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Task complexity and language production dilemmas
(Robinson's Cognition Hypothesis vs. Skehan's Trade-off Model)

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Abstract

Cognitive load of a task is an important factor that affects task production. There are various models for task complexity in SLA among which Robinson's Cognition Hypothesis and Skehan's model of task complexity argue different opposing positions. While Robinson argues that increasing cognitive load of a task increases accuracy, complexity, but not fluency, Skehan (1998) claims that "prioritization and predisposition (or both) seem to orient performance toward one (or two) of the three areas of accuracy, fluency, and complexity". This study analyzed the written data of 29 EFL learners on the basis of three production measures. T-test was employed as means of analysis. The findings revealed a trade-off between task complexity and language production elements. The study carries significant implications for syllabus designers and SLA researchers.

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1. Introduction

The degree of cognitive load and complexity of a task has been among the many factors that affect SL learners’ linguistic domains in speaking and writing (Rahimpour, 1997, 1999, 2002, 2008; Salimi & Dadashpour, 2011; Salimi et al. 2011; Robinson, 2007). The effect of cognitive complexity of a task on L2 learners’ written performance is one of the rarely explored areas in SLA literature. There are two opposing views on this issue. Skehan (1998) applied his model to L2 processing; arguing that performing in an imperfectly learned L2 imposes a large burden on the learners’ attention and causes the learner to make choices; to prioritize one aspect of performance such as accuracy, fluency, or complexity. This model of L2 performance has, however, been challenged by Robinson (2001, 2005). He argued that the more demanding a task is deemed to be in terms of its content, the more complex the language learner will attempt when transacting it: form and content are not in competition, but in league with one another. Robinson rejected limited attention capacity processing, and he proposed a model of attention in which language learner can access multiple attentional pools that do not compete. As depletion of attention in one pool has no effect on the amount remaining in another, language learner can prioritize both form and meaning and both accuracy and complexity. The main purpose of the present study is to see whether Skehan’s Trade-off Model or Robinson’s Triadic model of task complexity works on written language performance.

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2. Literature review

Based on the cognition, information-theoretic models of Skehan, 1998, and Robinson's, 2007, the Cognition Hypothesis, (Robinson 2005, 2007) it is claimed that tasks should be designed and sequenced on the basis of task characteristics. Rahimpour (2002) lists three theoretical frameworks for task complexity. According to him, the theoretical framework for the proposed task complexity is based on research into first language acquisition (e.g., Brown & Bellugi, 1964), research findings from second language development (Meisel, 1987), and functional linguistic theory (Givon, 1989). It is widely accepted idea that research into complexity of second language tasks is necessary to pedagogical decisions regarding the grading and sequencing of tasks for the purposes of syllabus design (Gilabert, 2007; Long, 2007; Rahimpour 1997, 1999, 2002, 2008; Robinson 1995, 2001, 2003, 2005, 2007a, 2007b; Robinson & Gilabert 2007; Oxford et.al, 2004; Mehrang & Rahimpour, 2010; Hosseini & Rahimpour, 2010; Salimi & Yousefi, 2009).

Robinson (2001, p: 29) defines task complexity as:

Task complexity is the result of the attentional, memory, reasoning, and other information processing demands imposed by the structure of the task to the language learner. These differences in information processing demands, resulting from design characteristics, are relatively fixed and invariant.

Task complexity, differences in intrinsic cognitive processing demands of tasks, will explain within-learner variation in successfully completing any two tasks (such as doing simple addition versus calculus, or doing the simple versus complex intentional reasoning task (Robinson, 2007:210). Gilabert (2009) argues that research into sequencing is of significant importance since it may contribute to L2 development by drawing attention to form. He also argues that research into sequencing is minimal. There are many suggestions with very few findings. This unresolved issue deserves further researching. Furthermore, research agenda are interested in how cognition may lead to balanced development of fluency, accuracy, complexity, and acquisition.

Ellis (2003:351) believes that task complexity is the extent to which a particular task is inherently easy or difficult. Different dimensions of task complexity are code complexity, cognitive complexity, and context dependency.

Like Robinson (2001), Gilabert et.al (2009), Ellis (2003) explains task complexity as 'within' learner variability. In other words, the variability is evident when the same learners perform different tasks.

Robinson (2001) attributes the complexity of the task into three factors including inherent characteristics of the task itself which is related to the nature of input, the task conditions, and the processing operations involved in completing the tasks and the outcome that is required. These factors according to Robinson (2001) come under the heading of task complexity. The complexity of a task is the valid criteria to be taken in to account in designing a task and syllabus. The design of a syllabus requires that the content be sequenced in a way so as to facilitate maximum learning (Ellis, 2003, 2008; Skehan, 2003; Nunan, 1989; Robinson, 2001; 2007). In effect, this requires determining the complexity of individual tasks so that tasks can be matched to learners' level of development, this argument is in line with teachability and learnability hypothesis proposed by Pieneman (1985). Skehan (1998a, 1998b) and Robinson. et. al (1995) reiterate that knowledge of task difficulty provides the teacher or syllabus designer with information about the level of challenge that a task is likely to contain, a level which the teacher will then have to match with his or her knowledge of the students who will do the task.

2.1. Models of task complexity

Different scholars have introduced various models of task complexity (Anderson & Lynch, 1988; Brindley, 1987; Brown & Yule, 1983; Candlin, 1987; Long, 1985; Prabhu, 1987; Rahimpour, 1997, 1999; Robinson 2001, 2007a).

2.1.1. Robinson’s Triadic Framework of task complexity

Robinson’s framework distinguishes three task components: task complexity, task conditions, and task difficulty shown in table 1.

| Task Complexity (cognitive factors) | Task Conditions (interactional factors) | Task Difficulty (learners factors) |
|-------------------------------------|----------------------------------------|----------------------------------|
| (a) resource-directing              | (a) participation variables             | (a) affective variables           |
| e.g., ± few elements                | e.g., open/closed                       | e.g., motivation                  |
| ± Here-and-Now                      | one-way/two-way                         | anxiety                           |
| ± no reasoning demands              | convergent/divergent                     | confidence                        |
| (b) resource-dispersing             | (b) participant variables               | (b) ability variables             |
| e.g., ± planning                    | e.g., same/different gender             | e.g., working memory              |
| ± single task                       | familiar/unfamiliar                     | intelligence                       |
| ± prior knowledge                   | power/solidarity                        | aptitude                          |

In a series of arguments advanced by Robinson, he proposed "comprehensive criteria" for determining task complexity (Robinson 2001, 2003, 2005, 2007a; Robinson et. al. 1995, 1996). It should be mentioned that his criteria, also called Triadic Componential Framework or The cognition Hypothesis, is not free of critique; Kuiken and Vedder (2007) have questioned the validity of the framework as being not empirically researchable and operationally feasible. Unlike Kuiken and Vedder (2007), the present researcher assumes some authority to this framework and believes that further research is needed to investigate some dimensions of the Cognition Hypothesis.

Robinson (2001) pointed out that the development of theoretically motivated, empirically substantiable, and pedagogically feasible sequencing criteria has long been acknowledged as a major goal of research aimed at operationalizing task-based approaches to syllabus design. To this end, he proposed distinctions between cognitively defined task complexity, learner perceptions of task difficulty, and the interactive conditions under which tasks are performed. Robinson (2001:29) strongly argued that Task Complexity is the result of the attentional, memory, reasoning, and other information processing demands imposed by the structure of the task on the language learner. These differences in information processing demands, resulting from design characteristics, are relatively fixed and invariant. Task complexity will aid explain within learner variance when performing any two tasks. It is, also, argued that the cognitively simpler tasks will involve a lower error rate, and/or be completed faster.

2.2. Research into task complexity and second language development

Robinson's Cognition Hypothesis (2001, 2003, 2005, 2007) claims that increasing the cognitive demands of tasks 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; 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.

More importantly, the Cognition Hypothesis predicts that along resource-directing dimensions more interactive complex tasks will result in greater amounts of interaction, and negotiation for meaning. Following Long (1996), it claims that such negotiation provides a content for attending to problematic forms in the input and output, and additionally that on complex versions of tasks, there will be greater attention to, and uptake of forms made salient during provision of reactive Focus on Form techniques such a recasts. Alternatively, where proactive Focus on Form is provided, for example in the form of pre- modified input to the task, then it similarly claims there will be greater use of this on complex, versus simpler task versions (Robinson & Gilabert, 2007).

Many TBLT research studies have investigated oral language production and, accordingly, there is a paucity of task-based research on written language production (Ong & Zhang, 2010). In reviewing task complexity studies on
written language production, most of the studies have examined the effects of manipulating the resource-directing factors (Kuiken & Vedder, 2007, 2008) than resource-dispersing factors (Yuan & Ellis, 2003). For resource directing factors, studies which have provided partial empirical support to Robinson’s Cognition Hypothesis, are Kuiken & Vedder (2007, 2008), and Ishikawa (2006).

The general findings of the studies done by Kuiken & Vedder (2007, 2008) supported the improvement of accuracy of SL development. Ishikawa (2006) examined the effects of manipulating task complexity with respect to here-and-now & there-and-then and he found that increasing task complexity with respect to here-and-now dimension increased the accuracy, fluency, and complexity of written language production. Kellogg (1996) investigated the effects of outlining on L2 learners’ accuracy and fluency. He found that fluency greatly increased. With respect to L2 writing, Yuan & Ellis, (2003) studied the effects of pre-task planning, on-line planning, and no-planning on accuracy, fluency, and complexity of Chinese Narration writings. They found that pre-task planning led to increased fluency and syntactic variety, on-line planning led to increased accuracy. Kang (2005) reported the results of the study done on pre-task planning on L2 learners’ written performance. Pre-task planning produced greater fluency and complexity of the learners. These paradoxical results obtained from different studies on task complexity on different aspects of tasks and the gap between the effects of task complexity on the real nature of written performance in literature studied above generated the reason for this study.

3. Research

On the basis of the above literature review the following research question and hypotheses were generated:

3.1. Research question and hypotheses

**RQ:** What is the effect of task complexity on L2 learners’ written performance?

**RH0:** There is no significant difference between task complexity and learners’ written performance.

**RH1:** Complex tasks will lead to more accuracy and complexity but not fluency than its simpler version in written production of EFL learners.

3.2. Accuracy measure: The number error-free T-units per T-units (Arent, 2003; Rahimpour, 2008).

3.3. Fluency measure: The fluency of the written production of the learners was measured by words per T-units (Ishikawa 2006).

3.4. Complexity measure: Complexity involves measuring both lexical and syntactic complexity. Lexical complexity of the written text was not taken into account because the learners used dictionaries to find the intended lexical item. However, for measuring syntactic complexity of the collected data, a measure of S-nodes per T-units was employed (Rahimpour & Hosseini, 2010; Gilabert, 2005; Robinson, 1995; Ishikawa, 2006).

3.5. Participants

The participants of this study were 29 female senior college students studying Translation and TEFL at Islamic Azad University of Maragheh, spring 2010, with Turkish L1 background.

3.4. Materials and Tasks Used in the Study

Two versions of the same decision-making task (one simple and the other complex task) were taken from Gilabert (2007) and Yusefi (2009).

3.5. Procedure

First, the participants were given the simple version of decision-making fire task and asked to compose an essay according to the picture in 45 minutes. After two weeks, the same participants were asked to write an essay on the
complex version of the same decision-making fire task. The reason for this two weeks time interval was to alleviate the memory effect and task repetition effects of the learners on the produced written data.

4. Data analysis and results

4.1. Comparison of the means of accuracy of written performance in simple and complex task

The means differences of accuracy in simple and complex task are presented below in table 2 and figure 1.

|                | N  | Mean | Std. deviation |
|----------------|----|------|----------------|
| Accuracy simple| 29 | 0.53 | 0.22062        |
| Accuracy complex| 29 | 0.62 | 0.17706        |

Figure 1 clearly represents the differences between the means in both tasks.

The descriptive statistics of comparisons of the means of accuracy in both tasks shows significant differences.

|                | Levene's Test for Equality of variances | T-test for Equality of means |
|----------------|----------------------------------------|-----------------------------|
|                | F          | Sig. | T          | df  | Sig. (2tailed) |
| Accuracy Equal variances assumed | 3.149 | .81 | -1.621 | 57 | .11 |
| Accuracy Equal variances not assumed | -1.621 | 53.49 | .11 |

Table 3 shows the results of statistical analysis of applying T-test to test the hypothesis. The results of SPSS at df = 57 and α = .05, suggested that there is not a significant difference between task complexity and L2 learners' accuracy. As a result, the null hypothesis is confirmed.

4.2. Comparison of the means of fluency of written performance in both simple and complex task

Vividly, the results show that learners produced more fluent language (mean=16.91) when they performed on a complex task than simple one (mean=13.65).
Table 4. Comparison of means of fluency in simple and complex task

|                  | N  | Mean  | Std. deviation |
|------------------|----|-------|----------------|
| Fluency simple   | 29 | 13.65 | 3.99424        |
| Fluency complex  | 29 | 16.90 | 5.45745        |

According to table 4 which shows the results of independent T-test for comparing the means of fluency of the two tasks, it is understood that complex task led to the production of more fluent language production. As a result our null hypothesis is again confirmed. So, the hypothesis claiming that complex task will lead to less fluent language performance is rejected.

4.3. Comparison of the means of complexity of written performance in simple and complex tasks

The results of the descriptive comparison of the means of complexity of simple and complex tasks are presented in table 5 and figure 3.

Table 5. Comparison of means of complexity in simple and complex task

|                  | N  | Mean  | Std. deviation |
|------------------|----|-------|----------------|
| Complexity simple| 29 | 2.12  | .53178         |
| Complexity complex | 29 | 2.75  | 1.09002        |
According to the data in table 5 and figure 3, it is clear that the means of complexity in complex task (mean=2.75) is greater than that of simple task (mean=2.12). Thus, task complexity affects the complexity of the written performance greatly.

| Complexity       | Equal variances assumed | Equal variances not assumed |
|------------------|-------------------------|-----------------------------|
| Levene's Test for Equality of variances | T-test for Equality of means | T-test for Equality of means |
| F                | Sig. | T    | df | Sig. (2tailed) | T    | df | Sig. (2tailed) |
| Complexity       | Equal variances assumed | -2.787 | 56 | .007         | 5.829 | .019 |
| Complexity       | Equal variances not assumed | -2.787 | 40.614 | .008 |

The results of statistical analysis and applying independent T-test at df = 5.6 and α = .05 shows that the null hypothesis is rejected and there is a significant difference between task complexity and complexity of written language and our hypothesis is confirmed.

5. Discussion and Results

Considering the results of the data analysis on task complexity and accuracy of L2 learners' written production, there was no significant difference between task complexity and L2 learners' written performance in terms of accuracy. The findings of this study in terms of the effect of task complexity on accuracy ran against the predictions of Cognition Hypothesis (Robinson, 2007). The findings of this study are in line with (Hosseini & Rahimpour, 2010) who found that task complexity doesn't have any significant effect on the accuracy of written narratives of L2 learners. The findings also are in line with the results of the studies done by Skehan & Foster (1999), Robinson (2007), and Mehrang (2009). However, the results are in contrast with the findings of researchers like Rahimpour (2007), Rahimpour & Hazar (2007), Michel, et.al (2007), Ishikawa (2006), and Kuiken & Vedder (2007, 2008).

This production of less accurate language in terms of task complexity can be attributed to the fact that (Van Patten, 1990; Schmidt, 2000; Rahimpour & Salimi, 2010) learners can't pay attention to language forms without a loss of attention to content and when they are free to allocate attention, they prioritize concern for the content over concern for the form. Unlike Robinson, Skehan (1998b) argues that human being has a limited attention capacity. Thus, increasing task complexity creates a kind of trade-off between form and meaning. Tavakoli & Foster (2008) also argued that simple task will relieve processing load and free up attention space to be devoted to accuracy.
Considering the effect of task complexity on the fluency of L2 learners' written production, task complexity had significant effect on L2 learners' production. Increasing task complexity along resource-directing factors led to the production of more fluent language. The findings of the study are in line with the prediction of Cognition Hypothesis proposed by Robinson (2005, 2007). This high rate of fluency in the written production can be attributed to the fact that increasing cognitive demand of pedagogic task has an important influence on learning. This cognitive demand imposes extra burden of information processing, memory capacity, and attentional resources on learners' mental capacity which pushes the L2 learners to go beyond their current level of language proficiency and stretch their interlanguage system (Rahimpour, 1999). The findings of this study in terms of fluency are in line with Hosseini & Rahimpour (2010), Ishikawa (2006) and Ong & Zhang (2010). Also, the findings are in line with Foster & Skehan (1999) also propose that more complex task directs the learners' attention to context and diverts their attention away from the form leading to more fluent production.

Considering the results of the statistical analysis for the effect of task complexity on the complexity of L2 learners' written production our hypothesis is confirmed and the results obtained showed significant difference between task complexity and L2 learners' written performance. Complex task led to the production of more complex language in terms of syntactic mode. The findings of this aspect of our study is in line with the predictions of Cognition Hypothesis which states that increasing the cognitive load of a task along resource-directing line will lead to more syntactic production of language. This high rate of structural complexity could be attributed to (Givon, 1989; Robinson, 2007; Salimi & Yusefi, 2009) the fact that increasing task complexity will stretch interlanguage system enabling learners to use syntactic mode of language which is characterized by greater use of morphology, greater syntactic subordination, and high noun to verb ratio (lexical complexity).

The findings of the study is in line with Ellis & Barkhuizen (2005) in that tasks with more cognitive demands push L2 learners to perform tasks in certain ways, prioritizing one or another aspect of language. Thus, complex tasks push learners to prioritize complexity over fluency. Tavakoli & Foster (2008) also argue that the more demanding a task in terms of its content, the more complex the language a learner will attempt performing a task. The explanation for the enhanced complexity may lie in the fact that complex tasks impose extra burden of information processing to the learners' mental capacities.

However, the results of this study ran against the findings of researchers like (Hosseini, 2009; Ishikawa, 2006) who found no significant difference between task complexity and L2 learners' written performance. They argue that the results support Skehan & Fosters' (2001, p: 193) preposition that "prioritization or predisposition (or both) seem to orient performance toward one (or two) of the three areas of accuracy, fluency, and complexity".

6. Pedagogical implications

The present study has a number of pedagogical implications for Second Language Acquisition (SLA) researchers, teachers, syllabus and task designers, and language testing specialists. The major problem in Task-based Language Teaching and syllabus designing is to determine a valid criterion for grading and sequencing tasks. Task complexity as argued by Robinson (2007) can be considered as a valid criterion for grading pedagogical tasks in terms of their cognitive complexity. Therefore, the findings of the study can be used as empirical basis for selecting, grading, and sequencing tasks. Moreover, the findings of the current study suggest that teachers should take into account the cognitive capabilities of the learners as well as the cognitive load of the structure of the task that imposes on the learner while teaching. As Pieneman (1985), Rahimpour (2002) argued tasks should match the learners built-in syllabus. In other words, teachability and learnability should be taken into account while designing and assigning tasks to the learners. Task complexity can be manipulated for the purpose of matching with learners' developmental sequence and their proficiency level.

The testers also should consider the cognitive complexity of a task while designing a task for assessment purposes. The pedagogical implications of the present study for SLA researcher is that research on task complexity can shed light on the nature of processes involved in second language acquisition and interlanguage development.
while performing a task. As Ellis (2009) argued TBLT has attracted the attention of a number of SLA researchers since it is a bridge between the theory of second language acquisition and actual language teaching.

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