**Title of Project:**
Effects of Task Complexity on Chinese EFL Learners’ L2 Oral Performance:
A Complex Dynamic Systems Theory Perspective

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**Motivation for the Research**
This study will attempt to combine task-based language teaching (TBLT) with learner corpus research and natural language processing techniques (see Alexopoulou et al., 2017). The current study is theoretically different from prior research because it mainly focuses on testing hypotheses on task complexity effects from the two major models: the Trade-off Hypothesis and the Cognition Hypothesis. The current study adopts a Complex Dynamic Systems Theory (CDST) perspective. From a Complex Dynamic Systems Theory standpoint, language is a complex, adaptive system featuring complete interconnectedness, nonlinear dynamic changes, contextual sensitivity, self-organization and self-adaptation (Larsen-Freeman, 1997; Larsen-Freeman & Cameron, 2013). The purpose of the study is to examine the effects of task complexity on interactions between micro task contexts and features of linguistic complexity in L2 oral production and within L2 speaker oral lexical and syntactic sub-systems and those between the oral lexical and syntactic sub-systems with increasing task complexity. This study will demonstrate the synergy of combining methods from corpus linguistics with computational linguistic so as to facilitate the natural linguistic analysis relative to lexical and syntactic complexity features. This process is helpful for investigating the effects of task complexity on learner performance using data from a large corpus. The aim is to exemplify the effective triangulation of corpus linguistics, computational linguistics, and task-based approaches to second language research (Alexopoulou et al., 2017).

**Research Questions**

1. How do the L2 learners’ oral lexical and syntactic measures change with increasing task complexity? What are the specific changes?
2. How do different lexical and syntactic measures interrelate with one another as task complexity increases?
3. Is there any interrelation between the L2 speakers’ oral lexical sub-system and syntactic subsystem? If yes, what are the specific relations?

**Research Methodology**

This study draws on the spoken corpus of Test for English Majors, Band 8 (TEM-8) in the *Spoken and Written Corpus of Chinese Learners (2.0)* (Wen et al. 2008), which is comprised of learners’ oral data in TEM-8 ranging from the year of 2003 to 2007. Considering that participants in the TEM-8 are English majors in the fourth university year, they can be approximately regarded as upper-intermediate learners. To achieve proper task complexity identification and balance the data scale, this study selected the oral data from the year of 2004 to 2006.

To answer the research questions and considering the multidimensionality of language performance, this study utilizes three advanced natural language analysis tools, namely the Tool for Automatic Analysis of Lexical Diversity (TAALED), Tool for Automatic Analysis of Lexical Sophistication (TAALES) (Kyle & Crossley, 2015), and Tool for Automatic Analysis of Syntactic Complexity (TAASSC) (Kyle, 2016), to investigate the lexical (by TAALED and TAALES) and syntactic (by TAASSC) features in the L2 oral corpus data.

In traditional research on second language performance, lexical complexity can often be investigated in the following three dimensions: lexical diversity, lexical density and lexical sophistication (Read, 2000). Grounded on previous literature and considering the features of L2 oral texts, this study selected both large-grained and fine-grained measures along the three lexical dimensions to observe task complexity effects on L2 speakers’ interlanguage performance.

Scholars in not in agreement about a definition of syntactic complexity in L2 research. Syntactic complexity has been considered in various ways in second language acquisition research and assessed through various measures, for a variety of groups of language learners, and for varied proficiency levels and learning tasks (cf. Kuiken, Vedder, Housen, & De Clercq, 2019). The syntactic complexity measures in the existing literature often seek to quantify one or more aspects of the following four dimensions: length of production unit, amount of subordination and coordination, the range of syntactic structures, and the degree of sophistication of certain syntactic structures (Lu, 2011, pp. 36-37). The five syntactic complexity measures are selected in accordance to the typical four dimensions of syntactic complexity measures illustrated above.

All the three natural language analysis tools can be available freely for research and educational purposes, and support batch processing. Before being put into computation, all of the oral texts in the spoken learner corpus used in this study have been meticulously cleaned. The basic principle for cleaning the data is not to affect the effective and accurate calculation of the measures. For example, some words typical in oral expressions, like “um”, “en”, “ha”, “er” are excluded in order to ensure the reliability of related vocabulary results. Incomplete sentences like “I think er the er and” are also not considered in order to have more accurate analysis.

For descriptive and inferential statistical analyses, the present study employed R (3.6.1 version) software for data analysis. Procedures were conducted including multivariate analysis of variance (MANOVA), given more than two measures in lexical and syntactic strands respectively are used to observe the changes of linguistic complexity, post-hoc multiple comparisons of variables, correlation tests, etc. The visualization of relevant results was also achieved through packages in the R (3.6.1) software.

**Summary of Findings**

In correspondence to the three research questions, some major findings are reiterated here in a succinct way. The first research question is concerned with the task complexity effects on lexical and syntactic
measures. The findings show a linear upward tendency of MRCF values, a U-shaped curve with the changes of BNCSF and MRCM values, and an inverted U-shaped curve with the changes of MATTTR, LD, BNCSR, MRCC, and MRCI values. In other words, with increasing task complexity, L2 learners’ lexicon is significantly affected with regard to both overall measures and specific word information measures. Moreover, most lexical measures display significant nonlinear fluctuations. In addition to lexical measures, the first research question also deals with how L2 learners’ oral syntactic measures change when task complexity increases. The findings indicate that with increasing cognitive task demands, L2 speakers display a higher value of dependents per clause and coordinate phrases per clause, yet a lower value of dependents per nominal, and some fluctuations of the use of dependent clauses per clause. However, the more general syntactic complexity measure, i.e., the mean length of clause, keeps steady with contextual changes.

The second research question is devoted to investigations on the interrelations with L2 speakers’ oral lexical sub-system and syntactic sub-system. The selected correlations to be discussed above demonstrate that both lexical and syntactic measures sustain interactions with each other under changing micro task contexts. As for the interrelations between lexical measures, the major findings show an increasing negative correlation between MATTTR and BNCSF, a decreasing negative correlation between BNCSF and MRCI, and nonlinear fluctuating changes of interrelations between some other general and specific measures. In contrast, the correlations between syntactic measures tend to be low and medium. The major findings suggest a decreasing negative correlation between MLC and DCC, an increasing mixed correlation between CPC and DC, and fluctuating relations between MLC and CPC, and MLC and DN.

The last research question is aimed to further examine the interrelations between the L2 speakers’ oral lexical sub-system and syntactic sub-system. However, the result shows that there is no significant correlation between any lexical and syntactic measures, which may be attributed to such factors as computational differences of selected lexical and syntactic measures and the learner corpus design.

Implications
The critical contribution of natural language analysis measures and tools is the consideration on the multidimensionality of linguistic complexity and the functional differentiation of lexical and syntactic indices used for analyzing the L2 oral texts. The choice and utilization of both local-level and global-level lexical and syntactic metrics enable us to observe more complex and dynamic changes of interlanguage performance brought by increased task complexity and nuances in the complete interconnectedness, interactions, self-adaptation and self-organization of the L2 oral lexical and syntactic sub-systems and their sensitivity to contextual changes. Previous task-based research (Jackson & Suethanapornkul, 2013) has encouraged scholars to take advantage of multiple linguistic measures with different functions, the feasibility of which has been testified in the present study. It is worth noting that with the development of data-driven research and automatic natural language processing tools and metrics (Kyle et al., 2017), the computational tools and models are going to make more practical contributions to the inventory of reliable linguistic complexity measures, and task-based language teaching investigations, as other core issues in second language acquisition, can indeed obtain benefits from the inclusive use of computational linguistic measures along both lexical and syntactic dimensions.

The literature of task-based research has already shown that TBLT research traditionally adopting standard experimental research design usually with relatively small data size can be usefully complemented by large-scale learner corpus research (Alexopoulou et al., 2017). The present study continues along this line by using Chinese L2 oral test corpus and attempting to identify task complexity in a post hoc way and further demonstrates that the interaction between L2 oral production and micro task contexts is less straightforward and more nuanced. Differing from a manipulative experimental
design in TBLT research and adopting a more exploratory data-driven corpus design, this study examined findings of L2 production along the continuum of task complexity across three tasks of the same task type, and find out how the oral lexical and syntactic sub-systems adapt to the micro contextual changes through the self-adaptation mechanism. To situate the multidimensionality of linguistic complexity possibly affected by task complexity in this study, I have chosen lexical and syntactic measures at different levels, which are instrumental in furthering the understanding of task complexity effects on learner language production. All these methodological considerations show that the data-driven synergy of large learner corpora, task-based language teaching research, and natural language analysis tools can provide feasible and practical methodological advice on investigating interlanguage performance especially within the TBLT paradigm.

From a theoretical perspective, findings in this study may greatly complement previous studies on testing the predictions from the Cognition Hypothesis. The Cognition Hypothesis claims that pedagogical tasks should be sequenced in an order of increasing task complexity (Robinson, 2005), and that in particular, when cognitive task demands are increased along the resource-directing dimension, learners’ increasing effort in conceptualization promotes more structurally and lexically complex and accurate oral language production (Robinson, Cadierno, & Shirai, 2009). The nonlinearity and disproportionate development of trajectories of lexical and syntactic measures under changing contextual situations further underscore the necessity of adopting a complex and dynamic viewpoint towards the effects of task complexity on L2 learners’ interlanguage performance. Instead of merely testing the task-based predictions from the cognitive-psycholinguistic models, it is important to research the mechanism beneath the changes of interlanguage performance under different task contexts, and the new theoretical perspective of Complex Dynamic Systems Theory (CDST) may indeed play an important complementary role in furthering previous research (Michel, 2013). Furthermore, the interactions whether between lexical measures or between syntactic measures have also demonstrated the complex, dynamic property of the interlanguage system, and the dynamic and disproportionate interconnectedness of the multiple components within the interlanguage system revealed from the oral texts. In this sense, the CDST perspective adopted in the present study has the potential to complement task-based research traditionally situated in a cognitive-psycholinguistic paradigm.

This corpus-based study also has some pedagogical implications especially for oral task-based language teaching. The manipulations of task complexity are important factors in task sequencing and syllabus design in oral curriculum. Through the data analyses on changes of oral lexical and syntactic measures and their within-and-between interrelations along with dynamic micro-contextual changes, it may be figured out that the design and manipulation of oral tasks should be closely connected to the changing trajectories of different dimensions of learners’ oral performance. In other words, the oral tasks should not be made based on the one-size-fits-all principle; rather, teachers may design oral tasks in consideration of different types of students’ oral features so as to help learners promote their oral performance more effectively. As in longitudinal development, learners’ linguistic performance under different tasks may show nonlinear trajectories, which may need more specific adjustments of task designs based on curricular goals. In this sense, a complex, dynamic and adaptive perspective should also be taken in the designing and sequencing of pedagogical oral tasks, as argued by Robinson (2010), so as to make better adaptations to the changing learners’ oral linguistic features in their interlanguage performance and development. Additionally, in terms of assessing L2 learners’ task-based oral interlanguage production, the complex and dynamic features in their performance should be fully considered. Even though the micro task contexts can be changing and diverse, the developmental trajectories of learners’ oral linguistic features may be recorded to help their future oral development. To be more specific, assessing learners’ oral performance should include different linguistic measures under different tasks, make comparisons between different task contexts in terms of their
multidimensional oral performance, and then provide more targeted feedbacks for learners to improve their own oral performance.

References


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