Available online at www.sciencedirect.com
ScienceDirect
Journal of Second Language Writing 17 (2008) 48–60
JOURNAL OF SECOND LANGUAGE WRITING

Cognitive task complexity and written output in Italian and French as a foreign language

Folkert Kuiken [a,*], Ineke Vedder [b,1]

[a] University of Amsterdam, Amsterdam Center for Language and Communication, Dutch Language and Literature, Spuistraat 134, 1012 VB Amsterdam, The Netherlands
[b] University of Amsterdam, Amsterdam Center for Language and Communication, Second Language Acquisition, Spuistraat 210, 1012 VT Amsterdam, The Netherlands

Abstract

This paper reports on a study on the relationship between cognitive task complexity and linguistic performance in L2 writing. In the study, two models proposed to explain the influence of cognitive task complexity on linguistic performance in L2 are tested and compared: Skehan and Foster's Limited Attentional Capacity Model (Skehan, 1998; Skehan & Foster, 1999, 2001) and Robinson's Cognition Hypothesis (Robinson, 2001a, 2001b, 2005). In the experiment, 91 Dutch university students of Italian and 76 students of French performed two writing tasks with prompts of differing cognitive complexity. Linguistic performance was operationalized in terms of syntactic complexity, lexical variation, and accuracy. The study provides support for the Cognition Hypothesis insofar as the written products of the cognitively more demanding task turned out to be more accurate, with significantly lower error ratios per T-unit than those of the cognitively less demanding task. No effects on the written output could be observed on measures of syntactic complexity or lexical variation. The implications of the findings for both Skehan and Foster's model and Robinson's Cognition Hypothesis with regard to L2 writing pedagogy are discussed and suggestions are made for the direction in which further research on the influence of task complexity on text quality should be developed.

Keywords: Accuracy; Attention; Cognition Hypothesis; Cognitive task complexity; Lexical variation; Limited Attentional Capacity Model; Multiple Attentional Resources Model; Proficiency level; Syntactic complexity; Writing performance

* Corresponding author. Tel.: +31 20 5253850.
E-mail addresses: f.kuiken@uva.nl (F. Kuiken), s.c.vedder@uva.nl (I. Vedder).
[1] Tel.: +31 20 5254233.

1060-3743/$ – see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.jslw.2007.08.003

Introduction

Since the introduction of task-based language pedagogy in the 1980s, tasks hold a central place in current second language acquisition (SLA) research and in language pedagogy. In a task-based syllabus, pedagogic tasks should be sequenced to increasingly approximate the demands of real-world target tasks (Robinson, 2005). The vitality of the research into task-based learning in SLA is evident in the large number of publications related to task-based language learning, teaching, and testing (Bygate, Skehan, & Swain, 2001; Ellis, 2003; Long & Crookes, 1992; Skehan, 2003).

A central issue in task-based language learning concerns the influence of task complexity on linguistic performance. There have been several studies that have investigated the effect of task complexity on different aspects of linguistic performance at different levels of L2 proficiency (for an overview, see Robinson, 2001a, 2005). Most of these studies have focused, however, on oral proficiency. There have only been a few studies that have considered the question of how the complexity of a writing task might influence the quality of the text resulting from this task. In the literature on both L1 and L2 writing, it has been suggested that some task types result in lower test scores than others, but the relationship between task type or task complexity and writing performance is by no means clear. In a study by Hamp-Lyons and Mathias (1994) on expert judgements of task difficulty in relation to test scores in ESL writing, it was shown that while the data confirmed the strength of the predicted relationship between task type and performance, their direction was the reverse of what had been predicted: expository and personal prompts, contradicting the common expectations that they would be easiest, turned out to be associated with the lowest writing scores, while argumentative and public prompts were associated with the highest scores. One of the explanations of the authors was that students, when a cognitively more difficult writing task is assigned, are stimulated to reach higher with their writing abilities than in case of a cognitively less difficult task.

In the present study, two different models of task complexity were put to the test: Skehan and Foster's Limited Attentional Capacity Model (Skehan, 1998; Skehan & Foster, 2001) and the Cognition Hypothesis by Robinson (2001a, 2005). In order to examine the effects of task complexity on written performance, a series of experiments were carried out among a group of university students of Italian and French with different levels of L2 proficiency. All participants had to perform two writing tasks in which cognitive task complexity was manipulated.

The question we will attempt to answer here is whether the syntactic complexity, lexical variation, and accuracy of L2 written output is influenced by cognitive task complexity. In what follows, the theoretical background, design, and results of the study will be presented. The paper concludes with a discussion of the theoretical implications for the two task complexity models under investigation as well as of the pedagogical implications of the findings regarding the question whether cognitively more difficult or easier tasks should be assigned in L2 writing classes. Finally, some suggestions are made concerning the direction in which further research on the relation between task complexity and written performance should be developed.

Task complexity and attentional resources

Skehan and Foster as well as Robinson have identified a series of task design factors that can be manipulated in order to achieve different levels of task complexity. What both models have in common is the crucial role of attention and how attentional resources are used during task completion. There exists, however, an important difference between the two models with

regard to their predictions of the effect of increasing task complexity on linguistic performance.

Skehan (1998, 2001, 2003) and Skehan and Foster (1999, 2001) understand task complexity as the amount of attention the task demands from the learners. The basic assumption of their Limited Attentional Capacity Model is that attentional resources are limited and that increasing the complexity of tasks and their multiple components reduces a pool of generally available attention capacity. As their attentional limits are reached, learners will prioritize processing for meaning over processing language form. Moreover, to attend to one aspect of performance (complexity of language, accuracy, fluency) may well mean that other dimensions suffer, and since a learner's processing capacity is limited, a prioritization of one aspect will hinder development in the other areas. Based on findings from a study by VanPatten (1990, 1996), Skehan and Foster argue that if a task requires significant attention to be given to its content and a high level of cognitive processing, there will be less attention available to be given to the linguistic output. As a consequence, tasks which are cognitively demanding are likely to draw attentional resources away from language forms. This may result in learners paying insufficient attention to forms and structures which still require controlled processing. The major claim of the Limited Attentional Capacity Model, therefore, is that an increase in cognitive task complexity will cause learners to pay attention first of all to the content of the task. As a consequence, the complexity and accuracy of the linguistic output will decrease.

A different view on the effect of cognitive task complexity on linguistic output is held by Robinson. In his Multiple Attentional Resources Model, also known as the Cognition Hypothesis, Robinson (2001a, 2001b, 2003, 2005) predicts that, if dimensions of cognitive task complexity belong to different attentional resource pools, increases in task complexity do not degrade linguistic output, but may lead, instead, to higher structural complexity and greater accuracy of learner output. Integrating information-processing theories (Schmidt, 2001), interactionist explanations of L2 task effects (Long, 1996), and psychological models such as Wickens's model of dual task performance (Wickens, 1989, 1992), Robinson proposes, contrary to Skehan and Foster, that learners can access multiple and non-competitional attentional resources. According to the Cognition Hypothesis, cognitively more demanding tasks, for the completion of which more attention is needed, are thought to promote more awareness and incorporation of forms made salient in the input. As a result, increasing task complexity will trigger greater linguistic complexity and higher accuracy in order to meet the greater functional demands they put on the learner.

Following these contrasting theoretical positions concerning the role of attention, Robinson's predictions with regard to the influence of cognitive task complexity on fluency, complexity, and accuracy on oral tasks are different from those of Skehan and Foster. Robinson claims that, since learners can simultaneously access multiple and non-competitional attentional pools, manipulating task complexity by increasing the cognitive demands of tasks can lead to simultaneous improvement of complexity and accuracy. Skehan and Foster, drawing on limited-capacity theories of attention that postulate that learners will prioritize either form or meaning, propose that, of the three areas of performance, complexity and accuracy are in competition with each other.

What these studies show is that the role of attentional resources in SLA in relation to different task demands is still controversial and in need of more research in order to establish whether single-resource or multi-resource models of attention are more likely to predict L2 proficiency, particularly with respect to written performance. Therefore, a pilot study was set up in which we tried to investigate the relationship between text quality and the cognitive complexity of a writing

task. In that study (Kuiken & Vedder, 2004a, 2004b), 51 university students of Italian with Dutch as L1 performed two writing tasks that varied in cognitive complexity in L2 and L1. What we found was an effect of task complexity on accuracy but not on the syntactic complexity and lexical variation of the texts. A possible explanation of the results in the pilot is that the effects of cognitive task complexity were partly constrained by the level of language proficiency, as the participants were all beginning students of Italian L2. With respect to the influence of task complexity, a threshold level might exist, similar to the Threshold Hypothesis (Cummins, 1979) in which it is hypothesized that it is necessary to achieve a certain level of L2 proficiency before one can do a specific task (e.g., read) in that language. Once the threshold level has been reached, L1 skills can be transferred and used for the same type of activity in L2. Below this (unspecified) proficiency level, learners cannot use their L1 skills in the execution of a task in L2 (see the conclusions of Schoonen, Hulstijn, & Bossers, 1998, in a study on reading comprehension; see also Schoonen et al., 2003, with regard to L1 and L2 writing). As beginners with a rather poor knowledge of Italian, the participants in our pilot study may have judged both the complex and the non-complex task to be difficult. As a consequence, their written output was not affected by the manipulation of cognitive task complexity. Another finding of the pilot study was that task complexity seemed to operate in L2 differently from the way it operated in L1. In the L1 (Dutch) part of the study, no effects of task complexity on lexical variation were found, but there was a significant effect of task complexity on the syntactic complexity of the text. Although task complexity does indeed appear to play a role in the mother tongue, we will not pursue that issue here, since the focus of the study presented in this article is on writing performance in L2.

This study: research questions

In this study, conducted among Dutch university students of Italian L2 and French L2, the effects of cognitive task complexity on various aspects of written performance were investigated. Our first research question was:

1. What is the effect of manipulating cognitive task complexity on syntactic complexity, lexical variation, and accuracy of learner output?

   Given the results of the pilot study (Kuiken & Vedder, 2004a, 2004b), we also took into account the role played by the level of language proficiency. Therefore our second research question was:

2. Is the output of low- and high-proficient learners affected by the manipulation of task complexity?

   With regard to the first question, Skehan and Foster's Limited Capacity Model predicts a better performance on the non-complex task as learners do not have to direct almost their entire attentional capacity towards the content of the task, and, thus, part of their attention can be devoted to linguistic form. Robinson's Cognition Hypothesis, on the contrary, expects learners to do better on the complex task as learners are able to share their attention between content and form. Since higher cognitive complexity is thought to trigger more awareness, it is predicted that an increase in task complexity will lead to greater syntactic complexity, more lexical variation, and higher accuracy on the complex task.

Concerning the second research question, no or smaller effects of task complexity for low-proficiency students are expected. It seems likely that for low-proficient students who still have to deal with basic formulation processes, the non-complex task is already extending their

interlanguage to its maximum, so that they will perform equally poor in both conditions. As a consequence, in the case of increased task complexity, the students will not have enough attention for both task content and linguistic form (Cummins, 1979). For high-proficient learners, on the other hand, the difference between the more and less complex tasks may be more noticeable, which is supposed to be reflected in their linguistic performance on the two tasks.

Method

Participants

The study involved the participation of 91 Dutch learners of Italian and 76 Dutch learners of French, all with Dutch as their mother tongue. We opted for two target languages as we expected to find differences in performance between the two groups of students due to differences in proficiency level. Students of Italian L2 start as complete beginners whereas students of French L2 have studied French at high school for about five or six years.

Materials

Two writing tasks were assigned to the learners in which cognitive complexity was manipulated. In both experimental conditions, participants were presented with a prompt in L1 (Dutch) explaining that they had to write a letter to a friend regarding the choice of a holiday destination out of five options. As Dutch students travel a lot, we considered this to be a task that was both natural and challenging for them. In each letter, a varying number of requirements had to be taken into account when choosing the destination: six in the complex and three in the non-complex condition. The requirements for their travel destination included aspects such as the presence of a garden, a quiet location, and a place to do physical exercise. In the complex condition, a choice of a Bed and Breakfast in either Italy (for the students of Italian) or France (for the students of French) had to be made (see Appendix A for a sample of the prompt for the complex condition with six requirements). In the non-complex condition, the writers had to choose a holiday resort in a distant country (Curaçao, Isla Margarita, Madagascar, South-Africa, or Tunisia). The letter had to consist of a minimum of 150 words so that the text would give a representative picture of the writing proficiency of the students. There was a time limit of 40 minutes per task and use of a dictionary was allowed. These were the conditions the students were used to when they had to perform similar writing tasks in the classroom. A cloze test, consisting of a shortened version of an article from *Panorama* (October 15, 2003) for the students of Italian and from *l'Express* (October 30, 2003) for the students of French, was constructed in order to obtain a separate measure of language proficiency. In these cloze tests, every 11th word was deleted, leaving 33 gaps.

Data analysis

Students' letters were coded in terms of accuracy, syntactic complexity, and lexical variation, following the considerations and recommendations of Wolfe-Quintero, Inagaki, and Kim (1998). In coding accuracy, we first counted the total number of errors per T-unit (EtotperT). Then, a division was made into three degrees of errors. First-degree errors (E1perT) included minor deviations in spelling, meaning, or grammatical form that did not interfere with the comprehensibility of the text. Second-degree errors (E2perT) contained more serious deviations

in spelling, meaning, grammatical form, or word order. Third-degree errors (E3perT) made the text nearly incomprehensible. Thus, the division was made according to the communicative seriousness of the errors, not with respect to linguistic categories (spelling, morphosyntax, style, and the like). Scoring was conducted by four native speakers of the L2. All of them were language teachers who had been teaching writing classes for several years. They were trained in three sessions until an interrater reliability score of 0.80 had been reached. Specific criteria for each error type were developed, illustrated by the following examples (1–3 are Italian; 4–5 are French).

1. Purtroppo nessuno di questi cinque Bed & Breakfast *corrisponde* [E1; soddisfa] completamente *a i* [E1; ai] tuoi *criteri* [E1; richieste, esigenze].
   Unfortunately none of the five Bed & Breakfast correspond completely to your criteria.
2. È nel centro storico, *come vuoi* [E2; come volevi/vorresti].
   It is in the historical center, as you like it.
3. *Siamo* anche *shoppen* in città [E3; potremmo anche andare a far shopping].
   We are also shopping in town.
4. C'est pour ces raisons que je crois que les *Maledives* [E1; Maldives] est la destination *plus* [E1; la plus] appropriée.
   It is for those reasons that I think that the Maldives is the most appropriate destination.
5. L'endroit est très tranquille, *il âgit que l'environ est trè suave et riant* [E3; les environs ont l'air très agréable].
   The place is very quiet, the environment is very suave and cheerful.

In these examples, the letter and number between the brackets refers to the type of error which has been made (E1, E2, or E3), and the correction suggested by the rater has also been added. The translations of the sentences are below them in italics.

To code syntactic complexity, it was operationalized as the number of clauses per T-unit (CperT). In addition, a dependent clause ratio was calculated, reflecting the degree of syntactic embedding per clause (DCperC). Next, lexical variation was established by means of the type-token ratio (TTR1), the number of word types divided by the total number of word tokens. In addition, an alternative ratio that corrects for text length was computed (TTR2): the number of word types per square root of two times the total number of word tokens (Wolfe-Quintero et al., 1998).

Design

In order to examine a possible effect of language proficiency, students from three different years in the language programs were included in the study. Data were collected in all writing classes. For Italian, this meant that we collected data in the autumn and spring semesters of students in their first year of study and in the autumn semester of students in the second and third years of study. The French data were collected in the autumn and spring semesters of first-year students and in the spring semester of third-year students; the language program for French does not include writing classes for students in their second year (see Table 1). The data collected were mainly cross-sectional, although some, but not all, first-year students performed the assigned tasks twice: in autumn and in spring. So, the numbers (*n*) in Table 1 refer to the number of observations of students of Italian and French made at different times during the language curriculum.

Table 1
Participants and tasks

Language	Year of study	Task observations			
		Autumn		Spring	
		Complex	Non-complex	Complex	Non-complex
Italian	1	$n = 43$	$n = 42$	$n = 33$	$n = 33$
	2	$n = 23$	$n = 23$		
	3	$n = 12$	$n = 12$		
French	1	$n = 48$	$n = 48$	$n = 33$	$n = 33$
	3			$n = 12$	$n = 12$

Note: n = number of observations.

Proficiency level was defined on the basis of the cloze scores (maximum score 33) and not in terms of year of study because within-group variance turned out to be very large. The Italian and French students were divided into low- and high-proficiency groups. Students of Italian with cloze scores below 18 (the median score) were in the low-proficiency group, and students of Italian with scores above 18 were in the high-proficiency group. The dividing score for the French students was 16 (the median). For Italian, the low-proficiency group consisted of 98 observations (mean = 13.23, S.D. = 3.45), and the high-proficiency group of 114 (mean = 23.49, S.D. = 3.02). For French, these numbers were 100 for the low-proficiency group (mean = 10.54, S.D. = 3.02) and 84 for the high-proficiency group (mean = 18.31, S.D. = 2.16). For both Italian and French, the average scores for the low- and high-proficiency groups differed enough from each other to consider them as two distinct groups.

Results

Our first research question concerns the effect of task complexity on the written output of the students. For the students of Italian, we found that cognitive task complexity affects various aspects of linguistic output to a different degree. With regard to accuracy, the students made fewer mistakes in the complex task than in the non-complex one. For the total number of errors per T-unit as well as for the first- and second-degree errors, these differences are significant. However, they are not significant for the third-degree errors (see Table 2, paired samples *t*-tests). No significant differences in syntactic complexity and lexical variation were found in the output from the complex and non-complex tasks.

For the students of French, the results were fairly similar. They made fewer mistakes in the complex task than in the non-complex one, and, similar to the students of Italian, these differences are significant with respect to the total number of errors per T-unit and the first- and second-degree errors, but not for the third-degree errors (see Table 3, paired samples *t*-tests). Again, no significant differences in the output from the complex and non-complex task were found with respect to syntactic complexity. The lexical variation in the texts based on the complex task as measured by the type-token ratio (TTR1) is significantly larger than in those based on the non-complex task; however, this finding is not confirmed by the alternative type-token ratio (TTR2).

Our second research question was whether task complexity affects learners with different levels of L2 proficiency. For the students of Italian, the results of an ANOVA (see Table 4) show a significant effect of *proficiency level* on accuracy (total number of errors and second- and third-

Table 2
Performance comparisons between tasks for students of Italian (paired samples *t*-tests)

Measure type	Measure	Complex		Non-complex		*t*	d.f.	*p*
		Mean	S.D.	Mean	S.D.			
Accuracy	EtotperT	1.99	0.83	2.37	0.98	−4.476	107	.0000***
	E1perT	1.35	0.57	1.58	0.60	−3.607	107	.0005***
	E2perT	0.57	0.41	0.65	0.47	−2.147	107	.0340*
	E3perT	0.12	0.36	0.13	0.16	−0.309	107	.7582
Syntactic complexity	CperT	1.70	0.34	1.73	0.36	−0.741	107	.4601
	DCperC	0.35	0.10	0.36	0.10	−1.523	107	.1306
Lexical variation	TTR1	0.51	0.08	0.52	0.08	−0.635	107	.5270
	TTR2	4.65	0.53	4.68	0.78	−0.602	107	.5487

Note: EtotperT = total errors per T-unit; E1perT = 1st-degree errors per T-unit; E2perT = 2nd-degree errors per T-unit; E3perT = 3rd-degree errors per T-unit; CperT = clauses per T-unit; DCperC = dependent clauses per clause; TTR1 = type-token ratio; TTR2 = ratio of word types to the square root of two times the word tokens; $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 3
Performance comparisons between tasks for students of French (paired samples *t*-tests)

Measure type	Measure	Complex		Non-complex		*t*	d.f.	*p*
		Mean	S.D.	Mean	S.D.			
Accuracy	EtotperT	1.97	0.71	2.33	1.06	−3.917	92	.0002***
	E1perT	1.40	0.51	1.59	0.73	−2.794	92	.0063**
	E2perT	0.48	0.27	0.64	0.38	−4.392	92	.0000***
	E3perT	0.08	0.10	0.10	0.11	−1.495	92	.1385
Syntactic complexity	CperT	1.73	0.37	1.71	0.36	0.238	92	.8127
	DCperC	0.36	0.10	0.37	0.09	−1.198	92	.2341
Lexical variation	TTR1	0.53	0.08	0.51	0.07	2.470	89	.0154*
	TTR2	4.81	0.47	4.74	0.45	1.524	89	.1310

Note: EtotperT = total errors per T-unit; E1perT = 1st-degree errors per T-unit; E2perT = 2nd-degree errors per T-unit; E3perT = 3rd-degree errors per T-unit; CperT = clauses per T-unit; DCperC = dependent clauses per clause; TTR1 = type-token ratio; TTR2 = ratio of word types to the square root of two times the word tokens; $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

degree errors); on measures of syntactic complexity (clauses per T-unit and number of dependent clauses per clause); and on lexical variation (alternative type-token ratio). They also show a significant effect of *task complexity* on accuracy (total number of errors and first- and second-degree errors). However, no significant *interaction* of proficiency level and task complexity on any of the measures scored can be established.

Like the results for the students of Italian, the results of an ANOVA for the students of French (see Table 5) show a significant effect of *proficiency level* on accuracy (total number of errors and second- and third-degree errors) and lexical variation (TTR2), but, in this case, not on syntactic complexity. Table 5 also shows that there was a significant effect of *task complexity* on accuracy (total number of errors and first- and second-degree errors) and lexical variation (TTR1). Similar to the observations with the students of Italian, no significant *interaction* of proficiency level and

Table 4
Effects of proficiency level, task complexity, and their interaction for students of Italian L2 (ANOVA)

Measure type	Measure	Proficiency level			Task complexity			Level and task interaction		
		F	d.f.	*p*	*F*	d.f.	*p*	*F*	d.f.	*p*
Accuracy	EtotperT	9.455	1, 104	.0027**	21.6435	1, 104	.0000***	1.3485	1, 104	.2482
	E1perT	1.9192	1, 104	.1689	14.499	1, 104	.0002***	.933	1, 104	.3363
	E2perT	13.939	1, 104	.0003***	4.6340	1, 104	.0337*	.6176	1, 104	.4337
	E3perT	5.9343	1, 104	.0166*	.0949	1, 104	.7586	.6987	1, 104	.4051
Syntactic complexity	CperT	12.628	1, 104	.0006***	1.1548	1, 104	.2850	1.4649	1, 104	.2289
	DCperC	12.043	1, 104	.0008***	3.0725	1, 104	.0826	.7554	1, 104	.3868
Lexical variation	TTR1	.1204	1, 103	.7293	.4022	1, 103	.5274	.8416	1, 103	.3611
	TTR2	10.622	1, 103	.0015**	.3644	1, 103	.5474	1.7113	1, 103	.1937

Note: EtotperT = total errors per T-unit; E1perT = 1st-degree errors per T-unit; E2perT = 2nd-degree errors per T-unit; E3perT = 3rd-degree errors per T-unit; CperT = clauses per T-unit; DCperC = dependent clauses per clause; TTR1 = type-token ratio; TTR2 = ratio of word types to the square root of two times the word tokens; $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 5
Effects of proficiency level, task complexity, and their interaction for students of French L2 (ANOVA)

Measure type	Measure	Proficiency level			Task complexity			Level and task interaction		
		F	d.f.	*p*	*F*	d.f.	*p*	*F*	d.f.	*p*
Accuracy	EtotperT	9.8414	1, 90	.0023**	15.0807	1, 90	.0002***	.3574	1, 90	.5514
	E1perT	2.6326	1, 90	.1082	7.7406	1, 90	.0066**	.7262	1, 90	.3964
	E2perT	21.321	1, 90	.0000***	18.8902	1, 90	.0000***	.4944	1, 90	.4838
	E3perT	18.265	1, 90	.0000***	2.2268	1, 90	.1391	1.8603	1, 90	.1760
Syntactic complexity	CperT	1.7416	1, 90	.1903	.1028	1, 90	.7492	2.0571	1, 90	.1550
	DCperC	.692	1, 90	.4077	5.8762	1, 90	.1753	2.2842	1, 90	.1342
Lexical variation	TTR1	1.2807	1, 87	.2609	5.8762	1, 87	.0174*	.1903	1, 87	.6638
	TTR2	8.7612	1, 87	.0040**	1.8636	1, 87	.1757	.4544	1, 87	.5020

Note: EtotperT = total errors per T-unit; E1perT = 1st-degree errors per T-unit; E2perT = 2nd-degree errors per T-unit; E3perT = 3rd-degree errors per T-unit; CperT = clauses per T-unit; DCperC = dependent clauses per clause; TTR1 = type-token ratio; TTR2 = ratio of word types to the square root of two times the word tokens; $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

task type was observed with the students of French. This means that, in both Italian and French, the effects of cognitive complexity are not related to language proficiency.

Discussion

In this study, the effect of cognitive task complexity on various aspects of written performance was investigated. Based on the results, we have to conclude that, with regard to syntactic complexity and lexical variation, hardly any significant differences were found between the complex and non-complex tasks. The only exceptions were the students of French whose type-token ratio was higher in the complex than in the non-complex condition. As a consequence, no evidence was found for either Robinson's Cognition Hypothesis or Skehan and Foster's Limited Attentional Capacity Model. In line with the predictions of the Cognition Hypothesis, for both Italian and French, an effect of task complexity on accuracy was found. The ratios of the total

number of errors and the first- and second-degree errors were significantly lower in the complex condition than in the non-complex one. This means that increasing task complexity along resource-directing variables leads learners to pay more attention to linguistic form in that their written output becomes more accurate, but it does not affect the syntactic complexity and lexical variation of the output.

With respect to the second question, whether this influence is the same for learners of different levels of proficiency, we expected to find no or smaller effects of task complexity for low-proficiency students. However, no interaction of task type and proficiency level could be observed. This result is in contrast with an earlier finding that the effect of task complexity on accuracy measures was stronger for high-proficiency learners (Kuiken, Mos, & Vedder, 2005). In that study, not all the students of Italian who participated in our current experiment were involved and neither were the students of French. The selection of participants in our earlier study may therefore have been biased in that there seemed to be more differences between the high- and low-level performers than in the present study (see also Kuiken & Vedder, 2007; Sercu, De Wachter, Peters, Kuiken, & Vedder, 2006).

The present study, in sum, shows that manipulation of task complexity affects accuracy but not syntactic complexity and lexical variation. Thus, the findings do not provide evidence in support of the predictions made by Skehan and Foster's Limited Attentional Capacity Model and only partially support those made by Robinson's Cognition Hypothesis. It would be premature, however, to conclude that both the Limited Attentional Complexity Model and the Cognition Hypothesis have to be rejected. As a matter of fact, there are several studies by now that have demonstrated that task complexity has an effect on accuracy (Iwashita, McNamara, & Elder, 2001; Robinson, 1995). The findings of the present experiment corroborate those of our pilot study (Kuiken & Vedder, 2004a, 2004b), and they are in line with Gilabert (2005, 2007), who, in a study on oral proficiency, also found greater accuracy (measured in terms of self-repairs) on more complex tasks that were manipulated on the there-and-then versus here-and-now variable. They also confirm the results of Hamp-Lyons and Mathias (1994) that, contrary to the common assumptions in several L1 and L2 writing studies that public and argumentative writing are more difficult to learn than personal and expository writing and, therefore, merit more pedagogical attention and more practice in order for students to master them, higher scores were associated with public topics and argumentative writing tasks. By and large, the pattern that seems to emerge is that an increase in task complexity leads learners to produce a text which is more correct but not necessarily more syntactically complex or lexically varied.

On the basis of the finding that increasing the cognitive complexity of a writing task leads to a more accurate output, one might conclude that there is indeed a relation between task complexity and linguistic performance. However, it remains to be seen to what extent this is really the case as no effect of task complexity on syntactic complexity and lexical variation could be observed. An alternative conclusion might be that increasing task complexity does not lead to a better performance and to linguistic development per se, but to more control over the existing interlanguage system. It is this increase in control that causes learners to make fewer errors. The next question to study would be why an increase in task complexity might enhance the control mechanisms of the L2 learner but does not promote language development. It goes without saying that linguistic development and changes in proficiency and control over time can only be investigated in a study with a more longitudinal design than the present one, which was mainly cross-sectional in nature.

With regard to linguistic performance, we have focused on accuracy, syntactic complexity, and lexical variation. In our study, no attempt was made to investigate the influence on

performance of other task-performer related variables such as motivation, learner style, and other individual learner differences, which may constitute important indicators of task performance. The Cognition Hypothesis also predicts that individual differences in cognitive abilities, as well as affective factors, will increasingly affect task-based performance and learning as tasks increase in complexity (Niwa, 2000; Robinson, 2001a, 2001b, 2005). It would be necessary, as suggested by Robinson, to look for possible interactions between learner type and task manipulation, as some learners might benefit more from such manipulations than others.

Additionally, there are other aspects of performance worth considering. In our experiment, no attention was paid to the actual content or the argumentative force of the text. No assessment was made of the effect of task complexity on the use of higher-order writing skills such as the cohesion and coherence of the text. It may be the case that these aspects of performance are also affected by an increase in task complexity. Moreover, it could be that the extra attention paid to accuracy in the more complex task condition is taken away from these higher-order processes. As a consequence, these aspects certainly deserve to be studied further.

References

Bygate, M., Skehan, P., & Swain, M. (2001). *Researching pedagogic tasks: Second language learning, teaching and testing*. Harlow, UK: Pearson Education.

Cummins, J. (1979). Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. *Working Papers in Bilingualism, 19*, 197–205.

Ellis, R. (2003). *Task-based language learning and teaching*. Oxford: Oxford University Press.

Gilabert, R. (2005). *Task complexity and L2 narrative oral production*. Unpublished doctoral thesis. University of Barcelona.

Gilabert, R. (2007). The simultaneous manipulation of task complexity along planning time and [+/−here-and-now]: Effects on L2 oral production. In M. García Mayo (Ed.), *Investigating tasks in formal language learning* (pp. 44–68). Clevedon, UK: Multilingual Matters.

Hamp-Lyons, L., & Mathias, S. P. (1994). Examining expert judgments of task difficulty on essay tests. *Journal of Second Language Writing, 3*, 49–68.

Iwashita, N., McNamara, T., & Elder, C. (2001). Can we predict task difficulty in an oral proficiency test? Exploring the potential of information processing approach to task design. *Language Learning, 51*, 401–436.

Kuiken, F., & Vedder, I. (2004a). Il Bed and Breakfast più bello d'Italia. Cognitieve taakcomplexiteit en tekstkwaliteit in Italiaans T2 [Il Bed and Beakfast più bello d'Italia. Cognitive task complexity and text quality in Italian L2]. *Incontri, 19*, 31–39.

Kuiken, F., & Vedder, I. (2004b). De relatie tussen cognitieve taakcomplexiteit en linguïstische performance bij het schrijven in T1 en T2 [The relation between cognitive task complexity and linguistic performance in writing in L1 and L2]. *Toegepaste Taalwetenschap in Artikelen, 72*, 23–32.

Kuiken, F., & Vedder, I. (2007). Cognitive task complexity and linguistic performance in French L2 writing. In M. P. García Mayo (Ed.), *Investigating tasks in formal language learning* (pp. 117–135). Clevedon, UK: Multilingual Matters.

Kuiken, F., Mos, M., & Vedder, I. (2005). Cognitive task complexity and second language writing performance. In Foster-Cohen, S., García-Mayo, M. P., & Cenoz, J. Eds. *Eurosla yearbook*. Vol. 5 (pp.195–222). Amsterdam: John Benjamins.

Long, M. H. (1996). The role of the linguistic environment in second language acquisition. In W. Ritchie & T. Bhatia (Eds.), *Handbook of second language acquisition* (pp. 413–468). San Diego: Academic Press.

Long, M. H., & Crookes, G. (1992). Three approaches to task-based syllabus design. *TESOL Quarterly, 26*, 27–56.

Niwa, Y. (2000). *Reasoning demands of L2 tasks and L2 narrative production: Effects of individual differences in working memory, intelligence and aptitude*. Unpublished master's thesis. Aoyoma Gakuin University.

Robinson, P. (1995). Task complexity and second language narrative discourse. *Language Learning, 45*, 99–140.

Robinson, P. (2001a). Task complexity, cognitive resources, and syllabus design: A triadic framework for examining task influences on SLA. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 287–318). Cambridge: Cambridge University Press.

Robinson, P. (2001b). Task complexity, task difficulty, and task production: Exploring interactions in a componential framework. *Applied Linguistics, 22*, 27–57.

Robinson, P. (2003). Attention and memory. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 631–678). Oxford: Blackwell.

Robinson, P. (2005). Cognitive complexity and task sequencing: Studies in a componential framework for second language task design. *International Review of Applied Linguistics, 43*, 1–32.

Schmidt, R. (2001). Attention. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 3–32). Cambridge: Cambridge University Press.

Schoonen, R., Hulstijn, J., & Bossers, B. (1998). Metacognitive and language-specific knowledge in native and foreign language reading comprehension. An empirical study among Dutch students in grades 6, 8 and 10. *Language Learning, 48*, 71–106.

Schoonen, R., Van Gelderen, A., De Glopper, K., Hulstijn, J., Simis, A., Snellings, P., et al. (2003). First language and second language writing: The role of linguistic knowledge, speed of processing, and metacognitive knowledge. *Language Learning, 53*, 165–202.

Sercu, L., De Wachter, L., Peters, E., Kuiken, F., & Vedder, I. (2006). The effect of task complexity and task conditions on foreign language development and performance: Three empirical studies. *ITL—International Journal of Applied Linguistics, 151*, 55–84.

Skehan, P. (1998). *A cognitive approach to language learning*. Oxford: Oxford University Press.

Skehan, P. (2001). Tasks and language performance assessment. In M. Bygate, P. Skehan, & M. Swain (Eds.), *Researching pedagogic tasks: Second language learning, teaching and testing* (pp. 167–185). Harlow, UK: Pearson Education.

Skehan, P. (2003). Task-based instruction. *Language Teaching, 36*, 1–14.

Skehan, P., & Foster, P. (1999). The influence of task structure and processing conditions on narrative retellings. *Language Learning, 49*, 93–100.

Skehan, P., & Foster, P. (2001). Cognition and tasks. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 183–205). Cambridge: Cambridge University Press.

VanPatten, B. (1990). Attending to form and content in the input: An experiment in consciousness. *Studies in Second Language Acquisition, 12*, 287–301.

VanPatten, B. (1996). *Input processing and grammar instruction: Theory and research*. Norwood, NJ: Ablex.

Wickens, C. D. (1989). Attention and skilled performance. In D. Holding (Ed.), *Human Skills* (pp. 71–105). New York: John Wiley.

Wickens, C. D. (1992). *Engineering psychology and human performance*. New York: HarperCollins.

Wolfe-Quintero, K., Inagaki, S., & Kim, H. Y. (1998). *Second language development in writing: Measures of fluency, accuracy and complexity.* Honolulu, HI: Second Language Teaching and Curriculum Center, University of Hawai'i at Mānoa.

Appendix A. Example of a complex writing task: Bed and Breakfast in Italy (Translation into English from the original prompt in Dutch)

Bed and Breakfast in Italy

You are planning to go on holiday with an Italian friend and want to spend two weeks together in May or June. You have decided to go to a Bed and Breakfast. Your friend has already surfed the internet and made a first selection. He/she picked five places, in Umbria, Rome, Rimini, Campania, and the Veneto region, and is now asking for your advice. The guesthouse or apartment you choose, however, has to satisfy a number of conditions. These criteria are:

- presence of a garden;
- a quiet location;
- located in (or in the vicinity of) the center;
- the possibility of doing physical exercise;
- swimming facilities;
- breakfast included.

None of the five addresses your friend sent you meets all of the criteria. A carefully considered choice has to be made, however. Read the five descriptions carefully, then write a letter of at least 150 words in which you explain which Bed and Breakfast you think is most suitable and fits the conditions best. Keep in mind that your text does not have to reflect your personal preferences. Write a letter in which you try to convince your friend that your choice is right, and support it with arguments. You have 40 minutes to write the text. Use of a dictionary is permitted.

1. Casa Lory
Location: Umbria, province of Foligno. Situated 15 km from Foligno.
Description: Quiet location, in rural setting. Bedroom in classical style, large terrace with view, garden. Grand old house, completely restored in 1998. Swimming pool 2 km away.
Breakfast: Extensive breakfast included in the price: home-made pies, fresh eggs, a variety of local cheeses, and assorted cold meats.
2. Europe B and B
Location: Lazio, Rome. Situated in the old center of the city.
Description: In the dynamic heart of the Old City of Rome, 10 minutes distance from the Coliseum. Apartment, four rooms, two bathrooms, fitness-room, private garden, garage. Special discounts for theatre and concert tickets. Cable television, safe, air conditioning.
Breakfast: No breakfasts served.
3. Bed and Breakfast Hotel Migani Spiaggia
Location: Emilia Romagna, Rimini, at a considerable distance from the city center, but situated directly next to the boulevard and sea front, with a lot of activity, even at night.
Description: Attractively priced, young and dynamic, open day and night, free parking, fitness, beach activities, bicycles available for guests, reduced entrance fees and shuttle bus to and from the clubs, special discounts for young guests and groups.
Breakfast: Comprehensive breakfast buffet, American style, between 8.30 and 11.00.
4. Dimora Carlo III di Borbone
Location: Campania, Vietri Sul Mare, province of Salerno, Amalfi coast.
Description: Situated on the boardwalk, in the old city center, apartment in historical block (18th century). Ideally located for those seeking to spend a quiet holiday on the beach or to go hiking in the mountains, but with shops, bars and restaurants conveniently located in close proximity.
Breakfast: Breakfast service during high season, between mid July and mid August.
5. Baffelan B and B
Location: Veneto, Valli del Pasubio, province of Vicenza, 800 m from the village, situated at the foot of the Monte Pasubio.
Description: For those looking for peace and mountain aficionados. Fully restored farmhouse with garden in tranquil region which has not been discovered by mass-tourism yet. We have two rooms for our guests on the top floor, with a total of 4/5 beds. The bathroom is shared between both bedrooms. Mountain bikes available upon request, mountain walks, horse-back riding.
Breakfast: Guests can prepare their own breakfast; not included.