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Different Task Complexity Factors and Cognitive Individual Differences: The Effects on EFL Writers' Performance

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Abstract: This study aimed at examining the main and interaction effects of increased intentional reasoning demands, planning time, and also language learning aptitude on syntactic complexity, accuracy, lexical complexity, and fluency (CALF) of 226 EFL learners' performance on letter writing tasks. The participants were first randomly assigned to three experimental groups to be given a task with differing degrees of reasoning demand (low, medium, and high) to each group. Then, within each reasoning group, we reassigned an equal number of high- and low- aptitude learners to Planning and No-planning groups by random stratified sampling. The results revealed that (a) increasing task complexity with regard to the amount of intentional reasoning demands resulted in greater lexical and syntactic complexity and less fluency while no significant effect was observed on accuracy; (b) increasing task complexity through planning time led to significantly lower syntactic complexity and fluency; (c) reasoning demands and planning time had a significant interaction effect on accuracy; and (d) the interaction effect of language aptitude was significant with neither planning nor reasoning factor, but a three-way interaction effect was found on accuracy. The findings are discussed in relation to cognitive task complexity (CTC) models which were the main impetus for this study.

Keywords: Cognitive Task Complexity (CTC), Planning Time, Intentional Reasoning Demands, Language Learning Aptitude.

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Introduction

Despite a mass of studies on the link between task features and oral production in the literature, task-based research in writing domain is still small in quantity. However, due to the higher possibility for online planning and its long-lasting and unhurried state, writing as a problem-solving and cognitive activity, is believed to enable the writers to maintain their focus on linguistic aspects of production (Byrnes & Mancho´n, 2014). Therefore, the effects of CTC manipulation are likely to be more evident in written modality.

Two influential but conflicting frameworks of CTC introduced by Robinson (2001a, 2001b, 2003, 2005b, 2007, 2011) and Skehan (1998, 2001, 2003, 2014; Skehan & Foster, 1999, 2001) have been the main theoretical impetus for CTC research studies like ours. Skehan, in Limited Attentional Capacity Model, claimed that due to our limited attentional resources, cognitively complex tasks would result in trade-off effects among three linguistic elements of production: accuracy, fluency, and complexity. Thus, accuracy and complexity are considered as competing dimensions of the language performance, and one dimension tends to receive less attention than the other.

Alternatively, Robinson's (2001a, 2001b, 2003, 2005b, 2007, 2011) Cognition Hypothesis suggested a multiple-resources view in which different aspects of language can be attended by learners while doing a cognitively complex task. Robinson believed that as tasks get more complex, learners will pay more attention to language input/output leading to a better performance, especially with respect to accuracy and complexity. He has identified resource- directing and resource-dispersing dimensions as the main factors in determining the CTC. The former ones involve those features that direct learners' attention to the specific linguistic features which are needed to perform the task (e.g., ± reasoning, ± here-and-now) while the latter disperse learners' attention over many non-specific areas of the L2 performance (e.g., ± planning time, ± prior knowledge).In this model, increasing the complexity of a task through resource-directing dimensions has been considered to result in higher levels of linguistic accuracy and complexity. Robinson justified these predictions by stating that complexity increase in terms of resource-directing elements would lead to noticing, conscious attention to language forms, and then to learning (Schmidt, 2001). On the other hand, an increase in complexity concerning resource-dispersing factors would lead to depletion or dispersion of attention and consequently to the decrease in all linguistic elements of production.

To date, researchers have utilized a variety of complexity features such as ± planning time, ± writing assistance, ± draft availability, ± here-and-now, and ± reasoning demands (see Ishikawa, 2006; Kormos, 2011; Kuiken & Vedder, 2006, 2007, 2008, 2012; Ong, 2014; Ong & Zhang, 2010, 2013). With regard to the great variation in the manipulated variables, measured linguistic elements, and the resulting inconsistency, we believe that more similar CTC studies in the field of writing are required to reach more robust conclusions. In his recent meta-analysis regarding L2 writing research on task complexity, Johnson (2017) concluded that elaborating the link between CTC and L2 writing focusing on attentional resources can devote much to the understanding of the differential systems and processes of composing and language production. Furthermore, the studies manipulating task complexity with respect to both resource-dispersing and the resource-directing factors particularly on written language production in a single experiment are evidently scarce.

Besides task characteristics, it is also anticipated that the existence of the variation in task performance can be partly due to the underlying individual differences (IDs) (e.g., anxiety, self-efficacy, and aptitude) which are an inseparable part of Robinson's (2001a, 2001b, 2003, 2005b, 2007, 2011) Triadic Componential Framework. IDs can affect task performance through intervening in the attentional resources' allocation to different aspects of language, dealing with attentional limitations, and consequently acquiring particular aspects of linguistic competence (Kormos & Trebits, 2012). The significant role of IDs in developing language competence has been studied abundantly and confirmed in L2 speaking, reading, and even L1 writing fields (Dornyei & Kormos, 2000; Kormos & Trebits, 2012), but much has remained unexplained, nevertheless, concerning how IDs might influence quality of L2 written productions and also development of this skill. As argued by Kormos (2012), learners with differing cognitive knacks will handle the complex cognitive and linguistic processes included in writing differently for learning a new language.

As mentioned above, making coherent conclusions is taxing due to variability of findings which is mostly related to the emerging nature of this type of research. Therefore, we intended to contribute more empirical data to the not fully-explored existing literature through investigating how CTC manipulation in terms of both resource-directing and resource-dispersing (intentional reasoning demand and planning time) can account for the variation in linguistic performance. We decided to select the CTC factor types similar to the ones mostly explored, though separately, in the widely cited research articles to take a further step toward more solid deductions. In addition, the novelty of our study lies on involving a

cognitive ID (language learning aptitude) to examine if language aptitude jointly works with manipulated task feature to affect the ways writers allocate their attention to different linguistic elements.

Literature Review

Writing Research on Manipulating Reasoning Demands of the Tasks

As predicted in Cognition Hypothesis, imposing greater amount of intentional reasoning demands, a resource-directing factor referring to reasoning about other people's intentions, beliefs and desires and relationships, on the tasks would result in simultaneous growth of accuracy and complexity. Of the relatively small pool of research manipulating reasoning demands as CTC factor, the findings are inconsistent. Regarding accuracy, Kuiken and Vedder (2006, 2007, 2008, 2011), in their successive studies examining the role of increased reasoning demands of letter writing task done by Dutch learners of Italian and French, noticed accuracy improvement in more complex task whereas Cho (2015) found no significant difference in the accuracy level of argumentative essays written by 110 Korean EFL learners.

Pertaining to syntactic complexity, the findings are more consistent though they do not offer any support for Cognition Hypothesis. Similar to aforementioned studies, Frear and Bitchener (2015), partially replicating Kuiken and Vedder's studies, did not observe any change in syntactic complexity through increasing CTC either. A further point which needs to be mentioned here is that in addition to measuring syntactic complexity as the ratio of all dependent clauses to T-units, Frear and Bitchener also took into account each group of dependent clauses independently (adjective, nominal, and adverbial clauses) and found variations particularly with respect to adverbial dependent clauses which decreased in more complex tasks. Thus, they argued that some other elements such as task type, proficiency level, or personal choices might have caused these variations.

Unlike syntactic complexity, lexical complexity in both Kuiken and Vedder's (2006, 2007, 2008, 2011) and Frear and Bitchener's (2015) studies was found to enhance by increasing CTC. However, it should be taken into account that when using the classic type-token ratio for measuring lexical complexity, the results were positive whereas using corrected type-token ratio, which accounts for text length, led to non-significant or negative effects in Kuiken and Vedder's studies. Indeed, the prediction of Robinson's Cognition Hypothesis regarding lexical complexity is supported but not very strongly. All in all, the

above findings indicate only partial support for both Cognition Hypothesis and Trade-Off Hypothesis, so more similar studies are required to validate or invalidate the predictions of CTC theories more confidently.

Writing Research on Manipulating Planning Time

Regarding planning time as a resource-dispersing factor, there is no contrast between the predictions of Robinsons's and Skehan's CTC models, and it is agreed that time restriction would negatively affect language performance. In comparison to the studies utilizing resource-directing factors, even fewer studies were found focusing on the effects of resource-dispersing factors, especially planning time on L2 written production.

The following two studies are the only ones utterly confirming the negative effects of increasing CTC along planning time on all linguistic measures. Ellis and Yuan (2004) explored differential effects of pre-task, on-line, and no planning on complexity, accuracy, and fluency of 42 EFL Chinese learners' written performance. In their study, no planning led to less complexity, accuracy, and fluency while provision of pre-task planning resulted in higher fluency and syntactic complexity, and on-line planning in greater accuracy. Following Ellis and Yuan and using the same tasks and CAF measures, Meraji (2011) found that provision of pre-task planning time fostered accuracy, syntactic complexity, and fluency.

The other studies in the literature concerning planning time provision have gained some partial support of the CTC theories and even contradictory results in some cases. For instance, in a case study done on three Japanese students, Ojima (2006) noticed more fluency and complexity but less accuracy as a result of planning. Fluency was also found to increase due to planning time provision in Rahimpour and Safari's (2011) investigation done on 37 EFL learners writing descriptive texts in two planning conditions. However, the complexity and accuracy of the texts did not appear to differ between two planning conditions. In addition, Mohammadzadeh Mohammadabadi, Dabaghi, and Tavakoli (2013) also conducted a study manipulating CTC through ± planning time alongside ± Here-and-Now dimension in picture sequence narration tasks. They found positive effect of planning time provision on accuracy but not on fluency and complexity.

Furthermore, Ong and Zhang (2010), who explored the effects of planning time in four levels alongside some sub-planning and revising factors on the fluency and lexical complexity in EFL learners' argumentative essays, gained completely opposite results. In their study, fluency was measured by taking into account both writing time (fluency I) and task completion time (fluency II). Surprisingly, higher fluency II and lexical complexity

levels were found in more complex tasks with the least planning time (free-writing condition). They surmised that the writers in planning conditions might have continued to plan even during the task execution which could have hindered them from writing more rapidly and retrieving more various lexical items. Finally, Abrams and Byrd (2016) also manipulated CTC in terms of different guided pre-task planning types (mind-mapping, chronological sequencing, and no-planning) and used the same measures for CAF as this study. In contrast to CTC hypotheses, they found that, the more complex the task, even along resource-dispersing variables, the better participants performed in terms of accuracy. On the other hand, planning time provision was found to have positive effects on fluency and lexical complexity which echoes the predictions of CTC hypotheses. The probable reasons for the disparities in results can be different task types or different measures for complexity and fluency used by the researchers.

Interaction of IDs with Task Characteristics

Despite the notable role of IDs in language development and a great stress laid on the investigation of interaction between task features and IDs, there is still a paucity of studies examining if learners with different cognitive and affective abilities may differ in the way they make use of the benefits of task manipulations. To the knowledge of the researchers, there are three studies (Kormos & Trebit, 2011; Niwa, 2000; Robinson, 2007) investigating the mediating effects of individual differences such as intelligence, aptitude, working memory, and anxiety in the field of oral task research and only two studies (Kormos & Trebit, 2012; Rahimpour & Nariman-Jahan, 2010) in written task research.

In written modality, Rahimpour and Nariman-Jahan (2010) tried to find out the effect of learners' self-efficacy as an affective ID, on the performance of three types of written tasks with different cognitive loads in terms of the concept load, fluency, complexity, and accuracy. They did not find a very strong relationship between self-efficacy and linguistic elements. Moreover, Kormos and Trebit's (2012) examined the relationship between the components of language aptitude and the fluency, lexical and syntactic complexity, and accuracy in both written and spoken modes of narrative task performance. Accuracy and complexity were the elements strongly affected by deductive ability and grammatical sensitivity of the learners. They also found that variation in the relationship between aptitude components and linguistic measures were mostly in oral performance than written production. In the current study, we also selected language aptitude as one of the best predictors of language learning success (Dornyei, 2005) to explore its combined effects with

CTC factors on the written production. Language aptitude research is called a 'success story' by Dornyei (2005) because of its old background in the literature, and also its effective function in second language acquisition. Robinson (2015) has also stated that cognitive IDs have "robust influences on success during L2 instruction in general, and the most notable one is aptitude" (p. 24).

Aptitude is argued to have the potential to forecast future success in learning a language (Carroll, 1993). Carroll (1981) identified four underlying dimensions of language learning aptitude: (a) phonetic coding, the ability to make a connection between sounds and symbols and recall them whenever it's required, (b) grammatical sensitivity, the ability to recognize the functions of words in sentences, (c) rote learning, the ability to acquire the connection between sounds and meanings, and (d) deductive learning, the ability to extract the rules from language materials. Some aptitude measurement tools have already been developed based on these four major dimensions; however, Carroll and Sapon's (1959) Modern Language Aptitude Test (MLAT) is the first and the most validated test which has been widely utilized by SLA researchers. According to DeKeyser (2000), MLAT "is usually considered the best verbal aptitude test in terms of its predictive validity for L2 learning" (p. 509).

The Present Study

We hope this between-subjects study will shed some light on task-based research in the writing domain by focusing on the main and interaction effects of two manipulated task complexity features (both resource-directing and resource-dispersing factors and one measured ID (language learning aptitude) on the written performance of the EFL learners in terms of CALF measures. The following research questions were addressed in this study:

RQ1. How does manipulation of task complexity in terms of resource-directing factor (± intentional reasoning demands) affect the CALF measures in EFL learners' written productions?

RQ2. How does manipulation of task complexity in terms of resource-dispersing factor (± planning time) affect the CALF measures in EFL learners' written productions?

RQ3. What are the combined effects of increased task complexity in terms of both resource-dispersing and resource-directing factors on the CALF measures in EFL learners' written productions?

RQ4. How does learners' language learning aptitude interact with the manipulated task complexity factors in relation to the CALF measures in EFL learners' written productions?

Methodology

Participants

Two-hundred and fifty-seven Iranian undergraduate students voluntarily participated in this study. They were all studying English at three state universities in East-Azerbaijan province, Iran. Three participants withdrew halfway, and twenty-eight ones who were determined as highly advanced or beginners through the Oxford Quick Placement Test (OQPT) scores were excluded from the study. Thus, the main sample included 226 learners aged between 19 and 29 (females=128, males=98). According to the results of the placement test, the proficiency level of the remaining participants was rated to be intermediate.

Instruments

The first instrument used in this study was OQPT to determine the proficiency level of the participants at the beginning of the study. The test was developed and published by Oxford University Press and University of Cambridge ESOL Examinations in 2001, and it is shortened version of the Oxford Placement Test. It includes 60 multiple choice items with 30-minute allocated time. Test takers can be placed in different proficiency levels ranging from level 1 (A1= breakthrough) to level 5 (C2 = mastery).

The second one was MLAT developed by Carroll and Sapon (1959) and consists of five parts based on four underlying dimensions of language aptitude. Part 1, Number Learning, requires the participants to learn the names of 1-, 2-, and 3-digit numbers in a new language and then transcribe the numbers they hear. In part 2, Phonetic Script, test takers study a phonetic script and choose the word that they hear from choices written in phonetic script. Part 3, Spelling Cues, taps participants' vocabulary knowledge and their ability to handle novel spellings of known words. Test takers in part 4, Words in Sentences, were required to choose a word that serves the same grammatical function as a specified word. Finally, in part 5, Paired Associates, they study a list of Kurdish vocabulary items and their English translations, and then they complete a multiple-choice test of the word pairs without referring to the original lists.

Finally, three letter writing tasks were utilized to elicit the written data. We used the tasks similar to Frear and Bitchener's (2015) with the full permission of the authors. In the task with the lowest reasoning demands (Task 1), the learners were required to write about their country to an English-speaking friend intending to visit Iran. In Task 2, they were told that their English-speaking friend had a plan to travel to Iran on the weekend and they were supposed to choose a suitable restaurant out of two and then write to that friend to let him

know which restaurant they would visit and why. The preferences of their friend and also the conditions of the restaurant were listed to the writers. In the highest complex task (Task 3), they were supposed to do the same thing as Task 2, but one restaurant was added to the list of restaurants and they had to regard the preferences of two more friends who would be with them on his visit.

Data Collection Procedures

Before starting to collect the main data, there were 257 participants who volunteered to sit for the placement test. We used OQPT to check the homogeneity of the participants and control their proficiency level as the probable confounding variable. Based on the results, 226 participants whose scores fell within intermediate score bands were selected as the sample of the study. Afterward, having taken MLAT, the participants getting scores above the median (median=48) were identified as high-aptitude learners and the ones getting lower were determined as low-aptitude ones.

Then, three experimental groups were randomly formed regarding the task with differing degree of cognitive reasoning demands (low, medium, and high complex) they received. As a between-subject study, we were required to have twelve independent groups. Therefore, a random stratification sampling was also done within each reasoning demand group in order to assign an equal number of high- and low- aptitude learners into planning and no planning groups. The experimental design of the study is shown in the Figure 1.

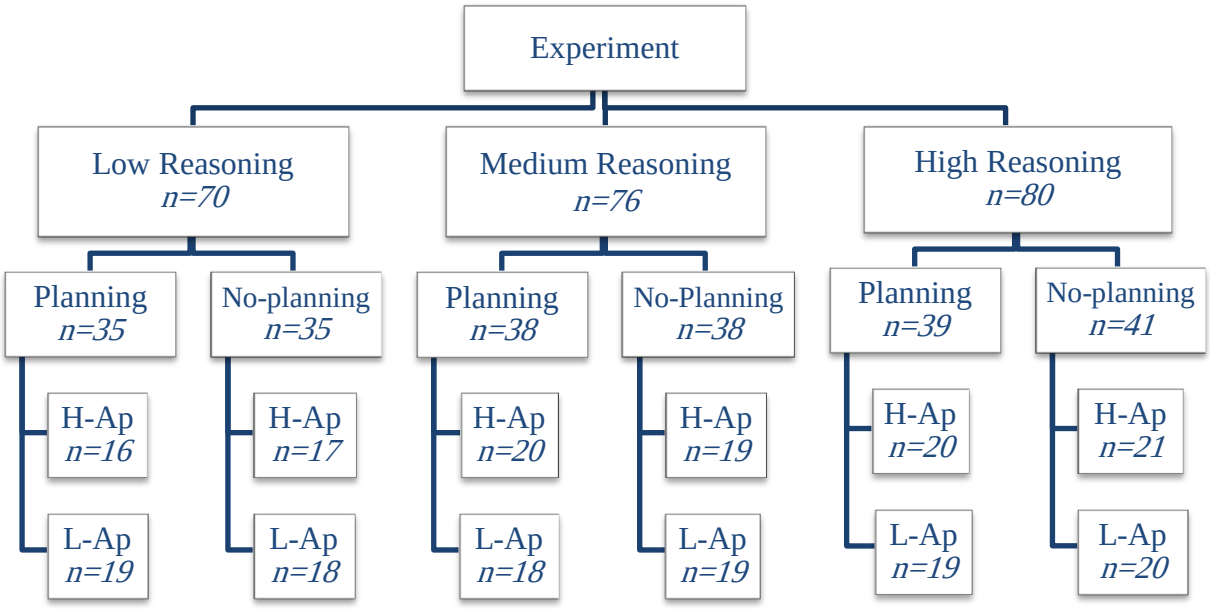

Figure 1. Research Design Diagram

In the last data collection session, task 1 was given to the first experimental group and Task 2 and 3 were given to second and third groups respectively. The researchers gave the necessary instructions to the participants in English and in Persian, if needed, and then they were given 2 minutes to raise their questions concerning the task completion. Additionally, the participants in Planning group were given 10 additional minutes before starting to write while the ones in No-planning group were instructed to write immediately with no planning. The total amount of allocated time for composing was 30 minutes for both Planning and No-planning groups. The participants in all groups were asked to write letters with about 200-250 words.

Coding Target Measures

We measured linguistic performance in terms of CALF measures including syntactic complexity, accuracy, lexical complexity, and fluency. Concerning syntactic complexity, we utilized a measure of subordination which is the ratio of dependent clauses to all T-units. T-unit was selected as the basic measurement unit of this study because of its confirmed value in signifying writing ability development (Hunt, 1965). Moreover, the accuracy of the participants' performance was examined by dividing the number of syntactically correct T-units to the total number of T-units. We didn't consider the wrong use of punctuation and capitalization as errors. For measuring lexical complexity, we used a mean segmental type-token ratio. In this formula the problem of variation in the text lengths, which may influence the results, was compensated by dividing each text into the segments with an equal number of words, calculating the type-token ratio of each segment, and finally computing the average of these ratios for each single text. Finally, fluency, the pace of writing, was measured by dividing the total number of words in each text to 30 minutes which was the total time given to the writers for task completion.

In order to make sure of the precision in our measurements, we gave the required instructions on coding the data to an English teacher and researcher and asked her to measure these language elements in 30 randomly chosen letters. Inter-rater reliability coefficients of .88, .84, and .91 were found for syntactic complexity, lexical complexity, and accuracy respectively. We didn't check inter-rater reliability for fluency since word count of each text was calculated by MS Word automatically after the texts were typed, and no disparity in judgment was possible.

Results

The research questions posed in this study sought to find out the main and also interaction effects of increased task complexity (±intentional reasoning demands and ±planning time), and language learning aptitude of the learners on CALF measures. Firstly, Table 1 indicates the means and standard deviations of all linguistic measures in the texts for the experimental groups.

Table 1. Means and standard deviations of linguistic measures in all experimental groups

	Low Reasoning				**Medium Reasoning**				**High Reasoning**			
	Planning (n=35)		**No-planning (n= 35)**		**Planning (n=38)**		**No-planning (n=38)**		**Planning (n=39)**		**No-planning (n=41)**	
	H-Ap (n=16)	L-Ap (n=19)	H-Ap (n=17)	L-Ap (n=18)	H-Ap (n=20)	L-Ap (n=18)	H-Ap (n=19)	L-Ap (n=19)	H-Ap (n=20)	L-Ap (n=19)	H-Ap (n=21)	L-Ap (n=20)
Syntactic Complexity	.50 (.11)	.41 (.16)	.33 (.08)	.36 (.18)	.47 (.16)	.57 (.17)	.50 (.15)	.34 (.11)	.51 (.20)	.42 (.16)	.38 (.16)	.32 (.11)
Lexical complexity	.82 (.02)	.79 (.03)	.79 (.03)	.78 (.02)	.80 (.02)	.77 (.04)	.79 (.03)	.79 (.03)	.82 (.02)	.80 (.02)	.81 (.03)	.79 (.04)
Accuracy	.69 (.12)	.47 (.13)	.67 (.12)	.57 (.14)	.73 (.12)	.65 (.22)	.65 (.19)	.47 (.11)	.66 (.14)	.57 (.11)	.72 (.12)	.49 (.16)
Fluency	8.19 (1.30)	8.60 (1.84)	7.55 (1.50)	7.80 (1.68)	7.75 (2.16)	7.72 (2.02)	6.49 (1.34)	6.07 (1.19)	7.70 (1.70)	7.61 (1.59)	6.71 (2.46)	5.52 (1.72)

To find the answers of research questions, we conducted a 3× 2× 2 between-subject multivariate analysis (MANOVA) on the CALF measures. Before reporting the results on each linguistic measure separately, the overall main and interaction effects of the research factors are indicated in Table 2. The main effects of increased reasoning demands ($p < .05$) of the tasks and planning time provision ($p < .05$) were found to be significant. Regarding the interaction of two CTC factors, the results revealed that there is a significant interaction effect, though not very strong one ($p<.05$, $\eta^2 = .043$). While language learning aptitude interacted with neither reasoning demands nor planning time separately, a three-way interaction effect among the all independent factors, two CTC factors and one ID, was found to be significant [Wilks's Lambda=.88, F (8, 422) =3.22, $p<.05$, $\eta_p^2=.058$].

Table 2. Summary of Factorial Analysis Results

Factors	**F**	**df**	**p**	**η^2**
Reasoning demands	4.47	8	.000	.078
Planning time	16.83	4	.000	.242
Reasoning demands× Planning time	2.34	8	.018	.043
Reasoning demands× Aptitude	.698	8	.694	.013
Planning time ×Aptitude	1.90	4	.111	.035
Reasoning demands× Planning time× Aptitude	3.22	8	.001	.058

Pertaining to the main effects of increased reasoning demands on each linguistic measure, it was found that increasing task complexity with regard to reasoning demands significantly impacted on the syntactic complexity [F(2, 223)=4.57, p = .011, η_p^2=.051], lexical complexity [F(2, 223)=3.99, p = .020, η_p^2=.046], and fluency,[F(2, 223)=9.27, p = .000, η_p^2=.098], but not on the accuracy [F(2, 223)=.383, p = .682, η_p^2=.004].

Comparing the groups pair-wise by conducting a Bonferroni post-hoc test, we found that the mean score of syntactic complexity in medium complexity (M=.47, SD=.15), p=.030 and high complexity group (M=.46, SD=.16), p=.040 were significantly higher than the low complexity condition (M=.40, SD=.15). Comparing the lexical complexity mean scores, post hoc analyses showed that the writers in the group with the highest reasoning complexity (M = .81, SD = .05) reported a significantly higher mean than the writers in the medium reasoning complexity group (M = .77, SD = .03), p = .028, but no other meaningful differences were found between groups. Finally, for fluency, the mean score of the group with the lowest complexity in terms of reasoning (M=8.05, SD= 1.62) was significantly higher than the medium complexity (M= 7.01, SD=1.85), *p*=.003 and high complexity groups (M=6.87, SD=2), *p*=.001. It should be also noted that the medium and high reasoning complexity groups did not report any significant differences in fluency.

With regard to the second research question, the results indicated that increasing task complexity through planning time negatively affected syntactic complexity [F (1, 224) = 28, p=.000, η_p^2=.116] and fluency [F (1, 224) = 27.57, p=.000, η_p^2=.114] and did not have any impact on other linguistic measures. In other words, the writers who were deprived of planning time prior to writing, reported less fluent and syntactically complex performance in comparison to the ones given 10 minutes to plan.

With respect to the joint effect of reasoning demands and planning time which was the issue raised in the third research question, we discovered an interaction effect only on accuracy [F (2, 223) = 6.55, p=.002, η_p^2=.058], but this effect cannot be considered as a strong one. Although, accuracy was found not to be influenced by each task complexity factors independently, it was interesting to note that the writers were able to write more accurately when two factors interacted with each other. As shown in Figure 2, the nonparallel lines signify the existence of an interaction effect. It can be seen that whenever the cognitive complexity was high with respect to reasoning demands of the task, planning time provision played an assisting role in increasing the accuracy whereas in low reasoning group, planning did not help much and even the participants in No-planning condition did better.

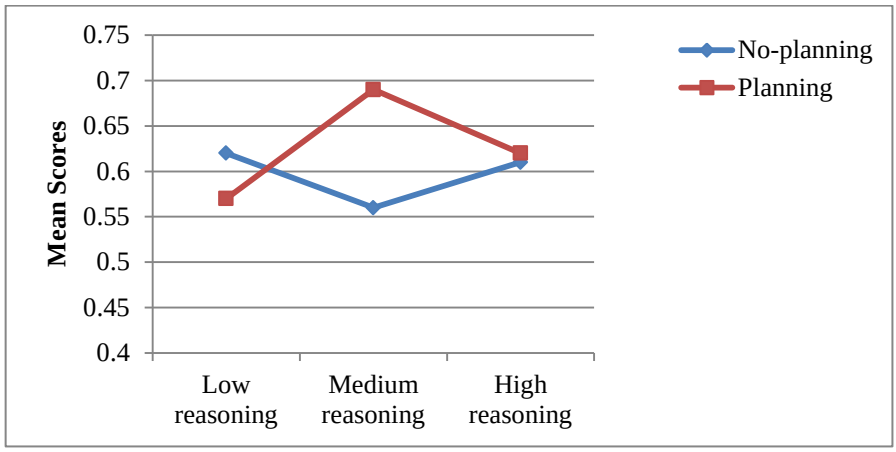

Figure 2. Interaction Effect between Reasoning Remand and Planning Time on Accuracy

Finally, concerning the interplay of aptitude with task manipulation factors, it is illustrated in Table 2 that aptitude did not show any two-way interplay with either reasoning demand or planning; however, the obtained three-way interaction of the factors was found to significantly but marginally affect accuracy [F(2, 223)= 4.12, p=.017, η_p^2=.037] and no other linguistic measures.

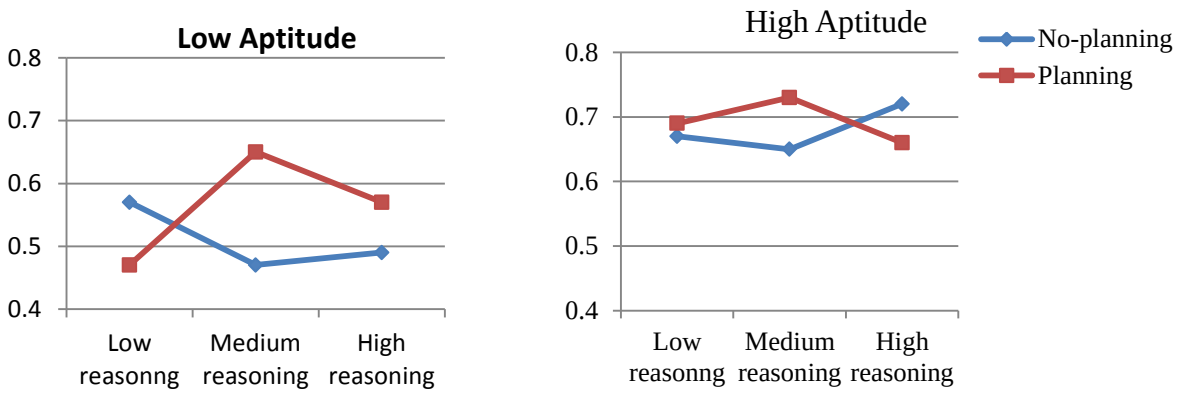

Figure 3. Three-Way Interaction Effect on Accuracy

As shown above, the interaction of reasoning demand and planning time factors did not occur in a similar manner and varied across two aptitude levels. The general picture signals higher accuracy obtained at high-aptitude level in comparison with low-aptitude one. Furthermore, in low reasoning group, the participants at low-aptitude level wrote more accurately when no planning was provided while the ones in the same reasoning group at high-aptitude level performed reversely with respect to planning conditions. On the other hand, in high complexity group, provision of planning time benefited low-aptitude participants more than high-aptitude ones.

Discussion

The Effects of Reasoning Demands Dimension

Robinson (2001a, 2001b, 2005b, 2007, 2011) predicted that increased CTC through resource-directing factors would lead to higher accuracy and complexity while it is not the case with regard to fluency. On the other hand, according to Skehan (1998, 2001), this kind of increase in CTC would result in a trade-off between accuracy and complexity and also a decrease in fluency. In this study, some positive effects on lexical and syntactic complexity, negative effects on fluency, but no effects on accuracy were found. Thus, due to the partial similarities of our findings with predictions of both CTC models, we cannot strongly confirm one hypothesis while rejecting the other.

Similar to our findings, Ishikawa (2006) and Ruiz-Funes (2013, 2014, 2015) also observed more syntactic complexity gains in the tasks with increased reasoning demands while Kuiken and Vedder (2006, 2007, 2008, 2011, 2012) and Frear and Bitchener (2015) found no significant differences. Regarding between-group differences in syntactic complexity, although the difference between medium-reasoning group (Task 2) and high-reasoning group (Task 3) was non-significant, the participants in both Task 2 and 3 conditions outperformed the ones in low reasoning group (Task 1). The reason that the difference between Task 2 and Task 3 was not big enough to be statistically significant can be related to the fact that CTC level of Task 3, in comparison to Task 2, was not cognitively stronger to trigger the participants' ability to use more complex language in terms of subordinations in an automatized way. Higher subordination in Tasks 2 and 3 in comparison to Task 1 can also be explained by different requirements of Task 1 in which the writers were required to only describe some features and qualities of their country in isolation, and it precluded using more subordinations while interrelated issues in Task 2 and 3 accompanied the use of embedded and subordinating means mostly in form of expressing cause and effect structures to support their choice of the best restaurant to go.

Regarding lexical complexity, our results are in line with those of Kuiken and Vedder (2006, 2007) and Frear and Bitchener (2015), but Kuiken and Vedder (2008, 2011) and Ong and Zhang (2010) did not observe statistically meaningful effects on the lexical variation through increased resource-directing factors. These dissimilar findings might have resulted because of different resource-directing factors utilized by Ong and Zhang (revising availability) or not considering the effect of text length in lexical complexity measurement by Kuiken and Vedder. In addition, although Frear and Bitchener also gained higher lexical

complexity in more complex tasks, they suspected that it might be due to the higher variation of lexical items in more complex tasks' instructions and not merely because of increased CTC effects. However, we take issue with them over this claim because in our study, significant differences were detected between only Task 2 and 3 whereas the widest contrast between the number of lexical items in task instructions was obviously between Task 1 and 3. Thus, we hold the view that increasing the conceptual demands of the tasks has contributed more to the high variation of lexical items revealed by the writers trying to realize those cognitive concepts. Finally, non-significant difference between the lowest and highest complex tasks in lexical complexity can be justified based on the requirements of Task 1 which were different somehow. Although high cognitive demands of Task 3 led to more lexical variation, the writers of Task 1 were also asked to freely write about their country from different points of view as they wish, which might have led to utilizing various range of vocabulary.

Although cognitively complex tasks are believed to "direct attentional and memory resources to aspects of the L2 system required to accurately understand and convey them" (Robinson & Gilabert, 2007, p. 164), in our study, accuracy was found not to change significantly across the groups. Ruiz-Funes (2013, 2014, 2015) also detected a decrease in accuracy in complex task while syntactic complexity was increased. Contrarily, Kuiken and Vedder (2006, 2007, 2008, 2011) determined the increase of CTC as a factor in producing more accurate output but at expense of complexity. In general, a tendency toward Skehan's Trade-Off hypothesis with regard to the existence of a competition between syntactic complexity and accuracy can be seen in the literature. Nevertheless, accuracy was not negatively affected by increased CTC in our study, and even a trend of growth was seen in mean scores of accuracy from low to complex tasks. Therefore, it cannot be taken as confirmation of a trade-off between complexity and accuracy. The probable reason behind non-significant differences in accuracy can be due to the wrong arrangement of the instructions and requirements of the cognitively complex tasks which did not establish contrasting levels of reasoning demands to cause the writers to display significantly different performances in accuracy.

Finally, observing decreased fluency as a result of increased CTC, is in line with both Robinson'(2001a, 2001b, 2003, 2005b, 2007) Cognition Hypothesis and Skehan's (1996, 1998, 2001, 2003) 'trade-off' Hypothesis. Similarly, Ruiz-Funes (2013, 2014, 2015) found negative effects of increased CTC on fluency and Ong and Zhang (2010) did not observe any

significant effects. It is believed that fluency requires learners to draw on their memory-based system in order to retrieve ready-made chunks of language, thus while their attention is directed to complex linguistic production consequently leading to more grammaticisation and accuracy, attention to higher speed of speaking or writing is deteriorated.

The Effects of Planning Time Dimension

Regarding our second research question, we noticed that planning time availability had positive effects on only fluency and syntactic complexity. In their CTC models, both Robinson (2001a, 2001b, 2003, 2005b, 2007, 2011) and Skehan (1996, 1998, 2001, 2003) have predicted that increased task complexity through resource-dispersing factors (e.g. planning time) would negatively affect all CAF measures. Except for the accuracy and lexical complexity, our findings support the above-mentioned predictions.

The findings of the present study are in line with Ellis any Yuan (2004) and Meraji (2011) who found a more complex and fluent linguistic performance in pre-task planning condition. However, dissimilar to our results, they also observed more accurate performance when the pre-task planning time was provided. With respect to fluency, Rahimpour and Safari (2011) also found the same results as ours; however, no influence was observed on complexity and accuracy. The findings of Mohammadzadeh Mohammadabadi et al. (2013) greatly diverge from ours since planning time provision was found to have positive impact on accuracy but not on fluency and complexity. On the other hand, there are two studies which detected some positive effects of removing planning time in a sharp contrast with our results and also with the predictions of CTC models. For instance, Ong and Zhang (2010) observed positive effects on fluency and lexical complexity, and Abrams and Byrd (2016) obtained the same result on accuracy though the positive effects of planning time provision on fluency and lexical complexity were also found in the latter study.

The non-significant effects of planning time on lexical complexity and accuracy in our study can be explained through considering the fact that the combination of limited attentional resources and the focus on increased syntactic complexity in formulating stage which was done during pre-task planning time might have played a hindering role in automatic retrieving and using of varied lexical items and also in the way to encode their message accurately. We can easily approve Yuan and Ellis (2003) who concluded that: “pre-task planning does not greatly assist formulation, especially of grammatical morphology. Thus, the linguistic correlate of effort put into conceptualizing what to say is enhanced complexity and fluency rather than accuracy”(p. 7).

Furthermore, as explained by Ong and Zhang (2010), sometimes task performers are excessively engaged with some aspects of language in pre-task planning that they continue planning even in formulating stage, and it hinders them from focusing on other linguistic aspects. In other words, the pre-task planning time was spent mostly on thinking about the content of their letters and how to present those intentional reasoning relations in more complex structures, so not enough attentional space was left to focus on lexical complexity and accuracy. Thus, pragmatic requirements of the complex tasks in this study may also be a reason for gaining higher syntactic complexity and fluency.

The Simultaneous Influence of Resource-Directing and Resource-Dispersing Factors

An interaction effect between intentional reasoning demands and planning time was found only on the accuracy but not on other linguistic measures. As discussed before, planning provision assisted the writers in more cognitively complex tasks (Tasks 2 and 3). To our surprise, accuracy was the only measure which did not differ among groups by manipulating each of these task complexity dimensions independently. Thus, it can be supposed that in order to prime writers to look for more accurate ways to convey their concepts and also to direct their attention to grammatically correct linguistic structures, task complexity needs to be manipulated with respect to more than one dimension at a time.

For validating this result, more studies exploring the simultaneous influence of complexity factors must be conducted in L2 writing domain. To the knowledge of the researchers, there are few studies doing this in writing domain. Mohammadzadeh Mohammadabadi et al. (2011) and Ong and Zhang (2010) found no interaction effect among the CTC factors, whereas accuracy was found to be affected by the combination of both CTC factors in our study. As discussed earlier, although a trend of increase was observed through increasing CTC with respect to reasoning demand, it was not statistically big enough. So, the increased CTC through resource-directing factor did its job in directing the attention to accurate language formulation, but since the writers were already occupied with complex language production, planning time provision played an assisting role in freeing already directed attentional resources. Moreover, the differences between our findings and those of the above studies can be attributed to the different types of the resource-directing factors utilized by the researchers.

Interaction of Language Aptitude with Task Complexity Factors

In the last research question, we intended to find out if language aptitude as an ID interacts with task complexity factors to affect language performance. In Robinson's (2001a, 2001b,

2005b, 2011, 2015) Triadic Componential Framework, it is supposed that task performance can be aided by IDs when the complexity of the tasks gets higher. In the present study, a three-way interaction effect was found on the accuracy of the written outputs. Low-aptitude learners seemed to benefit more from planning time provision in more cognitively complex tasks while high-aptitude learners were able to show more accuracy in cognitively complex tasks even without planning time. Thus, it can be concluded that some linguistic aspects of the learners' performance which cannot be affected only by CTC factors may depend on what they bring into task performance with themselves. Kormos and Trebit (2012) assessing the relationship between components of aptitude and language production also found that deductive ability and grammatical sensitivity components were positively related to the accuracy and complexity of the productions.

We also believe that since aptitude tests, particularly the MLAT, have been found to have a strong correlation with language proficiency, higher accuracy gains revealed by high-aptitude learners can be related to their more extensive acquired language competence and not to their knack of language. However, we should account for whatever external or internal factor which can help the learners in dealing with complex language tasks.

Conclusion

To sum up, the main findings of the study are listed here. Firstly, we found that increased CTC along reasoning demands resulted in significantly greater lexical and syntactic complexity in comparison to less complex tasks confirming Robinson's predictions in Cognition Hypothesis (2001a, 2001b, 2003, 2005b, 2007, 2011), but fluency significantly decreased which strongly supports the predictions of both Cognition Hypothesis and Skehan's (1996, 1998, 2001, 2003, 2009) Limited Attentional Capacity. When accuracy is concerned, the prediction of Cognition Hypothesis was not supported since we did not find any significant differences among different reasoning conditions. However, this cannot be regarded as a support of Skehan's hypothesis because negative effect of complex tasks on accuracy was not observed either. Secondly, regarding the main effects of increased CTC along resource-dispersing factor, it was found that removing planning time negatively affected fluency and syntactic complexity providing a confirmation of the above-mentioned CTC hypotheses except for the accuracy and lexical complexity. Thirdly and interestingly, increasing CTC along reasoning demands and decreasing it through planning time provision had a positive joint impact on only accuracy which was not affected by either of the CTC

factors separately. Finally, in line with Robinson's (2011, 2015) predictions, the learners possessing higher aptitude level were detected to gain more from the complex tasks manipulated through both resource-directing and resource-dispersing factors in terms of accuracy.

Implications

The present investigation has some implications for researchers, teachers, syllabus designers, and even test developers who work in task based language teaching (TBLT) and L2 writing fields. Besides the confirmed significant role of TBLT, determining criteria for grading and sequencing tasks is still a challenging issue which can be solved by more empirical data in this field. Skehan (1998) referred to task design as a means to promote 'balanced language development' since specific task characteristics "predispose learners to channel their attention in predictable ways, such as clear macrostructure towards accuracy, the need to impose order on ideas towards complexity, and so on" (p. 112). Thus, the teachers and syllabus designers need to consider which linguistic dimensions their learners need to improve first, and if there is no priority to improve specific linguistic dimensions, the teachers should be aware of the language aspects in which their learners are weak and need to be triggered by some external factors such as particular task types or task features.

In addition, IDs should not be ignored by teachers, syllabus designers, and researchers. Research on interaction between IDs and task features can lead to an appropriate adjustment of teaching methodologies to students or vice versa (DeKeyser, 2012). Pedagogically, Robinson (2011) argued that the data resulting from interaction studies can help educators to "match learners to sequences of simple to complex tasks along those resource-directing and dispersing dimensions they are best able to perform " (p. 8). As found in our study, learners with higher level of language leaning aptitude can benefit more from cognitively complex tasks in terms of resource-directing factors while the ones with lower aptitude used planning time as a help in more complex conditions. Finally, due to scarcity of research in L2 writing, we, researchers, can gain more conclusive results by doing similar research studies which would lead us to a better understanding of the nature of processes involved in L2 writing and how they result in L2 acquisition.

Limitations and Suggestions for Further Research

Besides the possible contributions, we admit some limitations of the current study and declare them here to be considered in the future trend of research. First of all, we analyzed CALF measures using one measurement formula for each, but different measures of the

linguistic elements are proved to lead to different results in the literature. Second, between-subject design of the study might be regarded as a limitation though we tried to compensate for this limitation by giving the participants a placement test together with stratified sampling to make sure of their homogeneity. Third, we utilized MLAT for determining aptitude level which is a validated and widely used test in the literature, but we did not take into account the role of each component of this test separately as suggested in Aptitude Complexes Hypothesis by Robinson (2005a). Finally, due to the emphasis which has been put on examining the interaction effects among contextually manipulated external factors and individuals' internal variables, it is highly advised to include other cognitive learner variables as well as the affective ones in similar studies.

Note

1) Doing MANOVA requires that the assumptions of normality of distributions, equality of variances, and covariances are not violated. Thus, Shapiro-Wilk's normality test, Leven's test, and Box's M test were all conducted to test these assumptions respectively. The results of the tests indicated p-values ($p > .05$) which revealed that the assumptions are met. Therefore, it can be claimed that the values produced by the MONOVA were accurate and reliable.

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