Task sequencing based on the Cognition Hypothesis

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Task-based language teaching is largely consistent with contemporary theories of language acquisition, yet implementing tasks at the curriculum level is still met with difficulty due to the absence of theoretically sound principles for designing a task-based syllabus. Robinson's (2001, 2003) Cognition Hypothesis and the SSARC Model (2010), which claims that pedagogic tasks should be sequenced in an order of increasing cognitive complexity, provide a cognitively motivated solution to this issue. An 8-week instructional course for a single learner was designed and implemented based on the SSARC Model. The effects of the instruction were examined using measures of speech complexity and fluency. Complexity showed notable gains as a result of engaging in cognitively complex tasks while fluency remained largely unchanged. The results were partially consistent with the claims of the Cognition Hypothesis, providing support for the task sequencing effects of the SSARC Model.

タスクを中心とした言語教授法の有効性は、現代の言語習得理論よって裏づけされているが、まだカリキュラムレベルにおける実践に至っていないのが現状である。その原因のひとつとして、タスク・ベース・シラバス作成の指針となる理論が確立されていないことが上げられる。Robinson (2001, 2003)の認知仮説とSSARC モデル(2010)がこの問題に対するひとつの解決策を提示している。Robinsonはタスクの連続順を認知的複雑性に基づいて構築することを提唱している。本研究では、RobinsonのSSARCモデルに基づき8週間の指導計画を構築、実施した。指導効果は発話の複雑性と流暢性の測定値により検証された。認知的複雑性の高いタスクに取り組んだ結果、発話の複雑性は増したが流暢性には大きな変化は見られなかった。この実験結果は、認知仮説の主張を部分的に立証し、更にはSSARCモデルのタスクの連続順効果を支持するものである。

Tasks have long served to provide the context for investigating language acquisition processes for researchers, and have also guided teachers in creating optimal learning conditions in the language classroom (e.g., see Ellis, 2003; Pica, Kanagy, & Falodun 1993; Robinson, 2001, 2007a; Skehan, 1999). Early task-based research and pedagogy were based on the assumption of innate language properties available to L1 and L2 learners (Chomsky, 1965; Krashen, 1981). This led to the non-interventionist approach to instruction, as exhibited in such language teaching methodologies as the Natural Approach (Krashen & Terrell,1983) and the Procedural Syllabus (Prabhu, 1987), which emphasized the importance of the provision of comprehensible input (Krashen, 1985). Further research into the effects of language instruction, however, revealed that focus on meaning alone was insufficient for acquiring higher levels of competence, suggesting the importance of interaction and negotiation

(Long, 1983), output (Swain, 1985), noticing (Schmidt & Frota, 1986), and focus on form (Long & Crookes, 1992) to facilitate acquisition.

More recent cognitive approaches to conceptualizing Second Language Acquisition (SLA) assign empirical/pedagogical values to tasks from yet a different perspective. Cognitive Linguistics (e.g., see Ungerer & Schmid, 2006; Evans & Green, 2006) and usage-based models of language acquisition (Ellis, 2002a; Ellis, 2002b) attribute language acquisition to environmental stimuli, human cognition, and its learning mechanisms. Language acquisition is assumed to be input-driven and experiential, and the first-person, participatory involvements in communicative uses of language allow for the form-meaning mappings to be established, and subsequently entrenched in memory (Robinson & Ellis, 2008, pp. 494-495). Communicative tasks provide optimal contexts for such learning since they "give input, time-on-task, and opportunities for relating form and function" (Ellis, 2002, p.175). Tasks may also serve to accelerate the acquisition process by allowing for various pedagogical manipulations, both proactively by means of pre-modified input (Robinson & Ellis, 2008) or task-essentialness (Loschky & Bley-Vroman, 1993), and reactively through focus on form (Doughty & Williams, 1998).

One problem for task-based instruction and research, however, has been the absence of a theoretically sound and operationally feasible taxonomy of tasks on which to base decisions regarding task sequencing. Robinson (2001, 2005, 2007a, 2007b, 2010) proposed a cognitively motivated solution to this issue with the Cognition Hypothesis. The Cognition Hypothesis asserts that tasks should be sequenced non-linguistically for L2 learners in an order of increasing cognitive complexity, and that these sequences will promote rethinking for speaking, interlanguage development and automatic performance. In essence, the Cognition Hypothesis is a pedagogical approximation of L1 cognitive and linguistic development. Robinson (2007a) uses the Triadic Componential Framework (see Appendix 1) to classify task features into three categories: Task complexity, task condition, and task difficulty and claims that:

> Increasing the cognitive demands of tasks contributing to their relative complexity along certain dimensions will; a) push learners to greater accuracy and complexity of L2 production in order to meet the greater functional and conceptual communicative demands they place on the learner; (b) promote interaction, and heightened attention to and memory for input, so increasing learning from the input, and incorporation of forms made salient in the input; as well as (c) longer term retention of input; and that (d) performing simple to complex sequences will also lead to automaticity and efficient scheduling of the components of complex L2 task performance. (Robinson & Gilabert, 2007, p. 162)

Robinson (2010) further proposes the SSARC Model as a way to operationalize the gradual increases in pedagogic task complexity in line with the claims of the Cognition Hypothesis. SSARC stands for *stabilize, simplify, automatize, restructure, and complexify*. Each refers to the sequential stages involved in the task-sequencing model, *stabilize* and *simplify* being the first stage, *automatize* being the second stage and *restructure* and *complexify* being the third and final stage in the sequence. Two basic principles underlie the model. The first is a parsimony principle, which states that task sequencing should be based solely on cognitive complexity factors. The second is a cumulative principle, which posits that tasks should increase in complexity, first on the resource-dispersing dimension and second on the resource-directing dimension. The resource-dispersing dimension places performative/procedural demands on the learner. These demands facilitate automatic access to an already established interlanguage system. On the other hand,

the resource-directing dimension of task complexity puts cognitive/conceptual demands on the learner. These demands direct learners' attentional and memory resources to aspects of the L2 system (see Appendix 1). By adhering to these principles, a target construction will follow three stages of development which involve: (1) stabilization and simplification while engaging in simple tasks; (2) automatization by increasing the performance demands of a task; and (3) restructure and complexification by introducing complexity to the task.

Research questions

The SSARC Model was initially designed for large-scale syllabus design, involving the gradual sequencing of tasks over long instructional periods. However, this study attempts to investigate the short-term effects of task sequencing proposed by the model in line with the claims of the Cognition Hypothesis. This study addresses two research questions:

1. To what extent does the learner's spoken fluency change over the course of increasingly cognitively complex tasks?
2. To what extent does the learner's spoken complexity change over the course of increasingly cognitively complex tasks?

Methodology

The learner

The participant in this case study was M., a 23-year-old Japanese female who worked as an assistant in an office for the English department of a women's university in Japan. She studied English for a total of 14 years and majored in English at university. She had never lived or studied abroad. Although M. had a lengthy period of formal instruction in English, she had limited opportunities to produce language in real conversational settings. In this sense, we viewed M. as being at a low intermediate level; she had a lot of knowledge about English, but had difficulties using it in communicative situations.

The instructional approach

The above assumptions of the SSARC Model were incorporated into a series of eight connected communicative lessons in which a pedagogical task of describing a picture sequence was broken down into several sub-tasks and sequenced in the order suggested by the SSARC Model. These tasks created the context, need, and support for the learner to communicate in English. Linguistic support for performing the tasks was provided both proactively and reactively. For each new task, the teacher first modeled the performance with target vocabulary and forms. In addition, reactive focus on form, both implicit and explicit was provided as needed.

The task sequence

The tasks were sequenced according to the SSARC Model using gradual increases in pedagogic task complexity in line with the claims of the Cognition Hypothesis. The basic structure of the target task was kept consistent across all of the meetings. Thus, tasks were manipulated solely at the cognitive complexity level by gradually increasing the complexity, first on performative demands, (i.e., single vs. dual task, +/- time pressure), and later on cognitive demands, (i.e., +/- intentional reasoning) (see Appendix 1). The set of tasks developed and used in this study revolved around picture descriptions/story telling using popular Japanese animated movie comic books. The use of Japanese comics helped control for the prior knowledge variable, a factor that could affect performative demands of tasks (Robinson, 2007a). The task sequence was broken down as follows:

Task 1: Guess the picture (version 1)

1. A set of pictures from a comic strip is placed randomly on a table.
2. Person A (the teacher) describes a picture and person B (the student) tries to identify the picture.
3. The teacher takes the first turn in order to model describing a picture. The student follows and they alternate turns until all pictures have been described and identified.

(This represents Stage 1 of the SSARC Model - the *stabilization* and *simplification* stage)

Task 2: Guess the picture (version 2)

1. The same set of pictures is placed randomly on the table.
2. Person B (the student) chooses one picture, but does not tell person A (the teacher) which one it is.
3. Person A asks Yes/No questions about the picture and person B answers. Person A tries to guess the picture that Person B has chosen.
4. The teacher takes the first speaking turn in order to model asking questions.

(This represents Stage 1 of the SSARC Model - the *stabilization* and *simplification* stage)

Task 3: Order the sequence of pictures

1. This time two sets of the same pictures are used. The teacher and the student hold a set each and are not allowed to see each other's pictures.
2. The student (Person B) sequences her set of pictures in what seems like a logical order. She then describes the picture sequence.
3. The teacher (Person A) listens to the student's descriptions and arranges his pictures to match the order described by the student.
4. The teacher describes his picture sequence back to the student to check if the order of their pictures is the same. The teacher's description utilizes and builds on structures the student used in her descriptions.

(This represents Stage 2 of the SSARC Model - the *automatization* stage)

Task 4: Tell the story quickly (fluency task)

1. Using the same ordered picture sequence, the learner now tells the whole story again as fluently as possible.

(This represents Stage 2 of the SSARC Model - the *automatization* stage)

Task 5: Tell the story with intentional reasoning (intentional reasoning task)

1. Using the same ordered picture sequence, the learner is asked to tell the story again, but must provide intentional reasoning to account for some aspect of behavior in the story.

(This represents Stage 3 of the SSARC Model - the *restructure, complexification* stage)

The tasks described above were designed to slowly build on one another within each lesson and over the eight sessions. No tasks from the sequence were used in Session 1 as it was used as an introduction session and to assess M.'s level. Tasks 1 and 2 were introduced in Session 2, and Tasks 3 and 4 were added in Session 3. Sessions 4, 5, and 6 followed the same sequence of

tasks (1-4) using different sets of comic strips. The learner was finally exposed to the full task sequence in Sessions 7 and 8, when Task 5, the final intentional reasoning task, was added.

Tasks 1 and 2 were designed to function as the stabilization and simplification stage, and involved simple descriptions of individual pictures from a set that, when put together, formed a coherent story sequence. After stabilizing the constructions for simple descriptions, the third task required the learner to sequence the pictures in a logical order and describe the sequence to their partner. This task involved dual processing, consisting of both making decisions about sequencing and describing them verbally. Dual task performance is a condition suggested by the model to be resource-dispersing (increasing performative demands), and therefore contributes to automatization (DeKeyzer, 2001, 2007; Robinson, 2010). Task 4 was a fluency task which required the learner to describe the picture sequence described in Task 3 again, but with added time constraints. This task was used to boost the automatization process and prepare for the subsequent restructure, complexification stage. Finally, Task 5 required the learner to provide intentional reasoning for certain actions described in the pictures. Intentional reasoning is a resource-directing variable (increasing cognitive demands) associated with stage 3 of the SSARC Model, which in effect promotes restructuring of the interlanguage system.

The game-like design of the tasks allowed for the creation of real communicative needs and also provided positive reinforcement each time the game was successfully completed. Teacher modeling and reactive focus on form played an important role in providing relevant linguistic constructions and in trying to foster repeated use. Care was taken to adjust the speed of progress and the type/amount of feedback to the level of the learner in order help build confidence and promote fluency.

Data collection and analysis

Each session was recorded and transcribed. To address our research questions, data from Sessions 7 and 8 were chosen for analysis since these were the sessions where the learner was exposed to the full task sequence (Tasks 1-5), which included all of the stages of the SSARC Model. In order to examine the change in speech production with regards to fluency and complexity after introducing the final intentional reasoning task (Stage 3 - *the restructure, complexification* stage - of the SSARC Model), Task 4 (the fluency task) and Task 5 (the intentional reasoning task) were analyzed and compared in terms of fluency and complexity. In addition, data from Session 4 were also analyzed to examine changes between earlier sessions (only involving Tasks 1-4) and later sessions (involving Tasks 1-5, the full task cycle).

Measures of fluency were adopted from Ellis and Barkhuizen (2005). Five measures of speech fluency were used: speech rate as measured by syllables per minute; pause length as measured by total length of pauses beyond one second; false starts as measured by incomplete utterances; repetition as measured by words, phrases or clauses repeated without any modification; and reformulation as measured by phrases or clauses repeated with some modification. In measuring complexity, two types of measures were adopted. Robinson (2007b) suggests that in order to capture the relationship between cognitive complexity and syntactic complexity, both general and specific measures of complexity are needed. S-nodes-per-T-unit was adopted from Niwa (2000) as a general measure. A T-unit is defined as a main clause plus any subordinate clauses, and an S-node as any embedded clause in each T-unit. For the specific measure of complexity, psycholinguistic state terms were adopted. Lee and Rescorla (2002), in their study of L1 children, demonstrated that the use of psychological state terms expressing emotion, desire, and cognition correlated significantly with the use of complex syntax.

Results and discussion

This case study attempted to examine the extent to which M.'s speech production changed in terms of fluency and complexity, after engaging in a sequence of tasks informed by the SSARC model. The results of the fluency analysis are summarized in Table 1. This table presents comparisons between three sessions for Task 4 (the fluency task) and Task 5 (the intentional reasoning task). The numbers in parentheses ( ) represent the time it took to complete each task respectively.

Table 1. Fluency measures

	Session 4		Session 7		Session 8	
Fluency Measures	Task 4 (1:40) SSARC Stage 2	Task 5 No Task 5 in this Session	Task 4 (3:53) SSARC Stage 2	Task 5 (4:00) SSARC Stage 3	Task 4 (4:24) SSARC Stage 2	Task 5 (4:56) SSARC Stage 3
Speech Rate (words per minute)	67	-	54	53	48	49
Pause length (seconds)	9	-	27	25	49	43
False starts	4	-	14	15	26	22
Repetition	0	-	3	2	2	6
Reformulation	1	-	3	8	10	6

Table 2. Complexity measures

	Session 4		Session 7		Session 8	
Complexity Measures	Task 4 (1:40) SSARC Stage 2	Task 5 No Task 5 in this Session	Task 4 (3:53) SSARC Stage 2	Task 5 (4:00) SSARC Stage 3	Task 4 (4:24) SSARC Stage 2	Task 5 (4:56) SSARC Stage 3
S-nodes per T-unit	1	-	1.20	1.36	1.47	2.17
Psychological state terms	0	-	2	2	7	7

Results show that speech rate decreased from Session 4 to Sessions 7 and 8, pause length increased notably from Sessions 4 to 7 and 7 to 8, and similar trends were observed in the number of false starts, repetitions and reformulations. As a whole, fluency diminished from earlier to later sessions. Next, fluency of speech was compared between tasks with and without intentional reasoning in Sessions 7 and 8. Results show little change on all five measures of fluency after introducing Task 5. Results of the complexity analysis are summarized in Table 2.

Results from Session 4 show that sentence structures were simple and that no psychological state terms were used in this session. However, in Session 7, when Task 5 was added, complexity, as measured by the amount of syntactic subordination, increased from 1.20 S-nodes per T-unit to 1.36.

Furthermore, in Session 8, when psychological state terms such as 'think' and 'feel' were introduced in the final task, the use of syntactic subordination further increased from 1.47 S-nodes per T-unit to 2.17. In addition, the use of psychological state terms increased from Session 7 to Session 8, although the sessions did not differ in the design of the task complexity.

Excerpts from the transcriptions below show an example of how M.'s speech changed as a result of engaging in a more complex task. The numbers in parentheses ( ) represent pause length in seconds. During Task 4 in session 8, M. produced:

> "after that eh Satsuki is picking picking the branches (2) eh after that eh Satsuki is (1) putting the branches in the boiler (3) eh ah boiler"

In Task 5, her speech changed to:

> "After that eh Satsuki is picking up the branches eh (3) because eh she needs (1) the branches (2) to (2) to eh boil (1) the water"

M.'s speech became syntactically more complex after being asked to incorporate the *because*–clause to include intentional reasoning in the story description.

This case study attempted to apply the principles of the Cognition Hypothesis and the SSARC Model to task design and investigated the short-term effects of task sequencing proposed by the model on M.'s speech production in terms of fluency (research question # 1) and complexity (research question # 2). Robinson's Cognition Hypothesis (2007b) predicts that when tasks increase in complexity along the resource-directing dimension, there will be greater accuracy and complexity but less fluency as measured by general measures of speech production. The results of the fluency measures in the present study did not reveal any differences between simple and complex tasks and therefore, were not consistent with the above claim. One possible explanation for this result is that the present study incorporated the full range of the SSARC sequence within a single lesson allowing for the same language for task performance to be recycled at each stage of the model. As the model predicts, the automatization stage, as operationalized in Tasks 3 and 4, may have allowed for sufficient chunking and automatization of relevant language forms to take place, resulting in little observable change in fluency after introducing the cognitively complex reasoning demands in Task 5. This assumption is relevant to how the present study operationalized the SSARC Model. The potential impact of this type of research design on learner production needs to be investigated and accounted for in future studies.

While fluency stayed unchanged, complexity increased notably as a result of engaging in complex reasoning tasks, and this served to support the above claim of the Cognition Hypothesis. In addition, the increase in the use of psychological state terms in Session 8 may have also had a strong relationship with the increase in syntactic complexity. This is consistent with another

claim of the Cognition Hypothesis, which states that when tasks increase in complexity along the resource-directing dimension, there will be greater syntactic complexity as measured by specific measures of speech production appropriate to the conceptual/communicative demands of tasks (Robinson, 2007b). Thus, the results from this case study imply that in larger group designs possible relationships between task complexity, the use of psychological state terms, and speech complexity may emerge.

Conclusions

This study provides support for the Cognition Hypothesis, the SSARC Model, and their implications for task-based syllabus design. While the establishment of a sound taxonomy of tasks is of primary importance, investigations of its application to practice following the SSARC Model would make significant contributions to task-based pedagogy. The present study, which incorporated the full range of the SSARC sequence into a single lesson, where a pedagogic task of describing a picture sequence was broken down into several sub-tasks, in a way, looked at the essence of language development suggested by the model. In order for the model to truly inform task-based syllabus design, the sequence of each complexity stage needs to be stretched across longer instructional periods and tested for predicted language change. Furthermore, the quality and quantity of instructional/linguistic support to be provided at each stage of the model is another area that requires investigation in line with the SSARC sequencing research. Within this extended research paradigm, the present study is merely a first step down a potentially pedagogically-rewarding road.

Bio data

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Appendix I

The Triadic Componential Framework for task classification—Categories, criteria, analytic procedures, and design characteristics (from Robinson 2007a)

Task complexity (Cognitive factors)	***Task condition*** (Interactive factors)	***Task difficulty*** (Learner factors)
(Classification criteria: cognitive demands)	(Classification criteria: interactional demands)	(Classification criteria: ability requirements)
(Classification procedure: information-theoretic analyses)	(Classification procedure: behavior-descriptive analyses)	(Classification procedure: ability assessment analyses)
a) Resource-directing variables making cognitive/conceptual demands	**a) Participation variables** making interactional demands	**a) Ability variables** and task-relevant resource differentials
+/- here and now	+/- open solution	h/l working memory
+/- few elements	+/- one-way flow	h/l reasoning
-/+ spatial reasoning	+/- convergent solution	h/l task-switching
-/+ causal reasoning	+/- few participants	h/l aptitude
-/+ intentional reasoning	+/- few contributions needed	h/l field independence
-/+ perspective-taking	+/- negotiation not needed	h/l mind/intention-reading
b) Resource-dispersing variables making performative/procedural demands	**b) Participant variables** making interactant demands	**b) Affective variables** and task-relevant state-trait differentials
+/- planning time	+/- same proficiency	h/l openness to experience
+/- single task	+/- same gender	h/l control of emotion
+/- task structure	+/- familiar	h/l task motivation
+/- few steps	+/- shared content knowledge	h/l processing anxiety
+/- independency of steps	+/- equal status and role	h/l willingness to communicate
+/- prior knowledge	+/- shared cultural knowledge	h/l self-efficacy