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The Application of the Less is More Hypothesis in Foreign Language Learning

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Abstract

The goal of this study was to test a foreign language teaching method inspired by Newport (1990)'s Less is More hypothesis. Computerized French language lessons were presented to 112 adults over two one-hour sessions. Learning trials were presented either in full sentences to resemble the adult learning environment, or in small phrases that incrementally increased in length to full sentences, resembling the steadily expanding processing capabilities of children. Trials were also ordered randomly or blocked such that multiple examples of the same objects and verbs were presented consecutively, in order to promote attention to individual words within those sentences. Language proficiency tests of vocabulary and grammar were administered after the lessons. The incremental and blocked conditions outperformed the randomly ordered full sentence conditions on the grammar measure. This outcome suggests that a teaching method based on Newport's Less is More hypothesis can be advantageous in learning a foreign language.

Keywords: adult language acquisition; constraints; starting small

Introduction

For many years, second language acquisition researchers and educators have been trying to sidestep the age effect problem in foreign language acquisition to help older children and adults reach a near native level of proficiency. Findings from this research demonstrate that (a) language is better learned at an earlier age, (b) despite numerous methods of explicit language instruction, older children and adult learners do not reach a native level of language proficiency, and (c) adults generally learn the word order and semantic aspects of language more quickly than children but usually never master the grammatical aspects (Newport, 1990). The demand for a solution to the age effect problem is essential to our multicultural society. A first step to solving this issue may be to investigate why young children are better language learners.

We suggest that second language educators may benefit from exploring developmental theories of language acquisition that (a) explain the robust findings of child-adult differences in language proficiency and (b) provide insight for methods of instruction to the second language teaching community. Developmental psychologists propose that the mind of a young child is more suitable for certain complex learning processes like language acquisition than is that of an older child or adult (Newport, 1990; Turkewitz & Kenny,

1982). Newport's Less is More theory explains that in the beginning stages of language learning, limited input helps children learn language (Newport, 1990). Young children's limited processing capacity and working memory only allow them to take in a small amount of the language heard around them, and as a result, they attend to limited language input such as individual words or morphemes. When learning a language, children must learn to map morphemes to specific meanings, and then combine those morphemes in original ways to create new sentences. Initial limited input may create the opportunity for children to analyze simple morphemes and create a small number of linguistic form-to-meaning mappings. When children's cognitive processes develop (working memory and processing capacity increase), they are then able to process more complex input, allowing them to learn the rules for combining morphemes in grammatical production. These cognitive processes fully develop around puberty (Newport, 1990).

The Less is More theory also explains why older children and adults do not learn language as well as young children. When older children and adults begin to learn language, they use their fully developed working memories and processing capacity to attend to complex sentences that contain multiple morphemes. From processing the complex input, adults (a) tend not to analyze individual morphemes but learn "frozen" combinations of multiple morphemes and (b) create many form-to-meaning mappings that are susceptible to noise. Out of the many possible morpheme mappings, only a few are correct, resulting in inconsistent and often incorrect language production. Therefore, adults do not learn the same morphological structure of a language as children.

Newport's research shows that late learners of ASL were more inclined to produce variable ungrammatical signs (Newport, 1990). Her theoretical explanation for these findings is the late learners immediately processed complex whole signs as units rather than analyzing the individual morphemes that make up a sign, encouraging the use of imitative unanalyzed signs. In contrast, the native and early learners of ASL used their developing cognitive abilities to process small parts of signs, enabling them to learn the individual morphemes and eventually produce original grammatically correct combinations of the morphemes.

Previous language learning studies found that initial limited exposure can be beneficial in learning the morphological structure of the language. Goldowsky &

Newport (1993) show that a computational model that has a filter restricting the amount of input when exposed to linguistic form-to-meaning mappings learns the correct mappings better than one without restrictions. Cochran, McDonald, & Parault (1999) demonstrate that restricting adults' language input by having them attend to an external working memory task or encouraging them to concentrate on small parts while being exposed to complex ASL morphology led to more consistent ASL production than did attending to the full complexity of the language. Kersten & Earles (2001) found that adults who were presented with an artificial language in small phrases that gradually increased in complexity performed better on vocabulary and morphology measures than did adults who were immediately presented with the full complexity of the language. These studies suggest that starting with limited input of language can facilitate learning.

Other research demonstrates learning benefits of a different approach to starting small. In particular, research on category learning has revealed that manipulating the order of learning trials, such that multiple examples of the same category are presented sequentially before exposing learners to the full range of variability in category exemplars, results in superior ultimate learning. For example, Sandhofer & Doumas (2008) show that manipulating the order of presentation so that children are presented with multiple examples of the same color category before introducing a new color led to better learning than did random presentation.

Additionally, Elio & Anderson (1981) introduced adults to two categories that differed on multiple attributes. The exemplars of each category were presented in either random or blocked order, in which multiple examples of the same category were presented before moving onto the next category. They found that learning the attributes of each category and generalizing new examples to the correct category were better in the blocked condition than the random condition.

These results suggest that blocking manipulations may function similarly to incremental presentation, encouraging learners to focus on the commonalities among members of an individual category and to ignore the variability associated with other, orthogonally-varying categories. Once learners acquire a basic vocabulary of individual categories, they may be in a better position to learn the more complex rules for combining those categories. Thus, teaching methods that encourage attention to simple information, and then gradually encouraging attention to more complex material, may be beneficial in learning the categories, and ultimately the structure, of language.

Present Research and Predictions

The present research tests the applicability of the Less is More hypothesis to second language learning by attempting to teach adults a foreign language using teaching approaches inspired by the theory. Adults participated in an unsupervised experiment consisting of two sessions of

French language lessons in which they watched short videos and heard French descriptions. Two different methods were used to encourage participants to initially focus on individual French phrases before attempting to learn the complex grammar of entire French sentences. First, consistent with the method used by Kersten & Earles (2001), some participants were initially presented with individual phrases that gradually increased in complexity as learning progressed, whereas others were immediately presented with entire sentences. Second, consistent with the methods of Sandhofer & Doumas (2008) and Elio & Anderson (1981), some participants were presented with learning examples in a blocked order that encouraged the acquisition of individual words within the sentences that accompanied the videos, whereas others were presented with learning examples in a random order. Crossing these two factors led to four between-subjects conditions.

The incremental random (IR) condition presented a set of French lessons initially in individual phrases that gradually increased to full-length sentences. First, participants viewed a set of videos and heard only the direct object that corresponded to the video in the French language. In the second phase, participants viewed similar videos but heard entire phrases (including the verb and direct object). In the final phase, participants viewed the same videos from the previous phases but heard the full complex sentences that consisted of subject, verb and direct object. The trials within each learning phase were presented in random order. We predicted that initially presenting the descriptions in individual phrases would promote the learning of individual words and their meanings. As longer phrases were presented, participants were expected to learn additional words as well as the rules for combining those words.

The incremental blocked (IB) condition presented participants with the French language in incrementally larger phrases as in the IR condition, but the order of presentation within each learning phase was blocked by similarity of object and verb. Similar to methods used in category learning, a block consisted of presenting two examples of the same object or verb sequentially before presenting a new object or verb. In the first learning phase, trials were blocked by similarity of object so that participants were presented with two trials containing the same object before moving onto a new object. In the second and third learning phases, in which participants heard verb phrases and full sentences, respectively, trials were blocked by similarity of verb meaning. The intention of blocking trials was to encourage acquisition of individual words within the speech stream. We predicted that both incremental and blocking manipulations would ultimately produce advantages in grammar acquisition.

The sentence blocked (SB) condition immediately presented the language in full sentences but in a blocked order similar to the IB condition. Even though these participants were not initially exposed to individual phrases, we expected that the blocked order of presentation would still encourage attention to individual words within the

speech stream, leading to better learning of those words and ultimately giving a grammar learning advantage to this group.

Emulating the adult learning experience, the sentence random (SR) or control condition was immediately exposed to the foreign language without restrictions. The SR condition viewed videos accompanied by full sentences in random order. Therefore, we did not expect these participants to focus on learning the individual morphemes or structure and do as well on the morphology measure as the other conditions.

Following the lessons were test trials assessing language acquisition. The measures of acquisition were vocabulary and grammar (word order and morphology) from the presented foreign sentences, as well as tests of inductive grammar, measuring the ability to extract grammatical rules and apply them to novel sentences. Although word order is a component of grammar, in this study it was measured separately from grammatical morphology. Performance on the vocabulary and word-order measures was predicted to be similar among all groups, as vocabulary and word order are generally acquired without difficulty in both adults and children. However, a disparity was expected in performance among conditions on both grammar measures that test participants' knowledge of morphology. The three experimental conditions (IR, IB, and SB) were expected to outperform the control condition (SR) in the measures of morphology.

Method

Participants

One hundred twelve native English speakers from Florida Atlantic University participated in this experiment. Only participants who reported in a language background questionnaire that they did not speak a Romance language and knew fewer than 30% of the French words on the vocabulary pre-test were included in the data analysis. The average age of the participants was 22.2 (SD = 4.6) years. Each participant was randomly assigned to one of the four conditions of the experiment.

Stimuli

French Language The stimuli included sentences of active and reflexive verb forms made up of high frequency French words. The French active sentences in the stimuli share similar structure to the English language. Each active sentence consists of a subject, action verb, and object. However, English and French languages have grammatical distinctions when conveying a reflexive action. In English, possessive pronouns are used to express a reflexive action, but in French, reflexive pronouns are used. The pronoun "se" is added and placed in front of the verb and definite articles describe the object rather than possessive pronouns. For example, a man brushing his hair is described as "L'homme se brosse les cheveux". If the "se" is omitted from the sentence, the statement changes the meaning to "The man brushes the hair," implying the hair of an object.

The word order of the French language is similar to English. Lesson and test trials were in French and only the instructions and examples of the tasks were in English.

Trials All trials were programmed into Superlab Pro 4.0 and displayed on computers. Each trial consisted of a video playing on the screen and a corresponding French description presented audibly through headphones. French text was not available. Each video consisted of an actor performing a specific action on him/herself or on an object. Six different actors performed the same actions in different contexts. A female native French speaker recited French descriptions into a recorder and the recordings were linked to correspond with the videos. Each trial was approximately 3 seconds in length.

Learning Trials Learning trials were designed to teach participants the semantics and grammatical structure of sentences using 8 verbs and 16 nouns. Lessons were made up of three learning phases. Each learning phase consisted of 32 trials that presented 4 examples of each verb (2 in the active and 2 in the reflexive form) and 2 examples of each noun. In the IR condition, phase 1 comprised 32 trials of videos accompanied by only the direct object description from the corresponding sentences, phase 2 consisted of 32 trials accompanied by the verb and direct object, and phase 3 comprised 32 trials with full sentence descriptions. The IB condition presented the same trials from the IR condition in blocked order. Phase 1 consisted of videos and direct object descriptions, ordered such that the trials with the same direct objects were presented one after the other. Phases 2 and 3 involved the exact trials from the IR condition, but ordered such that trials involving the same verb were presented one after the other, first in the active form then in the reflexive form. The SB condition consisted of three phases of trials with full sentence descriptions, but presented in blocked order similar to the IB condition. Participants in the control condition (SR) were exposed to trials with full sentence descriptions in random order identical to the last phase of the IR condition for all learning phases. See Table 1 for an illustration of the presentation of two learning trials between the groups.

Test Trials To measure participants' knowledge of the French vocabulary, a judgment task of 16 trials of videos and corresponding French sentences were presented. The correct trial included the appropriate object and verb description of the video, whereas the incorrect trial contained an incorrect noun or verb. The incorrect French sentences were taken from the learning trials but linked to an incorrect video from the learning trials entailing a different object or action.

As one test of participants' knowledge of French grammar, a word order forced-choice task for the active and reflexive sentences was administered. The word order task consisted of 8 trials. The correct trials resembled the learning trials, whereas the incorrect trials included videos

Table 1: Illustration of two learning trials for each condition.

Experimental Condition	Learning Phase 1		Learning Phases 2 & 3		
	Video	Audio	Video for 2 & 3	Audio Phase 2	Audio Phase 3
Incremental Random	woman sprays car	“la voiture”	Same as phase 1	“asperge la voiture”	“La femme asperge la voiture.”
	woman shakes bottle	“la bouteille”		“secoue la bouteille”	“La femme secoue la bouteille.”
Incremental Blocked	woman sprays car	“la voiture”	woman sprays car	“asperge la voiture”	“La femme asperge la voiture.”
	woman washes car	“la voiture”	woman sprays her face	“s’asperge le visage”	“La femme s’asperge le visage.”
Sentence Blocked	woman sprays car	“La femme asperge la voiture.”	woman sprays car	Same as Learning phase1	
	woman washes car	“La femme lave la voiture.”	woman sprays her face	“La femme s’asperge le visage.”	
Sentence Random	woman brushes her hair	“La femme se brosse les cheveux.”	Same as phase 1	Same as Learning phase1	
	woman cuts the ticket	“La femme coupe le billet.”			

from the learning trials linked to French sentences with incorrect word order.

The grammar forced-choice task assessed participants’ understanding of the morphological structure underlying the active and reflexive sentence forms. This task comprised 16 test trials. The goal of this task was to determine if the participants could correctly identify, discriminate, and link the active and reflexive sentence forms to the appropriate video. In other words, would participants learn to understand that reflexive actions are linked to reflexive sentences with the “se” pronoun and that active sentences (without the reflexive pronoun) are used to express actions on objects rather than to self? The correct choices consisted of videos with the correct corresponding French sentences resembling the learning trials. The incorrect choices included videos with incorrect grammatical French sentences of the active or reflexive forms.

The purpose of the inductive task was to assess participants’ ability to apply the learned French grammatical rules to new stimuli. First, there was a learning phase of 8 videos and sentences (4 active and 4 reflexive sentences), each presented twice. The intention of the learning phase was to introduce participants to new vocabulary. The testing phase consisted of a forced-choice task of 8 trials (4 reflexive and 4 active). The videos and French descriptions in the test trials were novel. In particular, a verb presented only in the active form during learning was presented in the reflexive form in testing. To succeed in the inductive task, participants had to use the grammar rules of verb forms extracted from the lessons to fit the video and description of the task. Since this was a forced-choice task, participants did not have to produce the verb; however, they had to decide which one of the provided sentences contained the correct verb form.

Procedure

The experiment consisted of two one-hour sessions. The first session entailed lessons and a vocabulary test. During the lessons portion, participants were instructed to view each video and listen to the French description. They were told to repeat the description after each trial. Participants viewed learning trials from each phase twice before moving on to the next phase, totaling 192 trials. Every participant was issued one-minute breaks after every 32 trials. Once the learning trials were all presented and another break was given, participants took the word-meaning test.

Two days later, the participants returned for the second session. First, participants viewed lessons identical to the third learning phase in session one, totaling 64 trials. After a break, participants completed the word meaning, grammar and word order measures. Following a final break, participants completed the inductive task, and then a short questionnaire on prior knowledge of the French language, concluding the procedure of the experiment.

Results

The results of this experiment are presented in Table 2. Each measure was scored as the percentage of the total correct acceptances and rejections out of the total number of test trials for each task. Analyses of the word meaning judgment task were split into two separate measures of verbs and nouns. A 2(noun vs. verb) X 2(1st session vs. 2nd session) X 2(incremental vs. sentence) X 2(block vs. random order) repeated measures ANOVA was conducted to investigate within and between group differences on word meaning measures. The results revealed a significant within-group difference between noun and verb learning, $F(1, 107) = 146.765, p < .001, MSE = 3.752$. Participants scored higher on the noun items than verb items of the vocabulary measures. However, there were no significant increment, blocking, or interaction effects on vocabulary (all $ps > .05$).

Table 2: Means (Standard Deviations) for Groups

Language Measures	Incremental Random n = 31	Incremental Blocked n = 25	Sentence Blocked n = 27	Sentence Random n = 29
Vocabulary				
1 st session nouns	.742(.21)	.613(.19)	.785(.18)	.830(.13)
2 nd session nouns	.811(.13)	.825(.16)	.810(.18)	.806(.20)
1 st session verbs	.612(.19)	.567(.18)	.638(.20)	.625(.24)
2 nd session verbs	.641(.16)	.610(.18)	.690(.18)	.586(.21)
Word order	.879(.14)	.930(.09)	.912(.12)	.897(.12)
Grammar (based on trials from lessons)	.621(.14)	.655(.13)	.683(.18)	.586(.13)
Inductive grammar (based on trials from inductive task)	.605(.20)	.640(.18)	.644(.25)	.543(.24)

A two way ANOVA was conducted on performance that tested participants' knowledge of word order for the active and reflexive French sentences. The results revealed no significant main or interaction effects on word order performance (all $ps > .05$).

Analysis of the grammar measures was conducted using three planned orthogonal contrasts. The first contrast compared the control participants (SR) to the three experimental conditions, examining whether manipulations that promote attention to low-level sentence elements promote acquisition of French grammar. The second contrast compared the IB condition to the IR and SB conditions, examining whether receiving both manipulations yields better knowledge of French grammar than receiving just one. The third contrast compared the incremental IR condition to the SB condition, examining whether one manipulation promoting attention to low-level sentence elements yielded better knowledge of French grammar than the other.

The first of these three contrasts was significant, indicating that the three experimental conditions scored significantly higher on the grammar tasks than did the control condition ($p = .023$). However, the other two contrasts were not significant (both $ps > .05$). These results suggest that the increment or blocking methods produced better performance than the sentence random method on the grammar tasks, but having both the increment and blocked methods did not facilitate performance any better than having one of the two methods.

Discussion

The goal of this study was to investigate the usefulness of language teaching methods that were based on the Less is More hypothesis. The results suggest that presenting the language lessons in increments, or in a blocked order does not lead to better performance on the word meaning and word order measures. However, the results of the other grammar measures suggest that these teaching methods can be advantageous in grammar acquisition.

The generally high levels of performance on the vocabulary measures suggest that participants had little difficulty learning the meanings of the words. All groups learned more nouns than verbs. This finding is consistent

with the notion that concrete count nouns are easier to learn than verbs, and with findings that children learn the names of objects more quickly than verbs (Gentner & Boroditsky, 2001). It can be said that the lessons promoted noun learning because the nouns were concrete, consistent and appeared at the end of each phrase.

The intent of the word order measure was not to test the effects of incremental presentation or order of the lessons but to confirm that the participants comprehended the lessons. All groups performed at similarly high levels near ceiling on the word order measure.

The crux of the experiment was the outcome of the grammar measures. Generally, adults have difficulty mastering the grammar of foreign languages. In this experiment, French language lessons inspired by the Less is More hypothesis were presented to adults as an attempt to overcome this challenge. The results revealed that learning strategies that encouraged the learning of language in small pieces by incremental presentation or blocked order of presentation facilitated learning the rules of grammar, with the three experimental groups performing better than the control group on these measures. Further analysis revealed that groups that used either incremental or blocked presentation, performed just as well as the condition that received both of these manipulations. These results suggest that either incremental presentation or blocking was sufficient to encourage attention to lower-level sentence elements and thus to ultimately yield better grammatical acquisition. The results of the study thus support our predictions that teaching methods inspired by the Less is More hypothesis may be fruitful in facilitating the acquisition of the grammar of a second language.

Limitations

The results of the experiment are consistent with Newport's Less is More theory, but there remain several limitations of the study that must be remedied before fully endorsing this theory. First, the grammar task involved only a single, relatively simple grammatical alternation. Despite this simplicity, the participants in the study still had difficulty learning the grammatical rule, performing only slightly above floor on the grammar measures. This difficulty likely reflects the limited amount of exposure to the language, involving only two one-hour lessons, and the

high demands of the task. High demands include auditory rather than visual presentation and a lack of explicit grammar instruction. Previous studies found that grammar performance is better in adults when using visual modes of instruction and testing and when using methods that encourage explicit rule learning instead of implicit learning (Conway et al., 2003, Dekeyser & Larson-Hall, 2001). The acquisition of more complex grammatical rules may require much longer, more varied training. However, this study provides a good steppingstone for further experiments.

Second, we designed our method with the assumption that children with limited cognitive processes preferentially attend to the ends of sentences, reflecting a recency effect in working memory. For that reason, the lessons in the incremental condition were presented in small increments starting with the last word of each sentence. This design gave participants simple and consistent lessons. However, the Less is More hypothesis does not state that children always attend to the last word or part of a sentence. If children do not always attend to the last word of a sentence but rather are equally likely to attend to any part of a sentence, then the incremental condition is not fully representative of children's language learning strategies. Changing the incremental condition to involve presenting randomly-chosen pieces of sentences would make the incremental condition less consistent, and as a result, language learning would likely be more difficult for adults.

Lastly, one may argue that the lessons resemble infant-directed talk (IDT). Studies suggest that IDT plays a role in language acquisition and can facilitate adult foreign vocabulary acquisition (Baldwin & Meyer, 2007; Golinkoff & Alioto, 1995). Though the Less is More hypothesis and IDT could potentially coexist in explaining children's language learning, further experimentation would be needed to investigate separate effects of IDT and incremental presentation on adults.

Implications

To address the challenge of learning foreign language grammar in adulthood, this study shows that foreign language educators may profit from incorporating teaching methods based on developmental theories. Presenting a foreign language in increments or in blocked order that promotes the learning of small pieces during the initial stages of language learning are alternative approaches for adults to learn the vocabulary and grammatical structure of a foreign language. Widely-used language teaching methods such as immersion programs or explicit instruction that heavily emphasize focus on semantics in the initial stages of foreign language learning tend to fall short of getting adults to the native level of proficiency in grammar (Harley, 1998). Although our proposal counters these established methods of adult foreign language instruction, it would be worthwhile for the foreign language community to further explore the potential of developmental theories such as Newport's Less is More hypothesis that can offer insightful new methods for foreign language learning.

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