an independent clause, or sub-clausal unit, together with any subordinate clause(s) associated with either" (p. 365).

Table 1 Measures of fluency and structural complexity used in the current study

Measures	Calculation
<i>Fluency measures</i>	
Phonation/time ratio	Time spent speaking (excluding filled pauses) divided by the total time from first to last word. This measure captures both the number and the length of pauses. Pauses are silent or filled (uh, mmm) pauses of 200 ms or more.
Number of reformulated words per 100 words	Number of words that were repeated or reformulated divided by 1/100 of the total words produced (to correct for differences in the number of words produced).
Articulation rate	Number of syllables divided by the total time (excluding filled and unfilled pauses) in seconds
<i>Structural complexity measures</i>	
Phrasal complexity	Number of words per clause
Complexity by subordination	Clauses per AS unit

2. Results

Before analyzing the fluency and complexity measures, it is necessary to check whether it was likely that speakers in the Decreasing Time condition experienced time pressure, and more so than in the Constant Time condition. To do so, we examine whether the available time was indeed used and whether the speakers' self-ratings of time pressure varied between the two groups.

2.1 Narration length and speakers' perception of time pressure

Table 2 shows the length of the narration (in seconds) per delivery. In the first delivery, the speakers in the Decreasing Time condition showed a considerable amount of variability in the length of their narratives, as indicated by the relatively high standard deviation. In the subsequent retellings and in the Constant Time condition, there was less variability. Overall, speakers tried to use most of the available time to narrate the story.

Table 2 Mean narrative length (and SDs) per retelling (in seconds)

	Delivery 1	Delivery 2	Delivery 3
Decreasing Time (180-135-90 sec.), n = 15	164 (14.8)	129 (6.2)	87 (1.6)
Constant Time (135-135-135 sec.), n = 17	127 (5.4)	128 (6.3)	131 (1.7)

To gauge whether students subjectively experienced time pressure, they were asked to indicate whether they agreed with the statement "I needed more time to tell the story" on a 7-point scale after each delivery. Table 3 clearly shows that, generally, the speakers disagreed with the statement, indicating they did not feel a need for more time. Only the Decreasing Time in the third delivery indicated some sense of time pressure. This is confirmed by the inferential statistics. There was a significant main effect of delivery ($F(2, 60) = 11.246, p < .001$), and a significant interaction between time condition and delivery ($F(2, 60) = 6.456, p = .003$). There was no main effect of time condition. A post-hoc paired t-tests for the Decreasing Time condition was used to evaluate the difference between the second and third delivery, as well as an independent t-tests comparing the two available-time condition on the third

delivery. Bonferroni corrections were applied so both effects are evaluated at a .025 level of significance. There was a large increase in ratings from the second to the third delivery ($t(14) = 4.000, p = .001, r = .73$), in the Decreasing Time condition. In addition, there was a significant medium-sized difference between the Decreasing Time and Constant Time conditions at the third delivery ($t(30) = 2.494, p = .018, r = .41$).

Table 3 Means and standard deviations of speakers' ratings of time pressure (1 = strongly disagree; 4 = neither agree nor disagree; 7 = strongly agree)

	Delivery 1	Delivery 2	Delivery 3
Decreasing Time	2.5 (1.5)	2.5 (1.4)	4.6 (1.8)
Constant Time	2.6 (1.7)	2.6 (1.7)	2.9 (2.1)

2.2 Temporal measures of fluency

Having established that speakers in the Decreasing Time condition experienced more time pressure on the third delivery than speakers in the Constant Time condition, fluency measures can be evaluated. Figure 1 shows the changes in the fluency measures across deliveries.

For **phonation/time ratio** there was a main effect of delivery ($F(2, 60) = 29.606, p < .001$) and an interaction between time condition and delivery ($F(2, 60) = 7.910, p = .001$). There was no main effect of time condition. Post-hoc tests (paired t -tests) were used to explore the differences between pairs of deliveries (first and second, and second and third delivery) in each condition separately. Bonferroni corrections were applied so all effects are evaluated at a .013 level of significance. Phonation/time ratio increased from the first to the second delivery ($t(14) = 5.430, p < .001, r = .82$) and from the second to the third ($t(14) = 3.388, p = .004, r = .67$) in the Decreasing Time condition. Both effect sizes are large. The differences missed significance in the Constant Time condition. For **articulation rate**, there was a significant main effect of delivery ($F(2, 60) = 7.802, p = .001$), and a significant interaction between time condition and delivery ($F(2, 60) = 5.252, p = .008$). There was no main effect of time condition. Post-hoc paired t -tests showed that articulation rate decreased from the first to the second retelling in the Decreasing Time condition only ($t(14) = 3.422, p = .004, r = .67$). Again, all effects were evaluated at a .013 level of significance. Finally, for the **number of reformulated words per 100 words**, there was a main effect of delivery ($F(2, 60) = 9.016, p < .001$). There was no main effect of time condition or interaction between delivery and time condition. Post-hoc paired t -tests (for both conditions combined) showed that the number of reformulated words per 100 words only decreased from the second to the third delivery ($t(32) = 3.008, p = .005, r = .47$), but not from the first to the second ($t(32) = 1.653, p = .109, r = .28$).

These results show that speakers in the Decreasing Time condition were able to substantially increase their fluency on two out of three measures, while the Constant Time group improved on only one measure. Positive effects were found mostly from the second to the third delivery. It seems, therefore, that speakers were more encouraged to increase their fluency on consecutive deliveries when they repeated their narratives under decreasing available time than under constant available time.

2.3 Structural complexity

To see if there was a trade-off between fluency and complexity, structural complexity was evaluated using two measures: clauses per AS unit and words per clause (see Figure 2). GLM-analyses with repeated measures showed no main effects or interaction for either the number of clauses per AS unit or the number of words per clause. This shows there were no group effects.

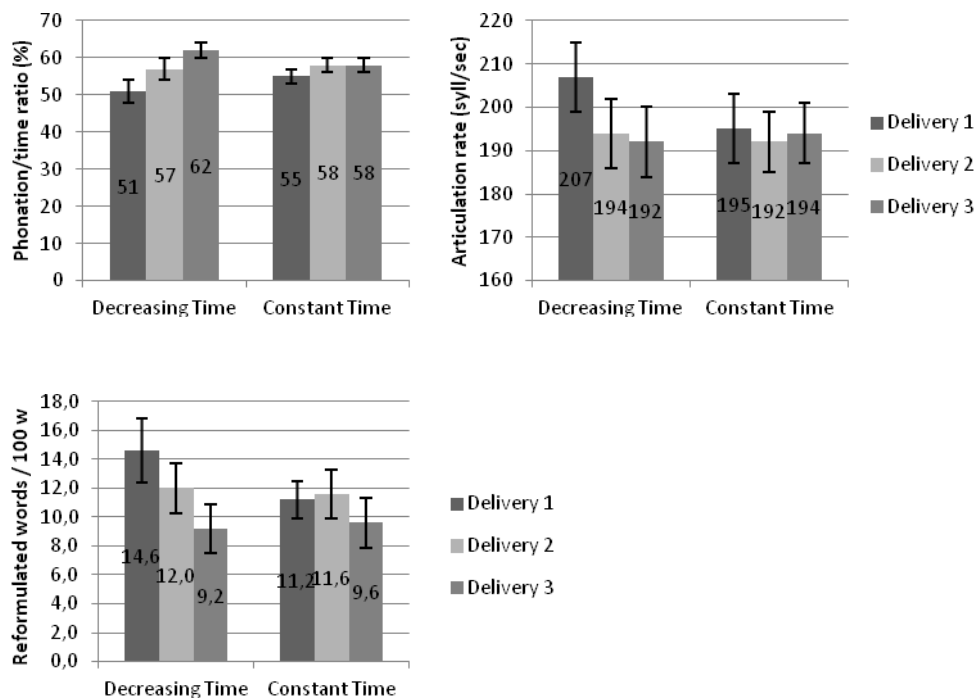


Figure 1 Means (and SEs) of fluency measures across deliveries.

There may, however, have been individual differences between speakers. It is possible that some speakers chose to prioritize fluency over complexity, while others prioritized complexity over fluency. If there was such a trade-off between fluency and structural complexity, it would show up as a negative correlation between the two. Correlations were calculated for each condition separately. In the Decreasing Time condition, both phonation/time ratio and articulation rate correlated strongly with clauses per AS unit on the first and last delivery (see Table 4). In addition, there was a marginally significant, medium-sized correlation on the second delivery. These correlations, however, were not negative—as was expected—but positive. This suggests that the correlations reflect proficiency differences between speakers, not a trade-off due to time pressure. The only trade-off that was found was between hesitations per 100 words and words per clause in the first delivery of the Decreasing Time condition. This was not a consistent finding, however. Finally, there were no significant correlations between words per clause and any of the fluency measures in any of the deliveries.

It is striking that there were no correlations between fluency and complexity measures in the Constant Time condition. This suggests that there was no relationship between fluency and structural complexity when the available time was constant, which means that performance reflected neither proficiency differences nor a trade-off between fluency and complexity for this group.

3. Discussion and conclusion

The first research question asked whether fluency increases when the available time to retell a story decreases across deliveries. This was shown to be the case. Two out of three fluency measures improved across deliveries. Phonation/time ratio improved only in the Decreasing Time condition. These findings suggest that the speakers who experienced more time pressure (as confirmed by the questionnaire data) were able to improve their fluency during the 4/3/2 task, especially from the second to the third delivery.

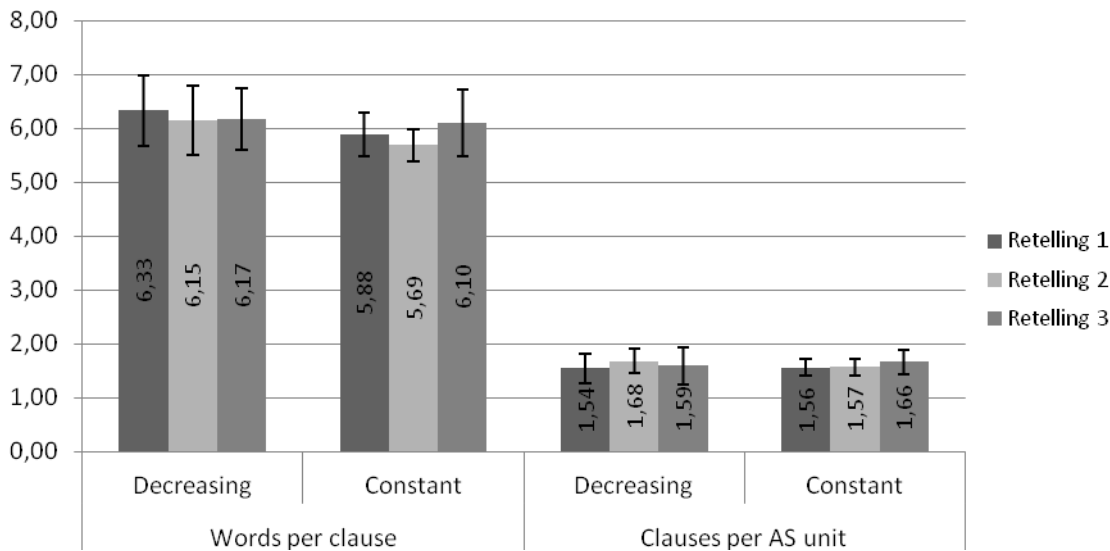


Figure 2 Means (and SEs) of complexity measures across deliveries.

It is possible that these speakers prioritized improvements in fluency over other aspects of performance. One such aspect is structural complexity, which was operationalized as phrasal and subordination complexity (Norris & Ortega 2009). Complexity did not increase across deliveries, however, whether the available time decreased or not. The second research question was therefore answered negatively: there was no trade-off between fluency and structural complexity when the available time decreased. Neither was there a trade-off at a between-subjects level: more fluent speakers did not produce less complex language. In fact, the reverse was found, in that speakers with higher fluency also showed greater structural complexity. This suggests that speakers relied on readily available resources: only those speakers who were able to use more complex language did so fluently. However, this correlation was found only in the condition where the available time decreased with each delivery. Importantly, speakers in this condition did not know until the second recording that the available time would decrease. Although it is possible that, under time pressure, speakers choose to rely on readily available resources, it is not clear why this correlation appeared on the first delivery already, where no difference in experience of time pressure was found.

The present study replicates the fluency effect of the 4/3/2 task found by Nation (1989). In addition, Nation found some qualitative evidence of an increase in subordination complexity across deliveries. However, in the present study the quantitative evidence could not support Nation's qualitative findings. Although there may have been a few instances in which speakers used more complex structures on repeated deliveries, this was not enough to yield an overall effect.

The results from the present study are somewhat different from those found by Yuan and Ellis (2003), Ellis and Yuan (2005), and Ahmadian and Tavakoli (2011). They also studied time pressure effects on task performance, but in the context of pre-task and online planning. They generally found that time pressure did not affect fluency but did lead to a decrease in complexity as compared to a no-time-pressure condition. This contrasts with the findings of the present study, in which decreasing available time (i.e., increasing time pressure) led to higher fluency but did not affect complexity. We propose two explanations for the difference in these findings. First, the instructions in the three planning studies favored complexity in the non-time-pressure condition and discouraged a focus on fluency. In the present study, instructions were the same for both conditions. Second, in the planning studies,

Table 4 Correlations between measures of fluency and structural complexity per delivery.

	Clauses per AS unit		Words per clause	
	Decreasing Time ¹	Constant Time ²	Decreasing Time	Constant Time
<i>Phonation/time ratio (Pearson)</i>				
Delivery 1	.662**	.237	-.043	-.216
Delivery 2	.457 [^]	.042	-.122	-.073
Delivery 3	.567**	.087	.104	.170
<i>Hesitations per 100 words (Pearson)</i>				
Delivery 1	-.596**	-.331	.682**	.391
Delivery 2	-.132	-.357	.072	.084
Delivery 3	-.534**	.071	.325	.271
<i>Articulation rate (Spearman's rho)</i>				
Delivery 1	.773**	.238	-.114	-.004
Delivery 2	.495 [^]	-.255	-.032	.037
Delivery 3	.749**	.283	-.014	-.147

* $p < .05$, ** $p < .01$, [^] $p < .10$

¹ $n = 15$; ² $n = 17$

the time pressure conditions did not include pre-task planning. Because pre-task planning has been shown to benefit structural complexity (see Ellis 2005), the absence of this planning created more growth potential. In the present study, three minutes of pre-task planning were provided. Although this is less than the ten minutes of planning in the planning studies (see also Mehnert 1998), it may nevertheless have supported complexity. It must be noted that the first delivery can also be seen as strategic planning for the second and third deliveries. It is interesting that the speakers in the Decreasing Time condition were able to maintain their complexity on the third delivery, in which they most strongly experienced time pressure. Repetition, therefore, may have contributed to the speakers being able to produce complex language on the third recording despite a sense of time pressure.

How can the effect of time pressure on fluency be related to the stages in the speech production process? In the delivery with the most time pressure (third delivery in the Decreasing Time condition), pausing was least. Therefore, it seems that time pressure encouraged fast retrieval of lexical items and grammatical structures, resulting in less pausing. In the third delivery, the number of retraced words per 100 words was also less than in the previous delivery. However, because this was the case in both the Decreasing Time and Constant Time conditions, this effect may have been mostly due to repetition, not time pressure. Thus, repetition may have helped to activate words and grammatical structures, which could then be retrieved more fluently (with less repetitions and reformulations) than in the first delivery. It remains to be examined whether the number of reformulations indeed mostly decreased for words and structures that were repeated across deliveries. In short, both time pressure and repetition seem to have impacted lemma retrieval and syntactic encoding. There was no evidence that time pressure or repetition affected conceptualization, which would show up in structural complexity.

These results show that time pressure is beneficial for oral fluency in the 4/3/2 task. However, it is uncertain whether this advantage will have longer term effects. If such effects are to be driven by increasingly efficient lexical retrieval and grammatical encoding, as suggested by de Jong and Perfetti (2011), speakers need to repeatedly use vocabulary and grammatical structures that are not yet fully automatized. Such repetition can support automatization. Under time pressure, however, speakers may choose to rely on already

automatic processes, e.g., using highly frequent vocabulary and simple syntactic constructions. One indication for such a reliance on readily available resources could have been a trade-off between fluency and complexity, in that as speakers prioritize fluency under time pressure, they might use less complex language. In contrast, speakers in the Decreasing Time condition—who increasingly experienced time pressure—were able to produce language as complex on the third delivery as on the first, but with greater fluency (less pausing and repair). De Jong & Perfetti (2011) found a long-term effect of repetition on fluency development, and the present study showed a short-term effect of time pressure. To investigate the long-term effects of time pressure, a follow-up to the present study is planned: the current findings suggest that repetition with time pressure could benefit fluency—including fluent production of complex language—but may not affect structural complexity.

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