

Fluency and Accuracy in a Dialogue in a Second Language

— Focusing on Short-Time Range Phenomena —

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Fluency and accuracy have been reported to show a trade-off relationship in spoken second language performance due to limited attentional resources to process explicit knowledge. However, little has been reported on how fluency and accuracy behave during the course of a conversation. A trade-off relationship might not apply if priming plays a role. This study investigated changes in fluency and accuracy during a dialogue. Non-English major university students with beginner-level proficiency engaged in an information-gap task under time pressure. Faster interlocutors slowed down while slower interlocutors speeded up with maintained accuracy. This suggests the involvement of priming effects.

Keywords: fluency, accuracy, dialogue, trade-off, priming

I. Introduction

Spoken performance in a second language (L2) exhibits a trade-off relationship between fluency, accuracy, and complexity due to limited capacity of attentional resources, and prioritizing one feature results in negative effects on the others¹⁾. A trade-off relationship has been reported between complexity and accuracy^{2) 3) 4)} as well as between fluency and accuracy⁵⁾. Considering that complexity develops with proficiency^{6) 7)}, trade-off relationship can be assumed to emerge between fluency and accuracy among beginner-level learners, whose linguistic complexity is yet to develop. Such effects of limited capacity of attentional resources are prominent under time pressure⁸⁾ due to little processing time under the time constraint⁹⁾.

This difficulty under time pressure is related to *implicit knowledge* and *explicit knowledge*. Implicit knowledge is about uses of language, while explicit knowledge is knowledge about the language^{10) 11)}. Implicit knowledge is automatic, unanalyzed, and lacking awareness, whereas explicit knowledge is controlled and analytic processing with awareness^{12) 13) 14) 15) 16) 17)}. The use of knowledge varies depending on the time pressure. Explicit knowledge can be accessed when there is sufficient time for processing, while implicit knowledge is likely to be used under time pressure^{18) 19) 20)}. Thus, if beginner-level interlocutors depend heavily on the analytic processing of explicit knowledge in a dialogue under time pressure, fluency

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and accuracy are likely to exhibit a trade-off relationship. On the other hand, if they utilize automatic implicit knowledge, fluency and accuracy can change regardless of the trade-off relationship.

There are three positions regarding implicit and explicit knowledge²¹). According to the non-interface position, implicit and explicit knowledge are not at all related. Explicit knowledge is available only for monitoring the output produced by implicit knowledge²²). The strong-interface position argues that explicit knowledge can become similar to implicit knowledge through proceduralization²³). The weak-interface position states that explicit knowledge facilitates the acquisition of implicit knowledge²⁴).

Implicit knowledge often results from *implicit learning* as DeKeyser²⁵) stated "[e]ven though implicitly acquired knowledge tends to remain implicit, and explicitly acquired knowledge tends to remain explicit, explicitly learned knowledge can become implicit in the sense that learners can lose awareness of its structure over time" (p.315). Implicit learning is learning something without conscious intention, whereas *explicit learning* is learning something with conscious intention²⁶).

Implicit learning is related to *priming*. Bock and Griffin²⁷) have argued that structural priming involves implicit learning rather than transient activation. Structural priming (or syntactic priming) is "unintentional and pragmatically unmotivated tendency to repeat the general syntactic pattern of an utterance"²⁸). N. Ellis stated that "[e]ach language processing usage results in the elements of the construction being primed and made more available in memory as a result"²⁹). The implication of this is that one interlocutor's utterances can cause priming effects on the other's in a dialogue. Thus, utterances of interlocutors are expected to interact implicitly with each other in a dialogue.

In fact, McDonough and Sato³⁰) utilized structural priming to elicit learners' repetition of the target grammar structure (= relative clause) in interactive practice. The participants engaged in two sessions of 15-minute trivia question activities with seniors, whose utterances included grammatical models without notification to the participants. The model sentences were expected to prime the use of the target grammatical structure, resulting in improved accuracy. The results revealed improvement in accuracy but not in fluency, which was evaluated by measures such as pauses and self-corrections. The study attributed the unimproved fluency to fluency measures used in the study, referring to the results of Tavakoli, Campbell, and McCormack³¹).

Tavakoli, Campbell, and McCormack³²) reported that articulation rate, speech rate, and length of run improved after a short period (four weeks) of the intervention of awareness raising and strategy training for fluency, whereas pauses and repairs (such as repetitions) did not indicate improvement of fluency. Indeed, Sato and Lyster³³), who used speech rate (pruned and unpruned), reported improvement in fluency in interactive peer activities on the sideline of their study on corrective feedback. In the study, a group of participants engaged in a 40-minute session to exchange information of a story and opinions with different

partners once a week over a period of 10 weeks. As a result, the group improved in fluency, but not in accuracy.

Studies^{34) 35)} have suggested the possibility of improvement in fluency as well as accuracy in interactive activities. However, these changes might also occur dynamically during one session of activities. For example, utterances of one participant can become more accurate by priming effects, but this same participant might try to speak faster later in the conversation, resulting in lower accuracy. In this, the average accuracy fails to detect the changes during the performance. This study investigated changes in fluency and accuracy during the course of a dialogue, which has been scarcely reported in the literature so far.

II. Purpose

In a dialogue, utterances of higher-accuracy interlocutors were expected to cause priming effects on lower-accuracy interlocutors, resulting in improvement of accuracy without a negative impact on fluency. Fluency might even improve because priming effects could make processing easier with less cognitive burden. This improvement in accuracy and fluency was expected to be clearer under time pressure due to constrained access to explicit knowledge. Therefore, this study examined the following hypotheses:

In a dialogue between beginner-level learners in a second language under time pressure,

- (a) Participants with lower accuracy will exhibit gain in accuracy in the course of a dialogue, and
- (b) Their fluency will be maintained or even improved despite the gain in accuracy.

III. Participants

Participants were non-English major first-year college students from two classes. Both classes were for beginner-level students corresponding to the A1 level of CEFR based on the GTEC-LR test. They were all Japanese students studying English as a compulsory subject. One class comprised 21 students (13 males, 8 females), and the other comprised 20 students (14 males, 6 females). Excluding incomplete data, such as the lack of names or the task, data from 26 participants (the first class = 14, the second class = 12) were analyzed. The data set from each class was collected with about a four-month interval for convenience of data collection. Participants signed a written consent form after being explained that consenting to the use of data was not obligatory.

IV. Method

1. Definitions

Fluency was defined as rapid and smooth real-time language use in this study, following the definitions of fluency in the literature in terms of real-time language use^{36) 37)}, flow^{38) 39)}, and speed⁴⁰⁾, as well as rapidness and smoothness⁴¹⁾.

This study focused on *utterance fluency* and adopted a *very narrow perspective* of fluency because the focus of the study was the speed of utterances measured by temporal measures. Lennon⁴²⁾ distinguished *broad sense fluency* and *narrow sense fluency*. Broad sense fluency refers to general oral proficiency, whereas narrow sense fluency is an isolable component of oral performance. Tavakoli and Hunter⁴³⁾ and Tavakoli⁴⁴⁾ proposed a more generalized view of fluency from four perspectives. In a *very broad perspective*, fluency reflects language proficiency in general. From a *broad perspective*, fluency includes accuracy and pronunciation, reflecting the ability to communicate messages. From a *narrow perspective*, fluency excludes grammatical complexity and accuracy. In a *very narrow perspective*, fluency is measurable by objective measures of speed, silence, and repair.

Segalowitz^{45) 46)} categorized fluency based on three domains: *cognitive fluency*, *utterance fluency*, and *perceived fluency*. Cognitive fluency refers to "the fluid operation (speed, efficiency) of the cognitive processes responsible for performing L2 speech acts"⁴⁷⁾. Utterance fluency is "the fluidity of the observable speech as characterized by measurable temporal features"⁴⁸⁾. Perceived fluency is "subjective judgments of L2 speakers' oral fluency"⁴⁹⁾.

Accuracy was defined as real-time language use without errors related to target grammar items in this study. *Error* was defined as the grammatical deviance from the standard norm adopted in the treatment. Defining accuracy inevitably involves the concept of error. For example, Skehan and Foster defined accuracy as "the ability to avoid error in performance, possibly reflecting higher levels of control in the language, as well as a conservative orientation, that is, avoidance of challenging structures that might provoke error"⁵⁰⁾. The error can be defined as a deviance from the norm. Lennon set the norm to native language usage by defining accuracy as "a linguistic form or combination of forms which, in the same context and under similar conditions of production, would, in all likelihood, not be produced by the speakers' native speaker counterparts"⁵¹⁾. Ahmadian and Tavakoli⁵²⁾ and Skehan⁵³⁾ also assumed native-likeness as the norm.

2. Measures

This study adopted speech rate as a fluency measure because the interest of the study was speed of utterances in a dialogue. Silence between turns was excluded because it was impossible to decide which speaker the silence belonged to. The speech rate was obtained by dividing the total number of uttered syllables by the total length of time of turns.

Speech rate is one of the speed measures for fluency. Fluency measures are categorized into three groups: (a) *speed fluency measures*, (b) *breakdown fluency measures*, and (c) *repair fluency measures*⁵⁴⁾. Speed fluency measures are related to the speed of utterances and include speech rate and articulation rate. Breakdown fluency measures are related to pauses and include mean pause time and pause frequency. Repair

fluency measures are related to repair phenomena such as reformulation.

Some fluency measures entail the issue of silence between turns in a dialogue. It is difficult to determine which speaker the silence between turns belongs to. Tavakoli⁵⁵⁾ speculated that reports in the literature, where dialogues were more fluent than monologues, might be attributable to definitions of fluency measures. She compared fluency measures based on two conditions: excluding pauses between turns or including such pauses by dividing them between the two interlocutors. Affected measures were speech rate, mean length of pauses, mean number of pauses, number of pauses clause-external (= numbers of pauses between clauses), and phonation time ratio. The results revealed that inclusion of silence between turns made the speech less fluent, but it was still better than in monologues.

Accuracy was measured by the proportion of correct uses of the target grammar items, rather than error-free units such as clauses, because multiple errors were expected in a clause due to low proficiency of participants. Target grammar items were article use, verb form, and preposition use.

The accuracy measure above was chosen considering the characteristic features of the accuracy measures. Accuracy is measured by *general measures of accuracy* and *specific measures of accuracy*^{56) 57)}. General measures of accuracy count in all grammatical errors^{58) 59) 60) 61)}. On the other hand, specific measures of accuracy count in one specific grammatical feature^{62) 63) 64)}. General accuracy measures are appropriate for investigating accuracy in general because they are sensitive to any differences^{65) 66)}. Specific measures of accuracy are effective when the study focuses on a specific grammatical item⁶⁷⁾.

Accuracy is expressed either by the number or proportion of correct/incorrect grammar items^{68) 69) 70)} or in terms of error-free units. One common unit is *clauses*^{71) 72) 73) 74) 75) 76) 77)}. Another common unit is the T-unit^{78) 79) 80)}. Measures in terms of error-free clauses are sensitive to any possible differences in accuracy^{81) 82)}, but they may not be suitable for low proficiency performance which is featured with multiple errors in one clause⁸³⁾.

Considering that the interest of the present study was a trade-off relationship between fluency and accuracy, the target grammar items were chosen on the basis of grammar items that beginner-level learners had already explicitly learned but were expected to be difficult to use under time pressure. Ellis⁸⁴⁾ has stated that indefinite articles are acquired late, although they are introduced in the elementary stage of pedagogical instruction. According to Bitchener, Young, and Cameron⁸⁵⁾, preposition use was the top item among errors in the writing of post-intermediate migrant learners. Tetreault and Chodorow⁸⁶⁾ mentioned that English as a Second Language (ESL) usage errors were commonly observed in prepositions, determiners and collocations. Subject-verb agreement error is reported to be a common type of error in the translation of other languages into English⁸⁷⁾.

3. Tasks

An information-gap task was adopted to elicit dialogues. This task was chosen to draw participants' focus primarily on meaning, not on forms, by setting the goal to exchange information. This was expected to reduce access to explicit knowledge by averting participants' focus from forms. The task also had an advantage in maintaining some control over the content of the conversation because the task required participants to exchange the same kind and amount of information with the same kind of linguistic structures. Evaluation of performance would be very difficult if one pair exchanges extensive information under high time pressure, while another pair exchanges limited information feeling little time pressure. Evaluation of accuracy would also be difficult if participants used different structures: for example, several prepositions in one pair, and then no use of such prepositions with another pair.

4. Materials

Two task sheets were used in the communication strategy practice (see Appendix A). They depicted the same town, but different locations were unlabeled and different destinations were provided. Five pictures were used in the main task. All of them depicted the same park with a tree, bench, trash can, and pond. The first two pictures were used for word practice. One was labeled with names of things: tree, bench, pond, trash can, and park entrance. The other depicted the same park without labels. The other three pictures were for the information-gap task (see Appendix B). All depicted plural agents engaged in some actions in the same park, but their locations and actions were different between the pictures. Two of the three pictures were used for the task: Pictures B and C for the first class, and Pictures A and C for the second class.

5. Procedure

The experiment was conducted as a part of regular lessons, following the procedure in Table 1. The experiment consisted of two parts: Communication Strategy Practice and Main Task. Communication strategy practice was administered because the degree of knowledge of communication strategies might affect the performance in the main task. The practice was expected to homogenize possible communication strategies at hand by teaching strategies to all participants. Strategies for the communication strategy practice were chosen based on strategies that were reported to be beneficial to oral communication performance⁸⁸. Adding some toning features, the practice adopted (a) confirmation checks including "Is that ~?", "You mean ~?", and repetition of utterances in a rising tone, and (b) response for maintenance strategy such as repetition of the other interlocutor's utterances in a falling tone.

Communication strategy practice consisted of three sections. In the first section, participants received

an explicit explanation of communication strategies. Sample sentences in the practice included useful expressions for the subsequent task section such as "Turn right." or "Go along the street." In the following section, participants engaged in a showing-the-way task in pairs. In this task, each participant in the pair was allocated a map. The maps depicted the same town, but different buildings were left unlabeled and different destinations were provided (see Appendix A). The goal of the task was to identify the locations of three destinations: for example, Shopping Mall, Book Store, and Movie Theater. One participant asked for directions, using a set-phrase of "Could you tell me how to get to ...?" for one destination. The other participant gave directions in English. After the locations of the three destinations were identified, they switched roles. No time pressure was imposed during the task. Following the task, participants reviewed the communication strategies and reflected on their strategy used in the task.

The main task comprised two sections. The first section was word practice. It provided participants with necessary words to describe the pictures. Participants were instructed to look at the first picture labeled with words on the projector screen, and they repeated words (bench, tree, pond, trash can, and park entrance) aloud one by one after the instructor. After that, participants looked at the second picture without word labeling and checked if they remembered the words, working in pairs. This was followed by repeating the words aloud again after the instructor in an attempt to make them better remember the words.

In the second section, picture sheets were distributed face-down to participants (see Appendix B). One of two different pictures (Pictures B and C for the first class, and Pictures A and C for the second class) was allocated to each participant in the pair. They were informed that the goal of the task was to find out as many differences as possible between the pictures in terms of agents, locations, and actions. They were instructed to exchange information in English without looking at the other's picture.

After the instructions above were explained, the participants were instructed to flip over the picture, start conversation after 10 seconds, and finish the conversation within one minute. The 10-second lag was supposed to provide participants with enough time to grasp the situation in the picture but not long enough to formulate English sentences beforehand. The one-minute time limit was intended to put participants under time pressure so that they would rely on as much implicit knowledge as possible.

Table 1 Procedure of the Experiment

Week	Content
First Week	Communication Strategy Practice Explicit explanation of communication strategy Showing-the-way task Reflection on strategies
Second Week	Main Task Word Practice Task

6. Analysis

The two data sets from the two classes were analyzed as one cohort group, assuming they were relatively at the same proficiency level because they were from the same level of classes based on the placement test. The utterances were transcribed and analyzed by the researcher. Utterances in Japanese, the participants' first language, were excluded from the analysis. The number of syllables was counted including repetitions as well as short responses such as "Yes" "Oh" and "Really?" because they were considered meaningful for communication. The duration time of turns was measured by Praat⁸⁹), free software for speech analysis. Errors were coded, focusing on article use, verb form, and preposition use. Singular nouns of the agents should be preceded by an indefinite article *a*, because the agents were unknown to the listener. The things in the park should be preceded by a definite article *the* because the layout of the park was known to each other. Nouns with neither an article nor plural, such as "Tree, tree," were considered to be incorrect. Repetitions such as "Two, two girls." was counted as one occasion. The verb that did not agree with the subject in number was considered incorrect. When the number was unsure from the forms, a decision was made based on the picture. "Two dog is sitting." is such a case. From the forms, it was not clear whether "Two dog" should be "Two dogs" or "A dog," or "is sitting" is correct or incorrect. Based on the fact that there were two dogs depicted in the picture, "is sitting" was incorrect. The interlocutor possibly intended to describe two dogs and should have said "Two dogs are sitting." The use of the preposition *near* was considered to be avoidance due to its less informational value than *under* or *to*, and was excluded from the accuracy analysis. It seemed unfair to score general descriptions, such as "near the tree" or "near the pond," in the same way as specific descriptions, such as "under the tree" or "to the pond."

The data were divided into the first half and second half based on the number of turns in an attempt to investigate the changes in the course of the dialogue.

V. Results

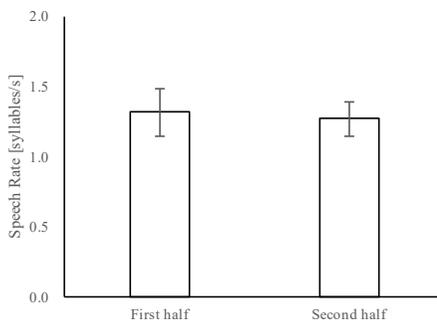
All participants completed their conversation within one minute. The average length of speech was 43 seconds ($SD = 8$ seconds). Each participant made 9.6 turns on average, with a mean length of turns of 6.1 syllables. Table 2 and Figure 1 show fluency and accuracy in the first half and the second half performance, and outcomes. The whole group exhibited no change between the two sections of performance.

Table 2 Fluency and Accuracy of the Whole Group

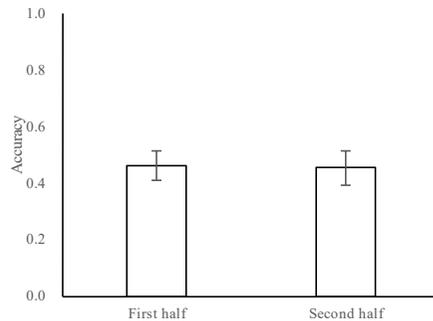
Measures	Performance		
	First half (SD)	Second half (SD)	Outcomes (SD)
Fluency	1.32 (0.62)	1.27 (0.45)	- 0.05 (0.45)
Accuracy	0.46 (0.19)	0.45 (0.22)	- 0.01 (0.19)

Note. $N = 26$.

(a) Fluency



(b) Accuracy



Note. $N = 26$.

Figure 1 Fluency and Accuracy of the Whole Group

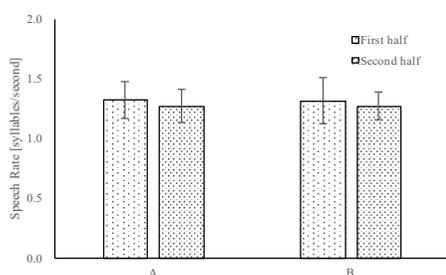
To examine the effects of gaps in accuracy between the interlocutors, the data were divided into two groups. Group A comprised participants who performed more accurately than their counterparts in the first half performance; Group B comprised those who performed less accurately in the first half performance. Table 3 and Figure 2 show that both groups exhibited no change either in fluency or accuracy between the first half and second half performance.

Table 3 Fluency and Accuracy Grouped on Accuracy in the First Half

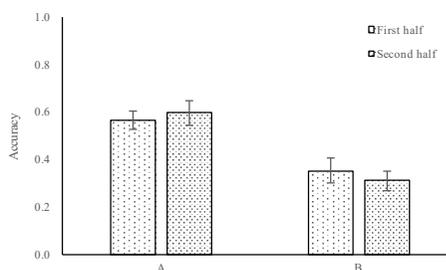
Measures	Group	Performance		
		First half (<i>SD</i>)	Second half (<i>SD</i>)	Outcomes (<i>SD</i>)
Speech Rate	A	1.33 (0.55)	1.27 (0.49)	- 0.05 (0.42)
	B	1.32 (0.70)	1.27 (0.43)	- 0.04 (0.50)
Accuracy	A	0.57 (0.14)	0.60 (0.18)	0.03 (0.21)
	B	0.35 (0.19)	0.31 (0.15)	- 0.04 (0.16)

Note. $N = 26$ ($n = 13$ for each subgroup). A = More accurate in the first half; B = Less accurate in the first half.

(a) Fluency



(b) Accuracy



Note. $N = 26$ ($n = 13$ for each group). A = more accurate in each pair in the first half; B = less accurate in each pair in the first half.

Figure 2 Fluency and Accuracy Grouped on Accuracy in the First Half

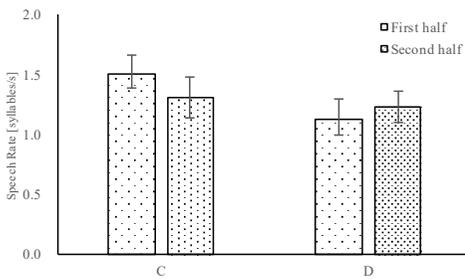
In order to examine the effects of gaps in fluency between the interlocutors, the data were divided into two groups. Group C comprised participants who performed faster than their counterparts in the first half performance, and Group D comprised those who performed slower in the first half performance. Table 4 and Figure 3 show the results. The most noticeable is that, as Figure 3 depicts, faster interlocutors in the first half (Group C) performed slower in the second half, while slower interlocutors in the first half (Group D) perform slightly faster in the second half. Considering the relatively small sample size, non-parametric analysis was conducted. The effect size r calculated from the z -value obtained by paired Wilcoxon signed-rank test was 0.40 (= medium) for Group C and 0.26 (= small) for Group D. Thus, faster interlocutors tended to slow down and slower interlocutors showed some tendency to speed up during the dialogue. Accuracy did not change in either groups.

Table 4 Fluency and Accuracy Grouped on Fluency in the First Half

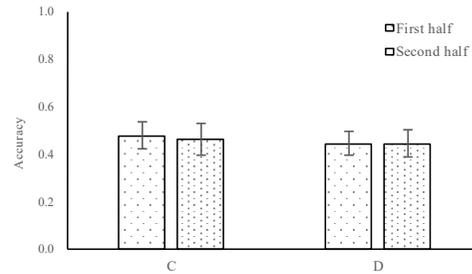
Measures	Group	Performance		
		First half (<i>SD</i>)	Second half (<i>SD</i>)	Outcomes (<i>SD</i>)
Speech Rate	C	1.51 (0.58)	1.31 (0.45)	- 0.20 (0.43)
	D	1.13 (0.61)	1.23 (0.46)	0.10 (0.44)
Accuracy	C	0.48 (0.21)	0.46 (0.24)	- 0.01 (0.12)
	D	0.44 (0.19)	0.43 (0.21)	0.00 (0.24)

Note. $N = 26$ ($n = 13$ for each group). C = the faster in the first half; D = the slower in the first half.

(a) Fluency



(b) Accuracy



Note. $N = 26$ ($n = 13$ for each subgroup). C = faster in each pair in the first half; D = slower in each pair in the first half

Figure 3 Fluency and Accuracy Grouped on Fluency in First Half

VI. Discussion

As a whole group, the results indicated no change in fluency or accuracy. This is probably due to the small amount of time required for the task. It was less than one minute compared to other studies, for example, 40 minutes for ten times, which yielded fluency improvement⁹⁰.

Analysis between higher- and lower-accuracy participants was expected to reveal gain in accuracy among the lower-accuracy participants. However, the results showed no change in either in accuracy or fluency. Thus, the first hypothesis, (a) participants with lower accuracy will exhibit gain in accuracy in the course of a dialogue, was not confirmed in the present study. This could be partly due to the small gap in accuracy between the groups. It is probable that priming by utterances with a similar level of accuracy did not yield substantial effects. In the study by McDonough and Sato⁹¹, for example, one interlocutor provided perfectly correct utterances to the other, while participants in the present study was relatively similar in accuracy as they were placed in the same beginner-level class. In order to confirm phenomena involving

accuracy, a further study is needed with a larger gap of accuracy between interlocutors.

However, analysis of groups based on fluency yielded interesting results. Faster participants slightly slowed down while slower participants showed a tendency to speed up in the second half. The accuracy of both groups remained at the same level as in the first half. In other words, the slower group exhibited some gain in fluency without a negative impact on accuracy, free from a trade-off relationship. This indicates the release of some extra attentional resources. This further suggests that the effects of priming played a role during the dialogue. The faster group slowed down probably because they found no need to speak at top speed due to the slower utterances of their counterparts. The faster group possibly performed at the highest accuracy and fluency with full engagement in the first half, but did not use full attentional resources in the second half, resulting in lower fluency. Thus, the second hypothesis, (b) their fluency will be maintained or even improved despite the gain in accuracy, was partly confirmed: That is, less fluent speakers showed some tendency to improve in fluency while they maintained accuracy.

The results might have touched upon the interaction phenomena between fluency and accuracy in the process of implicit learning. The findings suggest the existence of short-range dynamic phenomena involving implicit learning, which phenomena can be easily overlooked in long range analysis.

VII. Conclusion

An information-gap task was conducted for beginner-level learners of English under time pressure. Their performance was divided into the first half and second half based on the number of turns. Dependency on explicit knowledge was expected to result in changes following the trade-off relationship. On the other hand, priming effects were expected to result in changes in fluency and accuracy free from the trade-off relationship.

Analysis of the whole data indicated no change in fluency or accuracy. However, further analysis in the divided groups revealed that faster interlocutors tended to slow down and slower interlocutors showed some tendency to speed up in the second half of the dialogue. Accuracy exhibited no change in either group. In other words, fluency showed some gain without a negative impact on accuracy free from trade-off relationship in the slower group. This indicates the release of some extra attentional resources, suggesting that the effects of priming played a role during the dialogue. Some limitations of this study must be mentioned. The proficiency levels of the two classes were not confirmed directly in the experiment. The length of each dialogue was relatively short, which restricted the data segmentation to two: the first half and the second half. This made it impossible to observe changes over a longer course of time. Despite these limitations, the findings from the present study suggest the existence of short-range dynamic phenomena involving implicit learning, which can be easily overlooked in long-range analysis. For more observation and understanding of

the phenomena during a dialogue, further study is needed with longer conversation time as well as a larger gap in accuracy.

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Appendix A

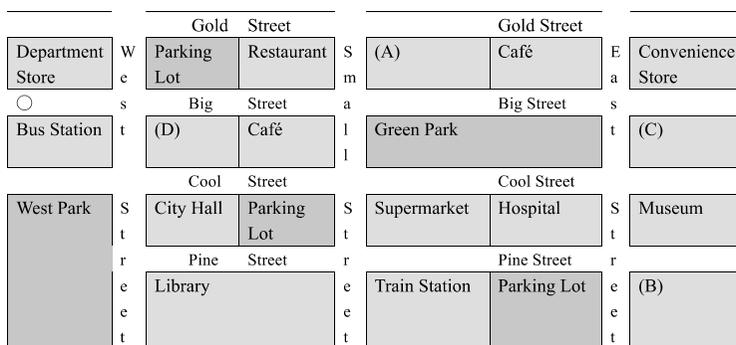
Pictures used in the Showing-the-way task

Card A

次の場所を英語でたずねて、その位置の記号を解答欄に記入しましょう。

Could you tell me how to get to ...

- (1) Shopping Mall ()
- (2) Book Store ()
- (3) Movie Theater ()

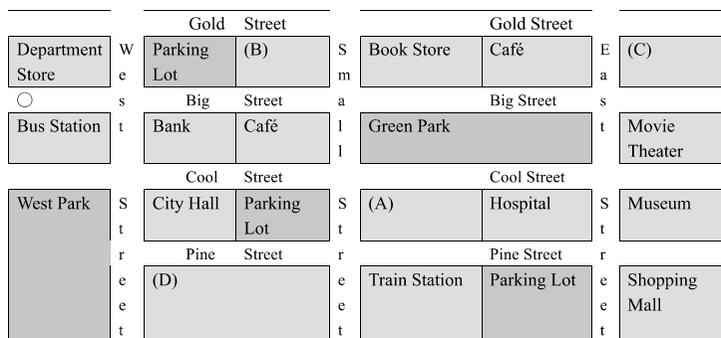


Card B

次の場所を英語でたずねて、その位置の記号を解答欄に記入しましょう。

Could you tell me how to get to ...

- (1) Supermarket ()
- (2) Convenience Store ()
- (3) Restaurant ()



Appendix B

Pictures used in the main task



Picture A



Picture B



Picture C