



## The effects of cognitive task complexity on writing complexity



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### ABSTRACT

This study reports the findings of a within-subject experimental study that examined the relationship between increases in cognitive task complexity and the writing of intermediate L2 writers of English. Potential effects on lexical and syntactic complexity were investigated. This article expands on past writing research using similar cognitive task complexity by adding a patently low complexity task to better track the effects of complexity, and a subordination measure that investigates each dependent clause separately. Thirty-four non-native speakers of English studying at language schools in New Zealand performed three letter-writing tasks of varying levels of task complexity. The findings revealed a significant effect for task complexity on decreases in syntactic complexity using a ratio of dependent clauses to T-units measure where independent clauses were measured separately. Conversely, significant findings were found for increases in lexical complexity, analysed as a mean segmental type-token ratio. The results of this study are discussed in relation to the Cognition Hypothesis (Robinson, 2001a, 2001b, 2005, 2007, 2011).

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### Introduction

Centrally, the present study contributes to on-going investigations into the suitability of writing as a beneficial medium for promoting the development of complex language in L2 learners (Ishikawa, 2007; Kormos, 2011; Kuiken & Vedder, 2007, 2008, 2012; Ong & Zhang, 2010; Sercu, De Wachter, Peters, Kuiken, & Vedder, 2006). The emphasis is on whether the manipulation of certain task-based variables, believed to affect a writer's cognitive burden and thus attention, will have a subsequent effect on their ability to produce attention-demanding elements in a written text.

Ostensibly, writing may not appear to be the best format for developing complex linguistic structures that require attention, especially when they are not proceduralized or automatized. For example, the act of writing has been characterized as a problem solving activity (Belcher & Hirvela, 2001) requiring a writer's constant management of limited attentional resources (Flower & Hayes, 1981). Thus, it appears counterintuitive that making writing more difficult by increasing the burden on attentional resources has any beneficial effects. However, writing has also been ascribed intrinsic characteristics such as recursion, planning time, and selective control (Ellis & Yuan, 2004; Grabe & Kaplan, 1996; Grabowski, 2007; Kormos & Trebits, 2012) that are potentially conducive to the production of complex linguistic structures that require attention.

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To date, task-based research with foci on the relationship between task complexity (as cognitive burden manipulation) and writing is growing, but it still remains a lesser domain than the oral modality, which has historically been the main focus of research (Carless, 2012). In the developing field of complexity and L2 writing, there have been a number of means by which cognitive burden has been increased or decreased on writers, while a wide range of potential effects has also been investigated. Variables have included the effects of planning time, writing assistance, and editing time on fluency, lexical complexity, metacognitive process, and text quality (Ong, 2014; Ong & Zhang, 2010, 2013). Kormos (2011) tested the addition and removal of narrative context on complexity, accuracy, and fluency in L1 (native language) and FL (foreign language) writing. Ishikawa (2007) examined the manipulation of here-and-now variables (and the incidental addition of planning time) on measures of accuracy, complexity, and fluency, and Kuiken and Vedder (2007, 2008, 2012) and Sercu et al. (2006) investigated the manipulation of reasoning demands and number of elements on complexity, accuracy, and fluency.

Considering the variations in both independent and dependent variables across this relatively small pool of research, there is a need for partial replication of some of these studies. Porte and Richards (2012) note the importance of partially replicating studies in L2 writing (in which central elements of an original study remain the same, but non-major aspects are varied between the past and present to facilitate comparisons). They also claim that replication or partial replication studies are important ways to test the robustness of past research and address the disjointed and conflicting findings resulting from the growing diversity of scope and topic in L2 writing research. We agree that sustained investigations may contribute to fully understanding the relationship between one set of variables and any extra unaccounted for variables that might be affecting results.

The present study is a partial replication study of Kuiken and Vedder (2007, 2008, 2012) and Sercu et al. (2006). Similar measures are used to operationalize the independent variables (cognitive task complexity) and the dependent variables (syntactic and lexical complexity). Additionally, similar frameworks have been utilized to make predictions about the relationships between cognitive task complexity and linguistic complexity. These are the Cognition Hypothesis (Robinson, 2001a, 2001b, 2005, 2007, 2011) and the Trade-off Hypothesis (Skehan, 1998, 2003, 2014; Skehan & Foster, 1999, 2001).

However, in contrast to these previous studies, we have included variations in the operationalizing of the dependent variables by adopting a more fine-grained approach to the measurement of syntactic complexity, with dependent clauses being analysed separately (Wolfe-Quintero, Inagaki, & Kim, 1998) as well as in one inclusive group. We have also addressed challenges related to the operationalizing of the independent variables. Regarding cognitive task complexity, Norris (2010) and Révész (2014) suggest that more evidence is needed to investigate whether manipulating task complexity actually affects the types of cognitive demands predicted by the Cognition Hypothesis (Robinson, 2001a, 2001b, 2005, 2007, 2011). We considered an additional concern. Specifically, if modifying task complexity has an effect on cognitive burden, there is currently no means by which these modifications can be accurately measured, and it is not clear how this might impact the findings. As a result, we introduced a patently low complexity task to highlight the effects of task complexity, which can otherwise be obscured by the inability to accurately gauge variations in task complexity between more complex tasks.

This paper starts with a brief review of the theoretical framework for cognitive task complexity. Subsequently, we discuss the different predictions made by the Trade-off Hypothesis (Skehan, 1998, 2003, 2014; Skehan & Foster, 1999, 2001) and the Cognition Hypothesis (Robinson, 2001a, 2001b, 2005, 2007, 2011) for increases in cognitive task complexity on output. In the subsequent section, writing complexity is discussed, focusing on the lexical and syntactic measures utilized in the present study. We also include rationales for using T-units and subordination. Finally, past studies on cognitive task complexity and writing that utilized similar independent and dependent variables to this paper are reviewed.

We then report on the results of a within-subject experimental study in which second language learners (classified as intermediate level with IELTS scores ranging from 4.5 to 5.5) were provided with writing tasks that had cognitive task complexity manipulated in the task design. Tasks ranged from patently low complexity to two higher complexity tasks. The results were analysed for evidence of changes in the linguistic features produced in the texts. Specifically, syntactic complexity was evaluated as variations in T-unit length. This was operationalized by measuring the ratio of dependent clauses to T-units across all dependent clauses, and the ratio of dependent clauses to T-units with each dependent clause measured separately. Lexical complexity was measured by using a mean segmental type-token ratio. This is a measure of lexical variety using the ratio of different lexical items to the total number of items used while accounting for text length.

### **Cognitive task complexity**

In the study of second language writing, complexity can be applied to two terms: Cognitive task complexity refers to the modifications made during task design that make a task difficult to complete, whereas writing complexity refers to the language in written output that can be considered varied and elaborate (Ellis, 2003). This study utilized both aspects of complexity by investigating the effects of cognitive task complexity on the texts produced by English L2 writers.

Broadly, cognitive task complexity can comprise the interaction of two elements manipulated in the design of pedagogical tasks (Ellis, 2003). These elements are types of information and amounts of information (Brown, Anderson, Shilcock, & Yule, 1984). These features are theorized to affect the cognitive burden a student experiences during task performance by placing varying demands on learners' cognitive resources. The effects of modifying these elements are frequently analysed using two frameworks: These are the Trade-off Hypothesis (Skehan, 1998, 2003, 2014; Skehan & Foster, 1999, 2001) and the Cognition Hypothesis (Robinson, 2001a, 2001b, 2005, 2007, 2011).

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