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An Empirical Investigation into the Facilitating Role of Automatized Lexical Phrases in Second Language Fluency Development

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Abstract

This paper presents an empirical study of the role of automatized lexical phrases in the development of second language speech fluency. The construct of fluency is defined in terms of temporal variables of speech which include the speed of production, amount of pausing, and the length of fluent runs of speech between pauses. As well, lexical phrases, multi-word units of speech stored in memory and retrieved as if they were single words, are discussed in terms of the mental processes underlying fluent speech production. In the present study, the possibility that automatic retrieval of lexical phrases is important in the development of spontaneous speech production in a second language was empirically tested. Four speech samples, collected over the course of two months, of six learners of English as a second language were examined for evidence of the role of lexical phrases in facilitating increased fluency. The results indicate that fluency increased as measured by temporal variables, and that lexical phrases played a role in the increase.

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1. Introduction

Second language (L2) speech fluency is a language performance phenomenon which, while integral to effective communication and ability to thrive in an L2 milieu, is not particularly well dealt with by the language teaching profession. Unfortunately, many L2 learners grapple with the effects of compromised fluency long after completing basic L2 training. As well, L2 teachers and assessors tend to bypass the facilitation of fluency and focus instead on language accuracy and a hope that input and practice will help learners to speak "more smoothly." This is generally because fluency is a challenging construct whose psycholinguistic foundations and place in the language curriculum have not been investigated or discussed fully. The present study is intended to investigate the nature of fluency development in an effort to further our understanding of this important element of L2 performance, so instrumental for effective communication, yet so marginalized in the language curriculum. This study investigates the role of formulaic language and psycholinguistic processes in the development of speech fluency in a second language. The monologic speech of six learners of English as a second language was sampled four times over a 13-week period and analyzed for evidence of the part that automatization of formulaic language or lexical phrases played in speech fluency development.

1.1 The Current State of Knowledge about Speech Fluency Development

Research to date on fluency has largely focused on temporal variables of speech, namely, speed, repairs, amount and frequency of hesitation, location of pauses, and length of runs of fluent speech between pauses (Raupach, 1980; Möhle, 1984; Lennon, 1990A, 1990B; Riggenbach, 1991; Freed, 1995; Towell, Hawkins & Bazergui, 1996; Hansen, Gardner & Pollard, 1998). There is some tentative research which indicates that the key to speech fluency lies in the automatization of a repertoire of formulaic speech units, sometimes called lexical phrases (LP), multi-word strings or frames which are retrieved from long-term memory as if they were single words (Chambers, 1998; Nattinger and DeCarrico, 1992; Towell et al, 1996). They are automatized, or embedded in memory, so as to be used without need for conscious effort, control, or short-term memory use. Research on formulaic language units has rich potential for helping to explain how spontaneous speech can occur under the heavy processing and time constraints of real-life discourse (Miller and Weinert, 1998; Skehan 1998; Weinert, 1995; Wray and Perkins, 2000). It appears that a majority of everyday spontaneous speech is

formulaic (Pawley and Syder, 1983).

1.2 The Need to Research Lexical Phrases and Temporal Aspects of Fluency

A gap exists within the current body of knowledge between the work focusing on temporal correlates of fluency and that which describes LP's and infers their role. There is a need for empirical investigation into how LP automatization might contribute to fluency. This study investigates fluency development and LP automatization analysis of the by linking developments in the temporal aspects with use of automatized LP's. Four speech samples of six learners over a 13-week period are analyzed for key temporal variables and the role of automatized LP's.

2. Literature Review

Work which investigates fluency must take into account a relatively rich body of previous investigation which falls into three categories: empirical study of the temporal correlates of fluency; psycholinguistic models of the cognitive processes underlying speech production; research and theorizing relating to formulaic language in general and lexical phrases in particular.

2.1 Research on Temporal Variables

Defining fluency repeatedly leads us back to the study of temporal variables in speech, such as speed, pauses, hesitations, fillers, and so on. Empirical research focusing on fluency has generally involved the elicitation of a speech corpus and analysis of temporal and qualitative aspects of the productions. Some studies have attempted to link clusters of performance variables with rater assessments of fluency (Lennon, 1990; Riggenbach, 1991; Freed, 1995), while others have compared first and L2 speech performance (Deschamps, 1980; Raupach, 1980), or conducted longitudinal examinations of the development of L2 spoken fluency (Dechert, 1980; Towell, 1987, Lennon, 1990A, Hansen et al, 1998). Across all of the studies of spoken fluency there has been agreement on the temporal variables which link closely to fluency, namely, rate of speech, pauses, length of fluent runs between pauses.

2.1.1 Rate of Speech

Speed or rate of speech is fundamental to a perception of fluency. As measured by words or syllables uttered per minute or second, it seems to improve along with other measures of fluency (Möhle, 1984; Towell, 1987; Towell et al, 1996; Freed, 1995) or to correlate with judges' perceptions of fluency (Riggenbach, 1995). Unfortunately, however, the awareness that speech rate relates to fluency gives us little information about what fluency really is, or how we can assist learners to speak faster.

2.1.2 Pause Phenomena

The most complex and one of the most informative elements of fluency studied so far is in the area of pause phenomena. This is where the rather impressionistic notions of "smoothness" and "naturalness" appear to be based in fact. Two aspects of pausing have been studied, namely, frequency and placement. Studying total pause times and frequencies has yielded some relevant results in comparing first and second language speech (Möhle, 1984), and studies which examine this temporal feature of speech over time show reductions in total time spent in pausing (Towell, 1987), or in unfilled or silent pause times (Lennon, 1990A). Riggenbach (1991) found that unfilled pause frequency was an important discriminator between subjects rated as highly fluent and those rated as less so by judges. Freed (1995) found that learners who had spent time abroad living in a target language milieu exhibited shorter and fewer silent pauses than those who had not.

Pause location is an even more salient variable to study if one wishes to understand how fluency works. Empirical researchers who have examined pause locations and fluency have generally found that syntactic location of pauses is a very strong indicator (Dechert, 1980; Deschamps, 1980; Lennon, 1984; Riggenbach, 1991, Freed, 1995). It appears that highly fluent L2 speakers and native speakers tend to pause at sentence and clause junctures, or between non-integral components of clauses and clauses themselves. Pausing at other points within sentences gives the impression of disfluency.

What does this information about pause locations tell us about speech production? It has been posited that there is a pattern of pausing in first language speech which is a natural consequence of the weight of psycholinguistic processing needed to produce speech. Pawley and Syder (1983) state that the norm for native speakers is to slow down near clause boundaries after four to ten consecutive words, and only rarely in mid-clause. An average of 270 to 300 syllables per minute are produced, and over 50% of fluent units are complete grammatical clauses. Pauses of less than two seconds are the norm between clauses and it is rare to pause more than .5 seconds in mid-clause, generally for emphasis or to breathe. Chafe (1980) states that first language speech occurs in two-second spurts of an average of five words each, with pauses appearing at these junctures, usually after a single clause, and marked by an intonation contour. Pauses serve a blend of rhetorical and syntactic functions in speech, as human consciousness and awareness activate small chunks of information and formulate speech to encode them. L2 speech is characterized by disfluent pause distributions likely because of the difficulty of formulating and encoding.

2.1.3 Length of Fluent Runs

The final and most salient variable associated with fluency is the length of runs of speech occurring between pauses. Research comparing first and second language speech has found shorter runs between pauses in L2 speech (Raupach, 1980; Möhle, 1984), and longitudinal research has found the runs increasing over time (Towell, 1985; Lennon, 1990B; Towell, 1995). Freed's 1995 study of learners who spent time abroad found a trend in the direction of longer runs in their L2 speech than in that of learners who remained at home. Why would the results of these studies be so? The answer likely has to do with the need to balance skills, attention, and planning during speech and the fact that advanced and fluent speakers have a greater repertoire of automatized chunks of language to use in order to buy time to formulate the next sentence or clause. In fact, an increasingly skillful blend of automatized chunks of formulaic strings and frameworks of speech, together with newly assembled strings of words, is what enables speakers to produce the longer runs between pauses which distinguish fluency. The proposed study will test whether this is so.

3. Automatic Processing and Fluency

Key to this entire process are the workings of mental processes and skills, combined with the use of formulaic language units.

The psycholinguistic concepts of automatic and controlled processing provide a conceptual framework which can explain many of the empirical phenomena described above. There is a body of literature which focuses on the distinction between automatic and controlled processing (Anderson, 1983; Levelt, 1989; McLaughlin, Rossman, and McLeod, 1983), in which it is posited that automatic processing causes certain nodes of memory to activate every time certain appropriate types of input occur. Consistent activation in a certain pattern by the same type of input over time leads to a learned, automatic process. This process is extremely rapid, and requires little or no effort or attention. It also helps to compensate for the limitations of short-term memory capacity, by allowing direct access to and retrieval from long-term memory. On the other hand, controlled processing is described as a response in which attention by the subject or speaker is required. Schmidt (1992: 360) categorizes the two processing styles as differing as to a number of important characteristics:

Automatic Processing	Controlled Processing
fast and efficient	slow and inefficient
effortless	effortful
not limited by short-term memory	limited by short-term memory capacity
not under voluntary control	under subject control
inflexible	flexible
inaccessible to introspection	at least partly accessible to introspection

In fluency research over many years it has been determined that automatic and controlled processing are a vital part of an explanation of how fluent speech occurs. Specifically, it appears that automatization of elements of language enables speakers to achieve the speed and pause patterns which characterize fluent speech. Levelt (1989) elaborates a model of language production which includes notions of automatic and controlled processing within a framework of conceptualizing, formulating, and articulating speech. This model has been used in fluency research to explain in part how formulaic language units may be automatized and retrieved at the point of formulation (Towell et al., 1996). Research into fluent performance in other language abilities, such as reading, also indicates that automatic processing is key (Segalowitz, 2000).

4. Formulaic Language Units in Use

A growing body of work indicates that formulaic language units themselves can be stored as automatized units in memory. Peters (1983), in a highly influential work on the role of formulas in acquisition, reports that some errors which occur in language acquisition indicate that multi-word sequences can be stored in units the same way as individual lexical items. Generally, the formulas tend to exhibit more phonological coherence than other utterances, be longer or more complex than the rest of the output, include syntactic structures which do not appear to be used in the rest of production, and to be invariate in form (Coulmas, 1979; Hickey, 1993; Miller and Weinert, 1998). Wray and Perkins (2000) note that a key characteristic of formulaic sequences is their frequent syntactic irregularity; for example, phrases such as 'by and large' and 'go whole hog' defy the rules of syntax and are holistic items similar to idioms and metaphors.

While some linguists such as Pinker (1994) still hold that creative construction of utterances is the paramount feature of all language use, it appears fairly certain that utterances of spontaneous spoken language contain phrases and clauses which have been stored as wholes. These are used in combination with creatively constructed stretches of language. Miller and Weinert (1998:394) state that '...we are not saying that the entire set of spontaneous spoken utterances consists of prefabricated chunks ... only that they contain a proportion of prefabricated chunks that ease the encoding and decoding load.' It is likely that the basis of fluent speech is an intricate interweaving of formulaic and newly constructed segments.

The pervasive nature of formulaic language units has been extensively documented. Nattinger and DeCarrico (1992:1), in a highly influential work discussing formulaic units called lexical phrases, define them as 'multi-word phenomena that exist somewhere between the traditional poles of lexicon and syntax, conventionalized form/function composites...', these units or patterns of lexical items and phrases provide frames and strings to help build sentences and increase speed of speech. Chambers (1998) finds that these formulaic language units are what allows learners to increase the length of fluent runs between pauses:

> These phrases...focus the attention of the listener while allowing the speaker time to formulate the utterance further. What appears to enable listeners to produce longer speech units is the increasing use of automatized chunks or clusters of words combined with newly assembled strings of words...these productive lexical and syntactic phrases are of particular value to foreign language learners and can enhance their fluency by providing a frame to build a sentence as well as approaching the characteristics of native-like speech. (Chambers, 1998; 542)

Automatized repertoires of such chunks and clusters seem to be key to fluent speech. This knowledge can take us far in the direction of teaching fluency.

Formulaic language units or formulae of these types likely are retrieved at many points in the planning and execution of speech. Dechert (1984) observed that the most fluent German students of English, required to retell a narrative in their second language in his study, appeared to establish 'islands of reliability' of ideas and language, around which they pieced together a spoken narrative. Sajavaara (1987), in a reflection on a wide range of factors affecting second language speech, observed that a concept or a single lexical item could trigger the release of other lexical items and phrases:

> A "word" activates, for example, certain frequent and prefabricated phrases, word combinations, grammatical constraints, selectional restrictions, semantic concepts and fields. (Sajavaara, 1987: 54)

A store of many aspects of conceptual items and links, lexical items, phrases, and patterns of language and ideas can be activated by stimuli in the input or the context. Automatized strings of language can then be generated appropriate to the ideas linked to the stimuli, while more specific items and constructions can be placed with or within the formulae. In this way, fluent speech is generated.

It seems more and more evident that fluency lies to a great extent in the control of large numbers of formulaic language units and sentence stems, at least in English, a relatively uninflected language. Pawley and Syder (1983) refer to the need for mastery of a body of lexicalized sentence stems:

> A lexicalized sentence stem is a unit of clause length or longer whose grammatical form and lexical content is wholly or largely fixed; its fixed elements form a standard label for a culturally recognized concept, a term in the language. (Pawley and Syder, 1983: 191)

Thus, a string or frame is needed which links to the concept or part of the concept to be expressed. These prefabricated pieces are to be strung together in a way appropriate to the communicative situation. As needed, attention and energy in the speech run is used to plan larger stretches of speech. A great proportion of the most familiar concepts and speech acts can be expressed formulaically, and, if a speaker can pull these readily from memory, if they are automatized, fluency is enhanced. This reduces the amount of planning, processing, and encoding needed within clauses. It gives the speaker time to pay attention to the multitude of other tasks necessary while speaking, such as generating specific lexical items, planning the next unit of discourse, syntactic processing of novel pieces, and so on.

5. Conceptual Framework

The research is framed by two theories of types which are common in studies which examine language development over time - a theory or model of language production, and a theory or model of language development. In addition, the research is guided by hypotheses drawn from the temporal research on fluency, integrated with the two main framing theories.

The model of production is that of Levelt (1989), which represents two kinds of knowledge: declarative and procedural. Declarative knowledge is knowledge "that," or knowledge about the world, while procedural knowledge is knowledge "how," or that which underlies skilled behavior. Levelt argues that for reasons to do with the nature of working memory and the speed with which speech is usually produced, fluent speech requires procedural knowledge. Production requires procedural knowledge in three categories: conceptualizing; formulating; articulating. Each of these functions by accessing different kinds of declarative knowledge. The formulation stage of production involves taking the declarative knowledge of the information to be expressed (encyclopedic knowledge), of the situation, and of how discourse is organized, and giving it an acceptable grammatical form, mapping on lexical items at the same time, and passing it all on to the phonological part of the formulator. There, a phonetic plan is developed and the speech is produced. The operations of the formulator are proceduralized and allow no "feedback" between stages, so that speed requirements can be met.

The model of development here is basically that of Anderson (1983) and his Adaptive Control of Thought (ACT*) model of cognitive development. The model contains three memory stores, of which two are long-term stores, and one, working memory, a limited- capacity one. Both the long-term stores have to deal with the outside world via the working memory. For behavior which requires rapid performance, such as speech production, conversion of declarative knowledge into procedural is essential. This is because working memory has a very limited capacity, and declarative knowledge requires attention and takes up too much "space" than knowledge which does not require the attention of the speaker. Procedural knowledge, on the other hand, does not require attention and can be processed by working memory in larger units without running out of working memory capacity.

Another reason why speech performance requires procedural knowledge is the way in which declarative and proceduralized knowledge are stored and accessed. Knowledge stored as declarative is retrieved by "interpretive" mechanisms, which are under the control of the user and are flexible, but because of the nature of working memory, only small amounts can be dealt with at a given time. Retrieval of these types of knowledge would be far too slow for spontaneous speech to occur. On the other hand, procedural knowledge consists of units called "productions" and takes the form of "if/then" kinds of match and execution sequences. In this way, an entire production sequence can be accessed instantly, reducing greatly the strain on working memory. These units of production are inflexible, however, and must be recalled as single units without modification.

Lexical phrases can be seen as "productions" in the Anderson sense. Presumably, they can be proceduralized or automatized, and play a key role in allowing fluent speech to occur under the constraints of real time. Therefore, their automatization should be the main cause of the changes over time in the temporal variables of speech documented by researchers.

Hypotheses can be generated, then, by integrating temporal variables with the Levelt model. To do so, it is necessary to look at speaking rates and interpret them in relation to aspects of the model. Three measures can indicate that more knowledge has been proceduralized: increases in overall speaking rate (SR), measured as syllables uttered per second of overall speech time; increases in articulation rate (AR), measured as syllables uttered per second of speech time excluding pauses; increases in phonation/time ratio (PTR), or the percentage of speech time taken up by actual speech as a proportion of total time taken to produce the speech sample. It is also possible to assume that an increase in the mean length of runs (MLR) over time is an indicator of increased proceduralization at the formulation stage of the model. However, it may be that this increase in MLR is attributable at least in part to greater time spent planning each utterance. But if this is true, then this planning would have to be occurring outside of the time during which speech is being produced, which means there would have to be more pauses, and/or longer pauses. Therefore, the temporal pattern which would probably result from increased proceduralization of knowledge would be: increased MLR, no increase in pause times - indicated by an increase in percentage of time spent speaking (PTS) - and increased speech and articulation rates.

As well, we can hypothesize that lexical phrases will play a key role in the development of fluency in this study, facilitating the increased mean length of runs.

At the surface, empirically observable level, then, we are hypothesizing that speech rate will increase over time, that the percent of time spent in speech will increase, and that the mean length of runs will increase. These comprise the set of quantitative hypotheses in the research. Underlying this set of temporal variables is the psycholinguistic foundation of fluency. Evidence of change at the surface level will be taken as evidence of increased proceduralization or automatization of knowledge in the formulation stage of speech production. The key linguistic element to be automatized is lexical phrases, which allow for the increase in mean length of runs in particular, and for a general facility in speech production.

Hypotheses:

1. Over time, L2 speech will exhibit a faster rate of production.
2. Over time, L2 speech will exhibit a greater amount of production time spent speaking as opposed to pausing.
3. Over time, L2 speech will exhibit longer runs between hesitations.
4. Over time, lexical phrases will appear more frequently in the longer runs between pauses.

6. Methodology

6.1 The Participants

The study was a longitudinal one, involving six high beginner level students of English as a Second Language (ESL) in an intensive English program at Carleton University, Ottawa, Canada. The participants were from three typologically different first languages (L1): Mandarin Chinese (SinoTibetan); Spanish (Indo-European); Japanese (Ural-Altaic). They were of both genders so that we had a male and female participant from each of the language groups. The participants were volunteers, initially from three different classes of roughly the same level in the program. Their names have been changed to two-letter codes for purposes of this report.

The Chinese speaking students were a 19-year-old male, QQ, from Beijing. At the beginning of the study QQ had only been abroad in Canada for three weeks, and had never studied abroad before. A student in China, he had studied English in the public education system there since middle school. The female Chinese speaker, SU, had been in Ottawa studying in Carleton's ESL program for two terms at the beginning of the study. She was 26 years old and a former office worker from Taipei, Taiwan. She had had no English training beyond public school.

Both Spanish speakers were from Venezuela. PA, a female 20 years old, had just recently arrived in Canada at the beginning of the study, and OL, the male Spanish speaker, was 18 years old and also newly arrived.

The two Japanese speakers were AT, a 22-year-old male, and RE, a 24-year-old female. Neither had had significant post-secondary school English language training, and both were newly arrived in Canada at the beginning of the study.

All of the participants were living in homestay situations with English-speaking Canadian families during the course of the study, the exception being QQ, who lived alone in an apartment owned by a relative.

6.2 The Data Collection

Data were collected on four occasions spanning two short summer terms at Carleton. One short six-week term ran from April 10, 2000 to May 19, 2000. The second term began May 29, 2000 and ran until July 7. A one-week break occurred from May 22 to May 26.

Speech samples were collected from all participants during the week of April 10, the week of May 8, the week of June 5, and the week of July 3. Therefore, samples were taken at regularly spaced intervals from the beginning of the first course to the end of the second.

The samples were elicited through the use of silent animated films. On each occasion, the participants were shown a silent film and instructed to retell the story on tape immediately after in the university's language laboratory. They were instructed to retell the story from the film spontaneously and not to take notes, rehearse, or to rewind or stop their tapes. Their speech samples ranged in length from as short as 87.3 seconds to as long as 487.7 seconds, or in excess of eight minutes. The films were selected to be of similar narrative complexity and length. Both were National Film Board of Canada productions of approximately eight minutes in length.

6.3 The Data Analysis

The taped speech samples were transcribed from a Sony hand-held tape recorder using Microsoft Word. The tapes were then recorded into SpeechStation2 speech analysis software, and a spectrogram and oscillogram produced for each. The visual representations of the speech were used to identify pauses and their duration; in determining the lower cut-off point for pauses, .3 seconds was chosen. Anything less than .3 seconds is easily confused in a spectrogram or oscillogram with other speech phenomena such as the stop phase of a plosive sound, and anything much longer can omit significant pause phenomena. Given that native speakers seldom hesitate longer than .5 seconds in mid-clause or 2 seconds at clause junctures, .3 seems a reasonable cut-off. As well, the tradition in fluency research has been to use .25 to .3 seconds as a lower end cut-off (Towell et al., 1996: 91).

After noting the time and duration of each hesitation, the transcripts were marked with the times and locations in parentheses where they occurred. From then, phonation/time ratio (PTR), speech rate (SR), articulation rate (AR), and mean length of run (MLR) were calculated for each participant. PTR was calculated by dividing the time spent speaking (excluding pause times) by the total time of the speech sample. SR was calculated by dividing total number of syllables uttered by the total number of seconds of recording time, including pauses. AR was calculated by dividing total syllables uttered by the seconds of speech time only, excluding pause times. MLR was calculated by dividing the total number of syllables uttered by the number of runs between pauses. As well, lexical phrases were marked in the transcripts and the ratio of lexical phrases to runs (LP/R) was determined, to see whether the use of lexical phrases helped to facilitate changes in the temporal variables.

Three criteria were used for determining whether a sequence was a lexical phrase. First, the taxonomy used by Nattinger & DeCarrico (1992) provided an overall guide for selection, as sequences from the transcripts were matched to the categories elaborated by Nattinger & DeCarrico:

> 1. Syntactic strings are strings of category symbols, such as 'NP+Aux+VP'. Which are generated by syntactic competence and which underlie all grammatical (canonical) structures of the language.
> 2. Collocations are strings of specific lexical items, such as rancid butter and curry favor, that co-occur with a mutual expectancy greater than chance. These strings have not been assigned particular pragmatic functions by pragmatic competence.
> 3. Lexical phrases are collocations, such as how do you do? and for example, that have been assigned pragmatic functions...
>
> (Nattinger and DeCarrico, 1992: 36)

Nattinger & DeCarrico go on to refine these categories to include polywords, institutionalized expressions, phrasal constraints, sentence builders, topic markers, discourse devices, and macro-organizers. A second criterion applied was

that of phonological coherence. Coulmas (1979) outlines conditions which need to be met if a sequence is to be considered formulaic. Two conditions, that the unit must be at least two morphemes long and cohere phonologically, are identified as necessary for formulaicity. Utterances which are formulaic, then, are polymorphemic and produced without internal hesitation or pausing. Similarly, Peters (1983), in an effort to elaborate criteria for identifying formulas in learner language, focuses on phonological coherence. Therefore, polyword sequences which are uninterrupted by pauses or fillers are tagged in the transcripts as lexical phrases. A third criterion, also pointed out by Coulmas and Peters, is greater length and complexity than other output. Sequences which match the Nattinger and DeCarrico categories, are phonologically coherent, and appear more complex than the rest of the output are lexical phrases.

7. Results

Results for each participant for speech rate (SR), articulation rate (AR), phonation/time ratio (PTR), mean length of run (MLR), and lexical phrase/run ratio (LP/R):

7.1 Numerical Tables

Table 1: Speech rate

Sample 1	Sample 2	Sample 3	Sample 4
PA 1.6	1.8	1.9	2.0
OL 1.7	1.8	2.2	2.5
AT .9	1.5	1.3	.9
RE 1.5	2.0	2.2	1.8
QQ 2.7	1.9	2.0	2.1
SU 1.8	2.1	2.2	2.1
TOTAL 2.4	2.3	2.0	1.9

Table 2: Articulation rate

Sample 1	Sample 2	Sample 3	Sample 4
PA 2.6	2.7	2.8	3.0
OL 2.5	2.8	3.0	3.1
AT 1.6	2.2	2.1	2.0
RE 2.1	2.7	2.7	2.6
QQ 4.6	3.2	3.1	3.0
SU 2.9	3.3	3.3	2.9
TOTAL 2.5	2.9	2.9	2.8

Table 3: Phonation/time ratio

Sample 1	Sample 2	Sample 3	Sample 4
PA 59.9	66.2	67.1	67.6
OL 68.4	65	72.5	79
AT 59.9	67.3	60.1	46.3
RE 68.1	73.6	80.3	70.6
QQ 59	60.8	63.9	69.4
SU 61.8	65.6	67.1	72.2
TOTAL 62.8	66.3	68.4	67

Table 4: Mean length of run

Sample 1	Sample 2	Sample 3	Sample 4
PA 3.4	4.0	4.3	4.7
OL 3.9	3.7	5.0	7.1
AT 3.1	3.8	3.3	2.4
RE 3.9	4.6	6.0	4.2
QQ 4.1	3.6	3.7	4.5
SU 4.2	4.7	4.8	5.2
TOTAL 3.7	4.2	5.6	4.7

Table 5: Lexical phrase/run ratio

Sample 1	Sample 2	Sample 3	Sample 4
PA .18	.23	.23	.37
OL .20	.28	.32	.52
AT .17	.26	.28	.15
RE .29	.33	.57	.32
QQ .31	.22	.29	.15
SU .40	.22	.37	.38
TOTAL .24	.25	.34	.33

The data reveal that a general trend exists toward confirmation of the four hypotheses:

1. Over time, L2 speech will exhibit a faster rate of production.
2. Over time, L2 speech will exhibit a greater amount of production time spent speaking as opposed to pausing.
3. Over time, L2 speech will exhibit longer runs between pauses.
4. Over time, lexical phrases will appear more frequently in the longer runs between pauses.

7.2 Hypothesis 1: Speech Rate Increase

Hypothesis number one holds that speech rate will increase. As measured by SR and AR in the data analysis here, we can see that a clear trend toward increased rate appears for two of the participants, the two Spanish L1 students, both of whom show a regular increase in SR and AR across the four samples. Two other participants show increases in SR and AR over the first three samples, but regressing to slower rates in the fourth sample. These two participants are RE and SU, the Japanese and Chinese-speaking female students. The other two participants, AT, the Japanese L1 male, and QQ, the Chinese L1 male, show no particular trend over the four samples, with AT showing increased SR and AR from the first to second trials only, and QQ actually producing slower speech over time. When the syllables uttered and speech times are totaled for all six participants, we see that SR actually decreased over the four samples for the group, while AR increased slightly from sample 1 to sample 2, stayed constant for sample 3, and dropped slightly for the fourth sample.

The two Spanish L1 speakers were the ones who increased their overall speech rate the most fully and consistently in this study. As native speakers of an Indo-European language with close lexical cognates to English, perhaps they were at a certain advantage over the Asian language speakers in this group, as vocabulary items and phrasing are likely close in many speech contexts. As well, they are at a shorter cultural distance as newcomers to mainstream Canada, being of a basically European background. This may make them high input generators in their interactions with local native speakers of English.

Both RE and SU, the Asian language female participants in the study, show increases in SR and AR over the first three samples, but not for the fourth one.
AT, the Japanese L1 male participant, shows difficulty in the first and the fourth samples as far as speech rate is concerned. In fact, AT had the most difficulty of all the participants throughout, his speech being characterized by a great deal of filler noise and unfinished fragments. There is a significant increase in speech rate measures for AT from his first to second samples, but the second, third, and fourth samples show no particular trend, with the fourth sample being produced little faster than the first.

QQ, the Chinese male L1 participant, actually shows reduced speech rate over the four samples as measured by SR and AR. His speech samples are also by far the shortest of the group. QQ was the only participant in the study who had little contact with native L1 English outside of his studies; he was the only one who did not live in a homestay, and likely was exposed to comparatively less English in actual conversational use than the other participants here. That could have affected the rate of increase of fluency as measured by speech rate.

7.3 Hypothesis 2: Increases in Speaking Time as Opposed to Pausing Time

A stronger case exists here for increase in proportion of time spent speaking as opposed to pausing, measured as PTR. It appears that, for most participants, the total proportion of pause time decreased fairly significantly over the course of the four speech samples. PA and OL, the Spanish L1 students, show consistent reduction in pause time over the course of the four samples, as do QQ and SU, the Chinese L1 participants. QQ shows a remarkable 17.6% increase in proportion of time spent speaking from Sample 1 to Sample 4, and SU a 16.8% increase. As well, RE, the Japanese L1 female participant, shows a strong 17.9% increase from Sample 1 to Sample 3, then regresses for the fourth sample, generally a weak performance for her. The total group PTR score shows an increase of 6.7% across the four samples, despite a reduction from sample 3 to sample 4.

The outlier here is AT, the Japanese L1 male participant. AT shows a large increase in PTP from sample 1 to sample 2, but his PTP score decreases from sample 2 through sample 4 to the point where he actually is hesitating 22.7% more in the fourth sample than in the first. As previously discussed, AT struggled to express himself in all of the samples, and sample 4 was a particularly difficult one for him. Unlike RE, the Japanese L1 participant, who showed a decrease in PTP for sample 4 as well, AT shows no overall trend toward an increase in PTP over the time of the study.

7.4 Hypothesis 3: Longer Runs Between Pauses

A key measurement of fluency is the mean length of runs between pauses. In this study, MLR shows a general trend toward longer runs, with some significant exceptions.

The two Spanish L1 participants, PA and OL, show a clear and distinct trend toward increased MLR across the time of the study. PA shows an increase each sample over the previous one, and sample 4 shows a 38% increase in MLR over sample 1. OL is the strongest performer in terms of MLR in the study; his samples each show a substantial increase in MLR, and he ends up with a very large 82% increase in MLR in sample 4 as compared to sample 1. SU, the Chinese L1 female student, also shows a clear improvement in MLR for each sample over the previous one, although less dramatically that either of the two Spanish L1 students. As well, RE, the Japanese L1 female student, shows a clear and strong improvement in MLR from samples 1 through 3, but produces shorter runs overall in sample 4. From sample 1 through 3, however, she shows an

increase in MLR of 53.8%. In total, the group shows an MLR increase of 27%, with sample 4 having a lower score than sample 3.

The two exceptions to the MLR increase trend are AT, the Japanese L1 male, and QQ, the Chinese L1 male. Neither shows any particular trend as regards MLR over the four samples, with AT actually showing a lower MLR for sample 4 than for sample 1. Why the MLR scores show no improvement for these two males is unclear, especially since QQ showed a strong increase in PTR over the course of the study. It is likely that he paused for shorter durations, but just as frequently. This might also explain his lack of increase in speech rate as measured by SR and AR.

7.5 Hypothesis 4: Lexical Phrases Will Appear More Frequently

The number of lexical phrases appearing in a transcript, divided by the total number of runs in the sample, produces the lexical phrase/run ratio, or LP/R. Here we can see rough evidence of a facilitating role for lexical phrases in the increase in fluency as measured by the temporal variables of SR, AR, PTR, and MLR. As with all of the data in this study, there are clear differences in the performances of the participants on this measure.

Again, the Spanish L1 participants showed a strong increase in LP/R. PA increased from .18 to .37 from sample 1 to sample 4, and OL from .20 to a remarkable .52. The other two participants to show an increase in LP/R are the two Japanese L1 participants. At shows an increase of from .17 in sample 1, to .28 in sample 3, with a decrease for sample 4. Similarly, RE increased from .29 in sample 1 to .57 in sample 3, but also decreases sharply for her fourth sample. Neither of the two Chinese L1 participants show and trend in LP/R, with QQ actually showing a decline across the time of the study. Overall, the group shows an increase in LP/R of 37.4% from sample 1 to sample 4. The fourth sample has a lower LP/R than sample 3.

8. Discussion and Conclusions

The overall result here is that most of these ESL students showed an increase in speech fluency over the 13-week period of the study, in most of the temporal measures. As well, there is some evidence of a facilitating role for automatized lexical phrases. While the increases in fluency by the measures used in this study are not uniform across the six participants, it appears that a case can be made for the influence of lexical phrases in the development of fluency in spontaneous speech in a second language. The four hypotheses tested are confirmed, and the need for more in-depth research of this nature is indicated.

It is interesting that no strong gender difference in fluency development exists among the participants in this study. Two of the males, At and QQ were exceptions to the trends on some measures, but two of the females, RE and SU, also were exceptions to the norm on some measures. Generally, though, the gender of the participants does not appear to have affected the results of this research.

The role of L1 on the performance of the participants is clear here. Both of the Spanish speakers show consistent and strong improvement over time on all measures of fluency in this study. Neither PA nor OL were the strongest on any measure at the first sample in the study, but both of them were at the top of the field as of the fourth speech sample. L1 influence may have helped them, as they are native speakers of a typologically similar language to English, which likely makes the workings of English fluency a matter of transfer of temporal aspects of speech such as clause-boundary pausing, as well as strategic aspects such as use of fillers and fluency devices such as "well," and "so."

The two Japanese L1 participants here were clearly more challenged by the task involved, and their progress is harder to discern. RE shows strong improvement in PTR, MLR, and LP/R over the first three speech samples, but she declines on all measures on the fourth sample. This may be a result of fatigue and distraction during the fourth sampling. AT, on the other hand, shows few real trends on any measure except PTR and LP/R, and those only for the first three speech samples. A unique aspect of AT's performance over time is that despite fluctuations in SR, AR, PTP, and MLR, he shows a distinct improvement in LP/R over the first three samples. It appears he uses more LP's over time, but that his fluency is still compromised. AT's speech samples are full of filled pauses and filler noises such as "uh," "mm'" drawled syllables, and repetitions of fragments. This speech style is clearly not conducive to overall fluency, even if one tends to use LP's. It is interesting to note that LP/R is the measure which shows improvement for both Japanese L1 participants. Perhaps they segmented LP's from input and tried to use them consciously, which might have enabled some increases in PTR and MLR, as we see in their results, but little improvement in SR or AR; more controlled types of processing of LP's would not necessarily show up in speech rate data, but might help with length of runs and amount of overall pause time.

The two Chinese students are equally puzzling here. QQ actually shows declines over time on some measures, but shows a clear and strong improvement of 17.6% in PTR over all four samples. He may not be using LP's to push his fluency forward, but automatizing other aspects of performance such as individual lexical items and syntax. The lack of corresponding improvements in SR and AR makes it unclear whether that is the case or not. SU is also a difficult case to understand. She shows overall progress on all measures except for LP/R. Like QQ, she appears to improve in temporal aspects of fluency without using more LP's.

All in all, this study provides some evidence of the role of automatized LP's in L2 fluency development. Most learners improved on most temporal measures of fluency, and there is preliminary evidence of a role for automatized LP's in

those improvements.

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