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Effect of Genre and Cognitive Complexity on Features of L2 Writing: An Application of Construction-Integration Model

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Abstract
This study examined the effects of genre and task complexity on the writings of second language learners in terms of measures of L2 propositional, lexical, and syntactic complexity, accuracy, and fluency. The interaction of proficiency level, as an individual factor, with genre and task complexity was also investigated. Propositional complexity, as one of the features of L2 complexity, was of particular importance in this study and was analyzed by means of Construction-Integration model. A proficiency test and four writing tasks with two levels of cognitive complexity, operationalized as provision of idea support, in two genres of personal letter writing and argumentative were administered to 60 students, who were studying mining engineering, mechanics, geophysics and literature. The findings of this study suggested that task complexity and genre significantly influenced writing measures of second language learners, as higher cognitive complexity and argumentative genre were associated with better quality in form. In particular, propositional complexity was observed to be affected by task complexity, where increasing cognitive complexity led to serial and dense presentation of propositions. Additionally, interaction effect was seen between genre and task complexity. Language proficiency also seemed to have a rather small, nevertheless significant, role in the medium. Further implications of the study are subsequently discussed.
Keywords:Construction-Integration model; Genre; Propositional complexity; Task complexity; Writing complexity.

Introduction

Drawing on Dahl's (2004) distinction between relative and absolute notion of language complexity, Bulté and Housen (2012, 2014) developed a representation of L2 complexity, in which absolute L2 complexity is divided into three subcategories of linguistic, discourse-interactional, and propositional. The most frequently studied aspect of L2 complexity is linguistic complexity, constituting the foundation of almost all of the previous studies in the task-based language teaching (TBLT) research paradigm. Such studies include focusing on task-internal features that are believed to influence the linguistic outcome of pedagogical writing tasks in terms of syntactic complexity, accuracy, lexical complexity, and fluency (henceforth CALF). The extensive interest in CALF measures of writing is mainly stemmed from their association with language development and the fact that they have been used for

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differentiating levels of proficiency (Lu, 2011; Norris & Ortega, 2009).

Two of the task-internal dimensions which have repeatedly been shown to have an impact on CALF are genre (e.g. Yoon, 2017) and cognitive task complexity (Kuiken&Vedder, 2008, 2011, 2012). Considering the effect of task complexity on linguistic features of writing, two influential models of task categorization, Triadic Componential Framework (Robinson, 2015; Robinson &Gilabert, 2007) and the Limited Capacity model (Skehan, 2014, 2015) have been a fruitful research topic in the past decade or so. Originally developed for the analysis of speaking, these models have also been extensively utilized as a framework for the analysis of writing tasks (e.g. Gilabert, Manchón, &Vasylets, 2016; Révész, 2011). Likewise, it has been argued that different genres will elicit certain syntactic and linguistic features. For instance, argumentative genre has been demonstrated to be associated with higher levels of syntactic complexity (Lu, 2011; Way, Joiner, & Seaman, 2000). Lexical complexity and diversity also have been found to be influenced by genre (Jeong, 2017; Olinghouse& Wilson. 2012; Ravid, 2005). Concerning the role of individual differences as modulating factors, the effect of genre appears to interact with proficiency level, as Jeong (2017), for instance, observed that only higher proficiency participants were able to obtain higher scores in expository genre compared with narrative genre. In a similar vein, Kuiken and Vedder (2008) highlighted the modulating role of language proficiency level on the effect of cognitive task complexity.

Propositional complexity, a feature of L2 complexity which has recently started to become a research interest in this paradigm (Vasylets, Gilabert, &Manchón, 2017), is of great importance to this study. Propositional complexity has been a fruitful research topic in other paradigms, among which studies pertaining to Alzheimer's disease are noteworthy, where propositional analysis of texts has led to reliable prediction of risk of dementia (Bryant et al., 2013; Farias et al., 2012; Fromm et al., 2016; Snowdon et al., 1996; Spencer et al., 2015), bearing witness to the importance of propositions in writing and what propositional analysis may reveal with regards to underlying mental processes of language users.In this study it has been tried to further examine the effect of genre, including personal letter writing and argumentative, and cognitive task complexity, operationalized as provision of idea support, on CALF measures and the propositional structure of textbase. Additionally, the modulating effect of proficiency level, as an important individual variable in a language teaching environment, has been investigated.

Literature Review

Writing, Task Complexity, and Genre

Classic models of writing, including Kellogg's (1996, 2004), Flower and Hayes' (1981), and Bereiter and Scardamalia's (1986), have emphasized the significance, in addition to the limited capacity, of working memory in the process of writing. Seemingly, all these models demonstrate no discord in terms of the stages involved in writing, with all of them proposing that language production utilizes a limited working memory and that formulation of ideas is supposedly the first stage of linguistic production. Subsequently, these ideas are translated into linguistic structures and then are written utilizing the writers' motor skills. The generation of ideas and the content is the initial stage in all the pertaining models, and, arguably, the most cognitively demanding stage (Kellogg, 1996).

Considering the analysis of writing tasks in terms of cognitive complexity, two models of task categorization, Triadic Componential Framework (Robinson, 2015; Robinson &Gilabert, 2007) and the Limited Capacity model (Skehan, 2014, 2015) provide rather different perspectives regarding the linguistic features of the output of language teaching tasks. Skehan (2014) and Robinson (2015) highlight the areas in which their respective models are different from one another. The basic claim of the Triadic Framework pertains to its fundamental distinction between resource-directing and resource-dispersing dimensions

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of task complexity, where, according to the Cognition Hypothesis (Robinson, 2015; Robinson &Gilabert, 2007), the former dimensions would lead to focusing the attentional resources and the latter would lead to better control over the already established knowledge of language. The Trade-Off Hypothesis (Skehan, 2014, 2015), on the other hand, does away with the mentioned distinction and simply claims that when learners are faced with cognitively demanding tasks, considering the limited attentional resources, they will have to prioritize one or two aspects of CALF at the expense of others. Robinson believes that increasing task complexity would push language learners to higher levels of accuracy and fluency, while Skehan argues that simultaneous attention to both accuracy and complexity, due to limited processing capacities, is unlikely (Skehan, 2014; Robinson, 2015). In the literature, generally, some studies have lent support to the Trade-Off Hypothesis (e.g. Ruiz-Funes, 2015) and some to the Cognition Hypothesis (e.g. Kormos, 2011; Vasylets et al., 2017; Michel, 2011), while the results of most studies have provided partial support for both (e.g. Frear&Bitchener, 2015). Nevertheless, there are still some pertaining issues that are yet to be investigated, especially considering the role of mode and individual differences. Additionally, in this research paradigm, the pertaining literature has predominantly focused on purely linguistic complexity and propositional complexity has been ignored.

Biber and Conrad (2009), in their discussion of the differences between genre, register, and style, claim that consideration of purpose and situational context is of great importance from the perspective of genre, and its main feature pertains to the conventions associated with a particular context and purpose (Halliday&Hasan, 1985), for instance the ways in which a letter could begin or end. It has been argued that genre, as a task variable, will elicit certain syntactic and linguistic features (Jeong, 2017). Olinghouse and Wilson (2012), for instance, investigated the vocabulary level associated with genres of story, persuasive, and informative in writings of fifth graders. The results of this study suggested that in terms of diversity, for example, persuasive genre elicited the most complex output from the participants compared with the other two genres. In a similar vein, the effect of genre on features of syntactic complexity was investigated by Beers and Naggy (2009), where writings of middle school students in two genres of narrative and persuasive were examined. Interestingly, it was observed that syntactic complexity, in this case clauses per T-unit, was positively correlated with text quality in narrative genre, while negatively correlated with text quality for persuasive texts. A study, however, investigating the effect of genre on idea units, i.e. propositional complexity, is yet to be conducted.

L2 Complexity

As previously mentioned, the overall operationalization of L2 complexity in this study was inspired by Bulte and Housen (2012, 2014). In this study, features of syntactic complexity, lexical complexity, and propositional complexity have been investigated, the details of which have been reviewed in what follows.

Bulté and Housen (2014) believe that there cannot be a one-size-fits-all operationalization of syntactic complexity. In a somewhat similar vein, Norris and Ortega (2009) claim that there are three sources of syntactic complexity, (i) complexity via subordination; (ii) overall or general complexity; and, (iii) subclausal complexity.In light of this multidimensionality of syntactic complexity, twelve indices of syntactic complexity have been shown to be reliable indicators of language proficiency (Ai & Lu, 2013; Lu, 2011). These syntactic indices include: mean length of sentence (MLS), mean length of T-unit (MLT), mean length of clause (MLC), verb phrase per T-unit (VP/T), clause per T-unit (C/T), dependent clause per T-unit (DC/T), dependent clause per clause (DC/C), T-unit per sentence (T/S), coordinate phrase per T-unit (CP/T), coordinate phrase per clause (CP/C), complex nominal per T-unit (CN/T), and complex nominal per clause (CP/C).

Crossley, Cobb, and McNamara (2013) in their discussion of the band-based and

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count-based approaches to quantifying and measuring lexical frequency, as an indicator of lexical quality, highlight the basic difference between these two approaches considering the basis on which the frequency of a given word is determined. In band-based approaches word frequency is determined by consideration of frequency bands, each of which are associated with a certain level of language proficiency, while in count-based approaches word frequency is determined by consideration of word incidences in a given corpus. Crossly et al. (2013) came to the conclusion that count-based measures of word frequency performed predominantly better in predicting proficiency level classifications, the best of which were CELEX indices computed by Coh-Metrix(Graesser, McNamara, &Kulikowich, 2011). McCarthy and Jarvis (2010) investigated the validity of MLTD, vocd-D, TTR, Maas, Yule's K, and an HD-D index, and suggested that MLTD, even though it is the only index that is not dependent on text length, is a reliable indicator of lexical diversity. Moreover, it was suggested that MLTD, vocd-D, and Maas assess rather unique lexical constructs, and using them in tandem in researches pertaining to lexical assessment was advised.

Propositions have been referred to as idea units by Ellis and Barkhuizen (2005), who by drawing on Levelt's (1993, 1999) notion of conceptualization process define idea units as a segment of message which is constituted of a topic and a comment. They believe that idea units can be considered as a tool for measuring the propositional completeness of a linguistic production. Kintsch (1998, 2004) provides the essential instructions in order to represent the propositional structure of the textbase. Following these instructions, one can segment pieces of language production into separate idea units for further propositional analysis. As these instructions serve a fundamental role in this research, in what follows they will be summarized as concisely and precisely as possible. Each P here represents an underlying proposition of the sentence:

(1) Verbs as predicate: Kintsch considers verbs to be the building blocks of propositions. They are almost always represented as a topic with an argument, which would constitute an atomic proposition. For instance, the boy falls is represented as a proposition as follows:

P1 [FALL, BOY]

Direct object of transitive verbs would also be included in the same proposition, as in the man killed the deer:

P1 [KILL, MAN, DEER]

(2) Propositions as arguments: propositions can also act as the argument for another proposition. For instance, a sentence complement can be the argument for a superordinate proposition.

Another instance of this is indirect object, which will play the role of topic to another proposition. An example would be the man gives me the book:

P1 [GIVE, MAN, BOOK]

P2 [P1, ME]

As it can be seen, this results into two propositions. Also, relative clauses will play the role of another atomic proposition which will be the argument of another complex proposition. For instance, like in the sentence the fruit that is grown organically is expensive:

P1 [FRUIT, GROWN]

P2 [P1, ORGANICALLY]

P3 [P1, P2, EXPENSIVE]

(3) Modification: adverbs and adjectives act as the predicate for atomic propositions. Adjectives are simply arguments to nouns, which are the topic, like in the blue car:

P1 [CAR, BLUE]

Or as in he drives carefully:

P1 [DRIVE, HE]

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P2 [P1, CAREFULLY]

Evidently, this modification can also be in a form of an adjective or adverb clause, or an adjective or adverb phrase.

Or in unless you run fast, you will miss the bus:

P1 [MISS, BUS]

P2 [RUN, FAST]

P3 [UNLESS, P2, P1]

(4) Problems and issues: In sentences like Paul hoped Mary would come, in which there are cognitive and causal verbs, and verbs of saying, thinking, and believing, are considered to be modifiers of the sentence complement:

P1 [MARY, COME]

P2 [HOPE, PAUL, P1]

There are other problems and issues related to some rare cases, such as highly ambiguous structures, whose analysis are beyond the scope of this study.Nevertheless, Bovair and Kieras' (1985) guidelines, who have attended to these issues in detail, can be considered as the reference point in case of such problems.

Only very recently, Vasylets et al. (2017), in TBLT research paradigm, aimed at exploring the effect of cognitive task complexity on propositional complexity among other features of L2 writing. Their study was significantly influenced by Chafe's (1994) notion of "Intonation Units", which has been defined as "a unit of mental and linguistic processing" (p. 55) that constitutes the amount of information on which one can hold and focus in his/her consciousness. Based on this notion and corroborated by sematic criteria, Vasylets et al (2017) observed that cognitive task complexity significantly affected propositional complexity. The current research was designed with the hope of utilizing the Construction-Integration model (Kintsch, 1998, 2004) in the process of identifying propositions in writing and measuring propositional complexity. One motivation for using this model instead of Intonation Units was applicability of Construction-Integration model for propositional analysis of written texts.

Research Questions

The current study was conducted with the hope of further investigation of the effect of genre and cognitive task complexity on CALF in L2 writing, with a particular attention to propositional complexity and the effect of interaction of proficiency level with genre and cognitive task complexity. To these ends, a factorial study was designed with cognitive task complexity and genre as within-subjects factors and language proficiency level as between-subjects factor.

The following research questions constitute the crux of this study:

1. How do genre and task complexity affect EFL writings in terms of lexical, propositional, and syntactic complexity, accuracy, and fluency?
2. How does second language proficiency level interact with the effects of genre and task complexity on lexical, propositional, and syntactic complexity, accuracy, and fluency?

Method

Participants

The participants of this study were all students, aged between 23 and 30, at an Iranian university. Their fields of study were mining engineering, mechanics, geophysics and literature. They had been living in Tehran for at least 2 years and they had quite a proper knowledge about the city of Tehran. They were initially recruited after a brief oral test by one of the researchers. The performance of the chosen participants on the subsequent proficiency test and their attendance in the data collection sessions determined their eligibility for being included in the final analyses, as participants with less than overall score

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of 10 were omitted. The proficiency test utilized in this study consisted of 52 items extracted from Reading and Use of English section of First Certificate in English (FCE) and Certificate in Advanced English (CAE), in order for the test to cover the range of B2 to C1 according to the Common European Framework of Reference for Languages. The answers to these items are available in Cambridge official website; hence, the items could be objectively rated. Getting the score of 10 from 52 was predetermined to be the cutting point for being included in the study after discussions among the researchers and a third party IELTS instructor.The pertaining data were initially collected from 89 participants, out of which 60 were found to be eligible. Among these, 12 were female and the rest were male.

Materials and Instruments

Writing tasks: Four writing tasks were used in this study, which were in genres of personal letter writing and argumentative prose. Within each genre, the tasks were manipulated in terms of cognitive complexity, operationalized as provision of idea support with accordance to models of cognitive complexity (Robinson, 2015; Robinson &Gilabert, 2007; Skehan, 2014, 2015) and following Ong and Zhang's (2010)and Révész, Kourtali, and Mazgutova's (2017) operationalization of cognitive complexity. The more cognitively demanding letter writing task required the participants to write a hypothetical letter to a friend of theirs regarding living and studying in Tehran, without provision of any idea support. The less cognitively demanding task involved writing about a forthcoming trip of a friend to Iran and making suggestions about the trip. The idea support for this task involved suggesting the participants to write about history, interesting places, the culture, and people of Iran. The less cognitively demanding argumentative essay involved writing about the issue of immigration in which the participants were required to write about the related aspects of immigration and the idea support involved pointing out issues regarding culture, crime rate, and economy of the immigrant receiving country.The cognitively complex argumentative essay was about immigration to European countries and how the participants would perceive the result of immigration and whether this immigration would be beneficial, where no idea support was provided for this task. Each of these tasks required an output of at least 150 words from the participants. The prompts for these tasks can be found in the appendix.

Target measures: The utilized syntactic indices include: MLS, MLT, MLC, VP/T, C/T, DC/T, DC/C, T/S, CP/T, CP/C, CN/T, and CP/C. These were utilized to account for the mentioned multi-dimensionality of syntactic complexity and, additionally, because they have been shown to be significantly associated with proficiency level. Lexical complexity was analysed by considering the following measures: CELEX mean word frequency for content words (CELEX), CELEX mean log frequency for all words (CELEXlog), CELEX mean log minimum frequency for content words (CELEXlogmin), and voc-D and MLTD indices of lexical diversity.

The analysis of accuracy involved, firstly, providing the evaluators, which also included the researchers, with error coding instructions based on Yoon and Polio (2017). These included errors in terms of word order, sentence fragment, run-on sentence, missing constituent, extra constituent, relative clause, word form, subject-verb agreement, plurals, genitives, articles, double negative, wrong pronoun, verb form, and preposition error. Subsequently, the number of errors per 100 words was calculated.

The measurement of fluency in writing has been a controversial topic. Nevertheless, fluency in this study was measured by considering the number of words written per second on the task, following the previous studies in this regard (e.g. Cho, 2018; Ong& Zhang, 2010; Ruiz-Funes, 2015).

Most importantly, the propositional analysis of the texts, as mentioned, was done with accordance to the Construction-Integration model. Computerized Propositional Idea

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Density Rater (CPIDR), which has been designed on the basis of this model (Brown et al., 2008), was used for conducting the analysis.

Procedure

The participants were divided into seven groups and the pertaining data were collected from each group in two sessions, the first of which also included the administrationof proficiency test. On each session two writing tasks were completed, whose order was randomized for every group in order to minimize the possibility of practice effects. Thirty minutes of time was dedicated to the proficiency test. Subsequently, the writing tasks were administrated while the time spent on the writing tasks was being measured. Twenty-nine of these participants were eliminated from the study, as they could not score higher than 10 in the proficiency test or could not complete the writing tasks properly. The participants were subsequently divided into two groups, higher and lower than the mean of the results from the proficiency test.

For the linguistic analyses of the collected data, L2 Syntactic Complexity Analyser (L2SCA), CPIDR, and Coh-metrix (Graesser, McNamara, &Kulikowich, 2011) were utilized. Twelve measures of syntactic complexity were analysed using L2SCA. Three CELEX measures, voc-D, and MLTD were also measured using Coh-metrix. For the propositional analysis of the texts CPIDR was utilized. Subsequently, the resulting measures of L2 writing, coupled with the results from the proficiency test, were subjected to the pertaining statistical procedures.

Results

An IELTS instructor was firstly asked to evaluate the writings of the participantsbased on the analytic scoring rubric adopted from (Yoon, 2017) to validate the utilized proficiency test. A significant correlation was observed between the results of the proficiency test and the scores on each of thewritingtasks(r>.80, p<.005 for all of the cases). Subsequently, 20 of the texts, 5 from each of the writing tasks, were randomly chosen to be evaluated by hand with regards to the utilized textual features in this research. The reliability analysis indicated that theconducted analyses of the textual features were in fact reliable (α>.78 for all of the measures).

The descriptive statistics of the initial observations can be found in Table 2. In order to address the first research question, the linguistic features of writings of the participants were subjected to repeated-measured ANOVAs, whose pertaining assumptions were checked. Skewness was checked for all of the variables, which was shown to be lower than 1 for most of the variables, except for CP/C, CP/T, DC/T, and MLTD, indicating the normal distribution ofmost of the data. The mentioned sets of data, which required normalization, were log-transformed. Bonferroni adjustment was conducted for measures of syntactic and lexical complexity (alpha=.004 and alpha=.01, respectively). Sphericity need not have been checked, as the within-subjects factor had onlytwo levels (Hinton, McMurray, &Brownclaw, 2014, p. 147). Considering the homogeneity of variances, Levene's test bears witness to the homogeneity of all sets of data except for T/S, Propositional Complexity (PC), and VP/T. The mentioned sets of data were also log-transformed for further analyses.

Table 2

Descriptive Statistics of the Target Measures

		LW without IS	LW with IS	AE without IS	AE with IS
Measure	N	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Accuracy	60	5.68 (3.58)	6.37 (3.53)	5.07 (3.03)	7.02 (4.96)

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Fluency	60	10.63 (3.25)	11.92 (3.26)	8.71 (2.84)	9.38 (3.14)
Lexical Complexity					
CELEX	60	2.61 (.15)	2.74 (.15)	2.76 (.12)	2.50 (.19)
CELEXlog	60	3.20 (.09)	3.29 (.10)	3.26 (.08)	3.14 (.14)
CELEXlog min	60	1.37 (.49)	1.61 (.40)	1.59 (.41)	1.28 (.36)
MLTD	60	58.39 (17.71)	54.84 (16.90)	61.57 (14.67)	60.27 (22.05)
Voc-D	60	58.09 (18.79)	56.42 (18.42)	63.36 (18.74)	58.06 (25.71)
Syntactic Complexity					
CN/C	60	.87 (.28)	.85 (.22)	.88 (.26)	1.20 (.41)
CN/T	60	1.34 (.49)	1.36 (.49)	1.58 (.66)	2.00 (.83)
CP/C	60	.22 (.12)	.16 (.10)	.16 (.12)	.26 (.19)
CP/T	60	.33 (.16)	.25 (.15)	.29 (.21)	.42 (.26)
C/T	60	1.52 (.25)	1.57 (.36)	1.73 (.44)	1.68 (.38)
DC/C	60	.32 (.10)	.34 (.13)	.40 (.12)	.37 (.12)
DC/T	60	.53 (.28)	.58 (.31)	2.02 (9.85)	.83 (1.39)
MLC	60	8.15 (1.50)	7.49 (1.08)	8.27 (1.31)	9.55 (2.06)
MLS	60	14.55 (3.78)	14.05 (3.20)	16.75 (3.92)	18.35 (3.91)
MLT	60	12.71 (2.89)	12.06 (2.98)	14.45 (3.89)	15.80 (3.69)
T/S	60	1.14 (.23)	1.18 (.16)	1.15 (.19)	1.15 (.26)
VP/T	60	2.03 (.47)	1.98 (.49)	2.24 (.59)	2.12 (.55)
Propositional Complexity	60	531.36 (34.75)	512.65 (31.32)	527.21 (32.02)	517.03 (36.36)

Note. LW = letter writing; IS = idea support; AE = argumentative essay.

The initial results of ANOVAs to address the first research question, summarized in Table 3, considering the effect of task complexity were found to be statistically significant for accuracy ($F(1, 59)= 24.69$, $p< .001$, $\eta p2 = .29$), fluency ($F(1, 59)= 150.19$, $p < .001$, $\eta p2 = .71$), two measures of syntactic complexity, including CN/T and CN/C, and lexical complexity, including CELEX and MLTD. So, in terms of lexical complexity two measures, namely CELEX and MLTD, and in terms of syntactic complexity also two measures, CN/C and CN/T were found to be significantly affected in this regard, in that cognitive complexity led to more complex, more accurate, and lower fluency in writing. Also, the effect of task complexity was significant for propositional complexity ($F(1, 59)= 19.80$,$p< .001$, $\eta p2 = .25$), where lower propositional complexity wasassociated with higher cognitive task complexity. Considering the effect of genre, the pertaining results were significant for fluency ($F(1, 59)= 76.84$, $p< .001$, $\eta p2 = .56$) and two measures of lexical complexity, including CELEX and CELEXlog, and many measures of syntactic complexity, including CN/T, CN/C, C/T, DC/C, MLC, MLS, MLT, and VP/T. Generally, argumentative essay resulted in higher lexical complexity and lower fluency in writing.

In order to explore the first research question further, a series of paired-samples t-tests were additionally conducted, which revealed that the effect of task complexity was statistically significant in each of the genres with regards

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Table 3
ANOVA Results Examining the Effect of Task Complexity and Genre

	Task Complexity			Genre			Task Complexity*Genre		
Measure	*p*	η_p^2	OP	*p*	η_p^2	OP	*p*	η_p^2	OP
Accuracy	.000	.295	.998	.942	.000	.050	.006	.120	.800
Fluency	.000	.718	1.00	.000	.560	1.00	.001	.174	.934
Lexical Complexity									
CELEX	.000	.258	.966	.007	.113	.540	.000	.650	1.00
CELEXlog	.077	.051	.203	.002	.146	.697	.000	.518	1.00
CELEXlogmin	.495	.007	.028	.286	.019	.063	.000	.274	.978
MLTD	.012	.101	.349	.008	.110	.393	.813	.000	.004
Voc-D	.035	.072	.312	.226	.024	.082	.396	.012	.040
Syntactic Complexity									
CN/C	.000	.347	.994	.000	.280	.959	.000	.305	.979
CN/T	.000	.190	.764	.000	.415	.999	.002	.148	.587
CP/C	.602	.004	.009	.250	.022	.039	.002	.141	.549
CP/T	.604	.004	.009	.014	.097	.330	.002	.142	.554
C/T	.918	.000	.004	.000	.188	.755	.357	.014	.023
DC/C	.506	.007	.012	.001	.158	.633	.213	.026	.048
DC/T	.205	.027	.050	.003	.137	.531	.238	.023	.041
MLC	.029	.077	.233	.000	.401	.999	.000	.329	.989
MLS	.115	.041	.090	.000	.634	1.00	.030	.077	.230
MLT	.215	.025	.047	.000	.622	1.00	.006	.120	.448
T/S	.295	.019	.032	.428	.011	.018	.466	.009	.015
VP/T	.120	.040	.087	.003	.134	.519	.585	.005	.009
Propositional Complexity	.000	.251	.992	.978	.000	.050	.340	.015	.156

Note. η_p^2 = partial eta squared; OP = observed power.

to the following indices: CELEXlog in letter writing (t(59) = -5.52, $p < .001$, d = 0.87) and argumentative genre (t(59) = 6.76, $p < .001$, d = -0.61), CELEXlogminin letter writing (t(59) = -2.71, $p = .009$, d = 0.48) and argumentative genre(t(59) = 4.68, $p < .001$, d = -0.74), and MLC in letter writing (t(59) = 3.34, $p = .001$, d = -0.44) and argumentativegenre(t(59) = -5.05, $p < .001$, d = 0.97). Further t-tests to explore of the effect of genre showed that the results were found to be significant in the less cognitively complex task for CPT (t(59) = -3.77, $p < .001$, d = 0.37) and CELEXlogmin (t(59) = 4.55, $p < .001$, d = 0.81). To summarize, an overall association was yet again observed between better quality of form and higher cognitive complexity and argumentative essay.

In order to answer the second research question, a series of ANOVAs, summarized in Table 4, were again conducted and an interaction was observed between genre and proficiency level with regards to CN/C and CN/T. This implies that solely the participants in the higher proficiency group were affected by genre, in terms of the mentioned indices. The results were not significant for task complexity in this regard.The interaction, however, between genre and task complexity was found to be significant for accuracy, fluency, three measures of lexical complexity, including CELEX, CELEXlog, and CELEXlogmin, and five measures of syntactic complexity, including CN/C, CN/T, CP/C, CP/T, and MLC.This

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means that the effect of cognitive task complexityon accuracy was significantly higher in the argumentative

Table 4

ANOVA Results Examining the Interaction Effect with Proficiency Level

	Proficiency*Genre* Task Complexity			Proficiency*Genre			Proficiency*Task Complexity		
Measure	*p*	η_p^2	OP	*p*	η_p^2	OP	*p*	η_p^2	OP
Accuracy	.067	.056	.450	.417	.011	.126	.612	.004	.079
Fluency	.146	.036	.304	.464	.009	.111	.540	.006	.092
CELEX	.053	.062	.254	.214	.026	.087	.209	.026	.089
Lexical Complexity									
CELEXlog	.008	.114	.532	.037	.072	.304	.575	.005	.022
CELEXlogmin	.214	.026	.087	.216	.026	.086	.117	.041	.151
MLTD	.359	.014	.046	.389	.012	.041	.042	.068	.287
Voc-D	.972	.000	.010	.522	.007	.026	.196	.028	.095
Syntactic Complexity									
CN/C	.348	.015	.024	.000	.181	.719	.718	.002	.006
CN/T	.932	.000	.004	.001	.164	.647	.557	.005	.010
CP/C	.410	.011	.018	.550	.006	.011	.340	.015	.025
CP/T	.096	.046	.105	.389	.012	.020	.536	.006	.011
C/T	.182	.030	.057	.921	.000	.004	.768	.001	.005
DC/C	.115	.042	.090	.240	.023	.041	.481	.008	.014
DC/T	.448	.009	.016	.140	.037	.075	.178	.030	.058
MLC	.864	.000	.004	.605	.004	.009	.632	.003	.008
MLS	.020	.089	.281	.293	.018	.031	.141	.036	.075
MLT	.023	.084	.260	.935	.000	.004	.913	.000	.004
T/S	.991	.000	.004	.509	.007	.012	.121	.040	.086
VP/T	.012	.101	.343	.371	.013	.022	.698	.002	.006
Propositional Complexity	.003	.138	.525	.366	.014	.022	.186	.029	.056

Note. η_p^2 = partial eta squared; OP = observed power.

genre, while, interestingly, its effect on fluency was higher in the letter writing genre. Also, generally, theeffectcognitivetask complexity was more pronounced in the argumentative genre with regards to the mentioned indices of syntactic complexity.

Discussion

This study aimed to investigate the ways in which genre and cognitive task complexity may affect L2 propositional, lexical, and syntactic complexity, accuracy, and fluency in writings of Iranian L2 learners. It must be noted that one of the concerns associated with a task-based teaching syllabus is the basis on which tasks should be sequenced (Ellis, 2005), and as the results are being discussed, the implications can also be extended to the process of task design by considering the specific purpose that the task is going to serve.

The first research question was concerned with the effect of genre and cognitive task complexity on features of L2 writing. In what follows, the observed results are discussed in terms of the utilized measures. Starting with fluency, a clear pattern was seen in which the highest fluency was observed for letter writing with idea support and the lowest was for the

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argumentative essay without idea support. In other words, generally fluency increased with the provision of idea support, and it was observed to be higher in the letter writing genre. This could be explained with accordance to Kellogg's (1996, 2004) model of writing, in which the most demanding stage of writing for the central executive is the planning stage, as it occupies the processing capacities of both the visual-spatial sketchpad and the central executive (Baddeley, 2007). The result of the mental processes in this stage will constitute the content of what is going be written; in other words, the ideas that are hoped to be mentioned will be formulated, and subsequently will be translated into linguistic outputs, mainly done by utilizing the phonological loop and inner-speech (Kellogg, Whiteford, Turner, Cahill, &Mertens, 2013). It appears that provision of idea support led to a decrease in the pressure in planning stage which resulted in the increment of fluency. The increase of fluency in the letter writing genre could also imply that less pressure for planning seems to be associated with the letter writing task. The results regarding the effect of genre on fluency echo the previous findings in this regard (e.g. Way et al., 2000). It must, however, be noted that the definition of fluency in this study was rather simplified, as more meticulous operationalizing of this feature requires a dynamic, rather than synoptic, analysis of the process of writing (Van Waes&Leijten, 2015). Such analysis could be conducted with online monitoring of the process of writing, using, for instance, keystroke logging computer programs such as Inputlog (Leijten& Van Waes, 2013). The simplified definition of fluency in this study, merely considered as the number of written words divided by the time spent on task, may in fact be the reason why an effect of genre and task complexity on fluency was observed.

As for lexical complexity, it appears that it was not affected by task complexity in a palpable manner. This observation was not in line with the results from a relatively recent study byRévész, Kourtali, and Mazgutova (2017), in which provision of content support led to a higher level of lexical complexity.Interestingly, by using the keystroke data of writing process, they observed that when content support was not provided, pauses between sentences and before revisions were not associated with higher lexical complexity. They argued that the complex nature of the task led the attentional resources to be allocated to planning, leaving fewer recourses for lexical encoding. What appears to have happened in the current study is that attentional resources of the participants were solely dedicated to meeting the demands of genre, as genre seemed to have had a strong effect on lexical complexity, for it was observed to be significantly lower in the letter writing genre. Dedication of attention to the genre of the task seemed to have left no resources to be manipulated by task complexity, with regards to lexical complexity. The observed effect of genre on lexical complexity is aligned with the results from Qin and Uccelli (2020), who investigated register flexibility of EFL writings across two genres of personal email and academic. They were able to show that academic genre is associated with higher levels of lexical complexity, and, in particular, voc-D was observed to be a significant predictor of lexical quality. This also completely conforms to the results from Bae and Min (2018), who found that argumentative genre was associated with better vocabulary. The observation in the current study could be justified by considering the reasoning demands associated with argumentative essay genre, as language users tend to modify their language in argumentative genre to meet the requirements of an argumentative essay (Ravid, 2005; Yasuda, 2011) which may have resulted in using more complex and less frequent words.

Considering the changes in syntactic complexity, a slight increase of complexity, solely in terms of complex nominals, was seen as a result of lack of idea support provision. Although the increment of syntactic complexity in the complex task was relatively small, this is totally at odds with the observation by Révész, Kourtali, and Mazgutova (2017). In their study, provision of idea support led to higher syntactic complexity. It must, however, be noted that the observed difference in syntactic complexity between the complex and simple

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task in that study wassolely significant in terms of words per T-unit.One must take into account the suggestion by Biber, Gray, and Staples (2016) regarding being cautious in interpreting T-unit-based measures of complexity, as, in their view, skilled writers tend to rely more on nominalization and nouns in promoting complexity in their writings.Additionally, as the participants came from diverse L1 backgrounds, which included various countries from Asia, Europe, and Africa, their results may be confounded by the different ways in which language users from different L1s are affected by complex task demand. Nevertheless, the current study supports the Cognition Hypothesis (Robinson, 2015; Robinson &Gilabert, 2007) in this regard, as complex task conditions led the participants to allocate more attentional resources to form.

The effect of genre was clearly suggestive of an increase in syntactic complexity in the argumentative genre. In addition to nominal complexity, the effect of genre was also visible with regards to mean length of unit and number of clause and verb phrase per unit. Higher levels of syntactic complexity have been demonstrated to be a fundamental feature of argumentative and academic writing (Biber, Gray, & Staples, 2016), a claim which was partially confirmed in this study.Additionally, the lower syntactic complexity in letter writing genre may be due to the personal style closely associated with casual speech, in which simpler forms of language are utilized, believed to be a common feature of personal letter writing genre (Biber, 1995). Modal verbs are also claimed to be used less frequently in letter writing (Biber& Conrad, 2009, p. 170) resulting in smaller units of production. According to Robinson (2015), the increase of syntactic complexity in the complex task in argumentative genre could also be justified by demands of complex intentional reasoning which leads to utilizing cognitive state terms – such as suspect, believe, and think – and, logically, complement clauses.

Considering accuracy, a decrease was observed in the number of errors in the task without idea support. This observation is at odds with the results from Rahimi and Zhang (2018) and Ruiz-Funes (2015), and, naturally, does not support the Trade-Off Hypothesis (Skehan, 2014, 2015). By the same token, Ishikawa (2007) and Kuiken and Vedder (2008, 2011, 2012) report the same findings as the current study, which is, additionally, in line with the predictions of the Cognition Hypothesis (Robinson, 2015; Robinson &Gilabert, 2007). Genre was not seen to be influential in this regard. The simultaneous increase in accuracy and syntactic complexity in the more cognitively complex task can also be explained with accordance to the Cognition Hypothesis (Robinson, 2015; Robinson &Gilabert, 2007), which states that due to the cognitive demands of the task-internal factors, language learners will be pushed towards maximizing their performance, leading to higher quality in form. Drawing on the parallel trajectory of L1 linguistic and cognitive development of children (Cromer, 1974), it is claimed, according to the Cognition Hypothesis, that the resource-directing dimensions affect the content that is going to be generated, and it is believed that these dimensions shift learners' attentional resources towards task-relevant factors and non-redundant elements, leading to greater accuracy. This was clearly supported by this study. Apparently, the supposed pressure on the verbal working memory (Kellogg et al., 2013) resulting from the process of verbal encoding did not lead to a drop in accuracy, even though fluency deteriorated.

The results pertaining to propositional complexity was particularly interesting, as provision of idea support led to significant decrease in propositional complexity, while no apparent effect of genre was observed. The dual process account of writing (Galbraith, 2009; Galbraith &Baaijen, 2015) claims that there are two general processes involved in writing, including a knowledge-constituting process, during which the contents for writing are synthesized and lead to a gradual development of ideas, and a knowledge-transforming process, in which the retrieved knowledge is transformed in the working memory according to the rhetorical goals.What appears to have happened is that the lack of provision of idea

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support led the knowledge-constituting process to be relatively more active during writing, to compensate for the lack of ideas, resulting inconveying more idea units in a serial manner (Kormos, 2006). According to Kellogg et al. (2013), the planning time helps organizing the propositions and ideas, for which "working memory provides a means for transiently holding knowledge in an accessible form so it can be effectively used" (p. 160). Higher demands in terms of the input to be processed will force language learners to be engaged in serial processing rather than a more parallel one, meaning that rather than a situation in which ideas are being processed simultaneously, "one idea has to follow another" (Skehan, 2014, p. 220). This means that the processes of planning, translating, and executing will shift from happening simultaneously towards a more parallel one, leading the process of linguistic production to be more effortful. Furthermore, in this study time was a key factor and planning time was not specified for the participants. This could explain the reason why anincrease in the density of propositions was observed in the more cognitively complex task, as the participants had to take considerable factors into account during formulation stage and keep them in their working memory throughout the task. It appears the substantial burden on the working memory, amplified by a lack of planning time, led to propositions to be delivered serially and in a dense fashion. At the same time, the deep processing of the task demands has seemingly led to, rather slightly, higher quality of text in terms of syntactic complexity. This was also reflected in the higher lexical complexity for argumentative task.

Considering the interaction between task complexity and genre, the results were also interesting. It seems that lack of idea support in the letter writing genre led to a significantly higher drop in fluency, compared to the argumentative genre. Apparently, the existing reasoning demands associated with argumentative writing (Ravid, 2005; Yasuda, 2011) have reduced the effect of idea support provision.Interestingly, however, idea support had a more significant effect in the argumentative genre with regards to accuracy, as provision of idea support led to more errors. The interaction effect was also significant for four measures of syntactic complexity, in which the argumentative essays were significantly under the influence of task complexity. These interaction effects yet again can be explained by the Cognition Hypothesis, where a cognitively demanding task is claimed to be associated with higher attention to form and accuracy. Regarding the interaction effect on lexical complexity, lack of idea support provision in the argumentative genre resulted in using more infrequent words; this was not the case in the letter writing genre, which could be, yet again, due the personal style inherent to the letter writing genre. These observations also lend support to the fact that the participants of this study demonstrated a considerable amount of register flexibility (Qin &Uccelli, 2020).

Regarding the second research question, the interaction with proficiency level, the pertaining results were not found to be statistically significant, except for an interaction with genre regarding two measures of syntactic complexity, including complex nominal per clause and T-unit. This means that generally both groups of proficiency were affected by genre and task complexity in the same manner and to the same extent. However, considering the two mentioned syntactic measures, the argumentative essays of participants with higher proficiency level were significantly more complex compared with the lower proficiency group. This finding corroborates the results from Kuiken and Vedder (2008), highlighting the existence of a threshold level, as in the Threshold Hypothesis (Cummins, 1979), to which language learners must reach in order to be affected by the manipulation of task features, including genre, which require certain reasoning demands.In addition, this implies that higher level of language proficiency is associated with better awareness of genre demands, as proficient language users are able to modify their writings in order to account for the situational and communitive demands of the task (Goulart et al., 2020). This is also in line with the results from the study of Bae and Min (2018), who observed that the sensitivity of language learners to genre varies dependently on their proficiency level.

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Conclusion and Implications

This research was conducted with the hope of further exploration of the effect of task-internal features on the linguistic output of language learners in terms of measures of CALF. One of the main points of interest was exploring the mentioned effects on propositional complexity as one of the sub-categories of L2 complexity (Bulté&Housen, 2012, 2014).

In conclusion, this study partially conformed to the previous findings in the literature with regards to the effects of genre and task complexity. Propositional complexity, whose analysis was based on Construction-Integration model (Kintsch, 1998, 2004), was seen to vary dependently on task complexity and independently from genre. Provision of idea support was observed to make the process of writing more fluent. This was even more the case in letter writing genre, meaning an interaction between task complexity and genre was observed in terms of fluency. An interaction was also observed regarding accuracy which indicated that provision of idea support led to significantly more decline in accuracy in argumentative genre, unlike the letter writing genre. These observations are an indicator of a better quality of performance in cognitively demanding situations, suggesting that in response to higher levels of cognitive demand language learners tend to devote their limited attentional resources to the quality of their writing in terms of complexity of form.

The pedagogical implications of this study are, clearly, regarding task design and implementation. The foremost implication that can be drawn is that maximizing the cognitive complexity of writing tasksis likely to lead language learners to be more aware of the form of their writings. Consequently, if the focus of the lesson plan is improving the form of writing and pushing the language learners towards their maximum potential, an increment in cognitive complexity of the task would possibly be fruitful. The genre of the writing task should also be taken into consideration, as it has been clearly demonstrated that it can significantly affect the textual quality of the outcome of the task. Teachers must therefore be aware of the effect that genre has on the textual features of their students and align the task design with the pedagogical purposes of the lesson.

The results suggest that learners appear to be very keen on demonstrating their linguistic abilities when it comes to dealing with a cognitively complex and argumentative task. This would ultimately result in utilizing all the syntactic resources and, at the same time, a considerable decline in fluency and accuracy. Consequently, this means that if the purpose of task design is promoting fluency, in other words a better control and mastery over the available resources, making tasks cognitively demanding would not serve this purpose. If, however, the goal of the study is improving syntactic knowledge, then more complex tasks would be advisable. It should be noted that this increase in cognitive task complexity would, additionally, probably lead to providing more information (i.e. higher propositional complexity) on the part of the learners, and an increase in the density of the propositions is to be expected in this regard. Concurrently, attention will be shifted towards improving the syntactic quality of writing. This effect is likely to be more significant for higher proficiency learners.

Limitations and Further Research

Evident limitations of this study regarding the participants were its limited number of participants and the fact that they were studying in different fields of study, which may have had some modulating effect on the final results. For future researches, it may be advised to include not only a higher number of participants, but also more homogeneous participants with regards to their academic fields of study. There are also a number of individual factors, beside proficiency level, that have been shown to have an effect on the writings of second language learners and even have a modulating effect on task complexity and genre. These individual factors include, but by no means are limited to, language aptitude

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(Kormos&Trebits, 2012), working memory capacity (Cho, 2018; Nielson, 2014; Zalbidea 2017), intelligence (Niwa, 2000), first language (Kormos, 2011; Tavakoli& Foster, 2008), anxiety (Robinson, 2007) self-confidence and self-perceived communicative competence (Révész, 2011). A more thorough research which would take all these potential intervening factors into account may be required in the future.

For further research, it is advised to adopt a dynamic approach to writing by analyzing the whole process of writing, rather than analyzing the writings of language learners as a final product. Mainstream utilization of keystroke logging computer programs, such as Inputlog (Leijten& Van Waes, 2013), can pave the way for more fruitful researches in this regard (Lindgren, Knospe, & Sullivan, 2019).

This study was designed in order to focus on two genres of personal letter writing and argumentative. Further studies could be conducted with regards to other genres as well, whose effects on various L2 features, including propositional complexity, remain unexplored. For further research it is advised to take the multi-faced nature of L2 complexity into consideration. Discourse-interactional complexity, for instance, remains to be studied in this research paradigm. Finally, further exploration of relationship between propositional complexity with task-internal and task-external factors is suggested.

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Appendix: Writing tasks

(Letter writing genre without provision of idea support)

Name:

Your friend is hoping to study at a university in Tehran. Write a letter to tell him/her about what he/she should know about living and studying in Tehran.

Your letter must have at least 150 words.

Dear…….

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(Letter writing genre with provision of idea support)
Name:
Your friend is hoping to visit Iran for a vacation. Write a letter to tell him/her about the he/she should know about traveling to Iran. You can consider the following points in your letter:

- Culture and people of Iran
- Interesting places
- History

Your letter must have at least 150 words.
Dear……

(Argumentative genre with provision of idea support)
Write an essay with regards to how immigration would affect the immigrant receiving and sending countries. You can consider the effects of immigration in terms of:

- culture
- economy
- crime rate

Your essay must have at least 150 words.
(Argumentative genre without provision of idea support)
Write an essay about the pros and cons of immigration to a western modern country.
Your essay must have at least 150 words.