

Second language writing development from a Dynamic Systems Theory perspective

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Abstract

This study investigated how the lexical and syntactic features of two Hungarian advanced English as a Foreign Language (EFL) learners' writing evolved over a period of four months from a dynamic systems theory (DST) perspective. The participants provided data in the form of written essays which were analysed computationally by software packages (Coh-Metrix 2.0, Coh-Metrix 3.0 and Synlex L2 Complexity Analyzer). It was found that both lexical and syntactic indices showed interindividual and intraindividual variability. The log frequency for content words index showed a gradual decline which suggests that both participants started to use less frequent lexical items in their writing. When measure of textual lexical diversity (MTLD) was plotted against mean length of T-unit (MLTU) and MTLD against dependent clause per T-unit (DC/T), it was found that both participants concentrated on lexical complexity rather than on syntactic complexity which was also confirmed by the interview data. The largest rate change occurred for coordinate phrases per T-unit (CP/T) for both participants.

Keywords: *dynamic systems theory, second language writing writing development, syntactic and lexical complexity*

1. Introduction

Second language (L2) writing development has been investigated from various perspectives: dynamic systems theory (Verspoor & Smiskova, 2012), sociocultural theories of language learning (Wigglesworth & Storch, 2012), theories of multicompetence in language learning studies (Kobayashi & Rinnert, 2012), goal theories in education and psychology (Cumming, 2012), genre theories in second language writing research (Tardy, 2012), and systemic functional linguistics (Byrnes, 2012). However, Cumming (2010) points out that “no single theory might ever explain such complex phenomena as second language writing, which necessarily involves the full range of psychological, cultural, linguistic, political, and educational variables in which humans engage” (p. 19). Manchón (2012) argues that the same applies to the development of second language (L2) writing capacities since it is “intrinsically a multifaceted phenomenon that is mediated by a wide range of varied personal and situational variables” (p. 5).

Second language writing development, as with any development, is about change. Therefore, the obvious methodological design is longitudinal in nature (Ortega & Byrnes, 2008). Previous studies on second language writing have mainly employed cross-sectional designs (e.g., Boshier, 1998; Manchón, Roca de Larios & Murphy, 1998, 2000a, 2000b; Roca de Larios, 1996, 1999; Sasaki, 2000) which did not allow for the investigation of the changes in the development of individuals’ second language writing. Cross-sectional studies used pretest-posttest designs which may not have been able to demonstrate development in writers’ performance. In contrast, a longitudinal multi-wave research design (e.g., Berman, 1994; Sasaki, 2004), comparing written samples at more than two points in time, might be able to capture development.

Previous studies on L2 writing development have employed three different types of methods: (1) *quantitative* (e.g., Roca de Larios, Murphy & Manchón, 1999), (2) *qualitative* (e.g., Armengol-Castells, 2001; Cumming, Busch & Zhou, 2002), and (3) *mixed methods* designs (e.g., Cumming, 1989; Sasaki, 2002) to study L2 writing development. However, Norris and Manchón (2012) point out that the triangulation of data sources and analyses – using teacher and student interviews, classroom observations, and writing product analyses – may result in richer and more trustworthy interpretations. This study employed a mixed methods design triangulating the qualitative (semi-structured interviews) and quantitative findings (lexical and syntactic indices).

2. Theoretical underpinnings

In this section, the theoretical framework of this study is outlined: dynamic systems theory. In addition, recent views on lexical and syntactic complexity are reviewed.

2.1 Dynamic systems theory

Dynamic Systems Theory (DST), originally used to describe the behaviour of complex dynamical systems in applied mathematics, has been applied to several disciplines such as physics, biology and more recently to social sciences. In 1997 Larsen-Freeman published her oft-cited and pioneer work entitled *Chaos/Complexity Science and Second Language Acquisition* which made her the first researcher to study second language acquisition from a DST perspective. Larsen-Freeman (1997) characterised dynamic systems as “dynamic, complex, nonlinear, chaotic, unpredictable, sensitive to initial conditions, open, self-organizing, feedback sensitive, and adaptive” (p. 142).

One fundamental change in SLA terminology made by pro-DST applied linguists was to newly define the term *second language acquisition*. Long (1993) gives the following broad definition of an SLA theory:

SLA theory encompasses the simultaneous and sequential acquisition and loss of second, third, fourth, etc. languages and dialects by children and adults learning naturalistically or with the aid of instruction, as individuals or in groups, in second or foreign language settings (p. 225).

De Bot and Larsen-Freeman (2011) broaden Long's definition even further by moving from *acquisition* to *development* and from *development* to *use*. They give the following definition: "a theory of SLD describes and ultimately explains the development and use of more than one language in individuals" (p. 6). The word *development* instead of *acquisition* in the definition refers to the fact that linguistic skills can grow and decline. In other words, language acquisition and attrition are equally possible outcomes of developmental processes. Moreover, *acquisition* suggests that at one point language is acquired, while *development* supports the belief that this process is ongoing.

Chaos theory studies the behaviour of dynamic systems which are highly sensitive to initial conditions. A small change at one point in a nonlinear system can result in large differences to a later stage. De Bot and Larsen-Freeman (2011) point out that in second language development "minimal differences between learners, even when they go through similar learning experiences, lead to very different learning outcomes" (p. 10). They simplify this statement by claiming that "similar teaching approaches do not necessarily lead to similar learning" (p. 10).

Every element is connected to other elements in a dynamic system. Obviously, a change in one system will have an effect on the other systems. For example, a change in the

learner's lexical system can affect the learner's phonological system. When learners acquire a new word (e.g. *born*) they have to learn its pronunciation (/bɔ:n/) as well. Moreover, learners have to acquire its grammatical use (mainly in the passive) i.e. the acquisition of a new word also has an effect on the syntactical system.

Interaction with the environment and internal reorganisation result in a change in systems. An example of this feature in second language development is when language learners acquire a new word, usually a synonym (e.g. *gulp*, *sip* etc.) for a previously learnt more frequent word (e.g. *to drink*). In this case, the lexical system will reorganise itself by making differences between types of drinking (*sip*, *drink*, *gulp*).

In summary, DST is an ideal framework to study second language writing development. First, second language development is nonlinear in nature (Larsen-Freeman, 1997). Therefore, a two-wave (pretest-posttest) research design cannot plot individual growth trajectory. Instead, a multi-wave research design has to be adopted. Second, language systems (syntactic, lexical, phonologic, etc.) are interconnected. Thus, measuring only one of the language systems is not adequate to trace development. Instead, the investigation of more systems is necessary. Third, language development is dependent on initial conditions. Therefore, we need to collect as many different types of data as possible at the start of the study and during the investigation in order to discover how second language development took place.

2.2 Lexical complexity

Lexical complexity generally refers to lexical variability and lexical sophistication. The most reliable lexical variability measure to date is the measure of textual lexical diversity (MTLD) developed by McCarthy (2005) and validated by McCarthy and Jarvis (2010). MTLD is calculated as the mean length of sequential word strings in a text that are above a

certain threshold (0.72). MTLTD calculates the type-token ratios (TTR) until the TTR falls to 0.72, when the first factor is produced. The counting of the TTRs is restarted. The final MTLTD value is calculated by dividing the total number of words by the total number of factors. The calculation does not discard remaining data so a partial factor for remainders of the data is calculated. The programme runs forward and backward and the final MTLTD value is obtained.

Lexical sophistication or lexical frequency profile might be indicative of a learner's vocabulary knowledge (e.g., Laufer & Nation, 1995). Lexical sophistication refers to the use of less frequent words in a text. Jarvis (2013) suggests assessing the overall commonness of the words in relation to the frequencies of those words found in large corpora such as the British National Corpus (BNC) or the American National Corpus (ANC). The most straightforward approach to measure lexical sophistication is to identify each word in the text with its rank in the corpus. The mean rank for all words would produce the lexical sophistication index. Another way to calculate lexical sophistication would be to convert rank orders to frequency bands (Laufer & Nation, 1995).

2.3 Syntactic complexity

Most studies on writing development have utilised quantitative measurements such as average length of structural units or the extent of clausal subordination. Researchers assumed that longer units and more subordination reflect greater complexity. A large percentage of these studies has relied on the construct of T-unit: "one main clause with all subordinate clauses attached to it" (Hunt, 1965, p. 20). The two most frequently used measures have been the mean length of T-unit (MLTU) (e.g., Larsen-Freeman, 1978, 1983; Ishikawa, 1995, Henry, 1996), which is the average across all T-units in a text, and clauses per T-unit (C/TU)

(e.g., Flahive & Snow, 1980; Bardovi-Harlig & Bofman, 1989; Hirano, 1991), which is the number of dependent clauses per T-unit.

The dependence on T-unit-based measures and clausal subordination was demonstrated in a review of literature by Wolfe-Quintero, Inagaki, and Kim (1998). Their extensive synthesis confirms that clauses per T-unit and dependent clause per independent clause have been the best complexity measures so far (pp. 118-119). The conclusion in the synthesis by Wolfe-Quintero et al. (1998) has made a huge impact on the studies of L2 writing development since its publication. Studies in the 2000s have relied heavily on T-unit-based measurements (e.g., Brown, Iwashita, & McNamara, 2005; Ellis & Yuan, 2004; Larsen-Freeman, 2006; Nelson & Van Meter, 2007) and subordinate clause ratios (e.g., Brown et al., 2005; Li, 2000; Norrby & Håkansson, 2007). In addition, Ortega (2003) confirms the heavy reliance on these two types of measurements in her survey of 27 studies. She found that 25 studies employed MLTU, while 11 studies relied on C/TU to measure grammatical complexity in college-level ESL and EFL writing. Other measures included were mean length of clause (MLC), mean length of sentence (MLS), T-unit per sentence (TU/S), dependent clause per clause (DC/C), dependent clause per T-unit (DC/TU), and clause per T-unit (C-TU).

The heavy reliance on T-unit-based and dependent clause measurements has received some criticism. For example, Bardovi-Harlig (1992) claims that “in evaluating the syntactic complexity of compositions written by advanced adult second language learners, T-unit analysis does not seem to reflect accurately the knowledge of the learner” (p. 391). The employment of these two measurements was also found problematic by several researchers in the 2000s (Rimmer, 2006, 2008; Ravid, 2005; Ravid & Berman, 2010; Norris & Ortega, 2009).

3. Methodology

This longitudinal case study investigated two Hungarian EFL learners' second language writing development – specifically the development of lexical and syntactic devices – by adopting the dynamic systems theory.

3.1 Research questions

This study answered the following two research questions.

1. Did the writers' performance evolve in terms of lexical complexity over a four-month period?
2. Did the writers' performance evolve in terms of syntactic complexity over a four-month period?

3.2 Research context

The present study was carried out in a private language school in Budapest, Hungary. This private institution offers language courses from A1 to C1 CEFR levels in four different languages (English, German, Italian and Spanish). At the school two different language exams approved by the Hungarian state can be taken. These are the language exam of the Budapest University of Technology and Economics and The European Language Certificates (TELC). The language institution offers courses which are specifically designed to prepare students for these two different language exams.

3.3 Participants

Two Hungarian EFL learners who were studying at the above-mentioned private language school participated in the study. The participants had to pass a successful language

exam at B2 CEFR level in order to be eligible to enroll for the course offered by the language school. The participants took part in 90-minute lessons twice a week from October 2012 to June 2013. The participants were the only students in the class and the course objectives were to develop students' four basic language skills i.e. writing, speaking, listening and reading skills. It is important to note that no one of the skills was emphasised more than the other during the course.

The first participant in the study, Augustine (a pseudonym), is a native speaker of Hungarian, aged 19. He took an English language exam at B2 CEFR level in 2012. Augustine started his university studies in 2012 at a university in Hungary. He has been learning English for more than 12 years. According to him, he has difficulty with grammar because he keeps forgetting the correct uses of tenses. He spent two weeks in London where he took part in a language course.

The second participant in the study, Andrew (a pseudonym), is also a native speaker of Hungarian, aged 18. He took a successful English language exam at B2 CEFR level in 2012. He has been studying English for more than ten years. He pointed out that his spoken English is worse than his writing. He spent one week in England with his family in 2009 and another week with his classmates in 2011. Table 1. shows a summary of the participants' profile.

Table 1.

Participants' Profile

	Augustine	Andrew
Gender	Male	Male
Age	19	18
L1 background	Hungarian	Hungarian
L2 learning Length of learning English	12 years	10 years

experience	Length of staying in an English-speaking country	2 weeks	2 weeks
Level of English language proficiency		B2 CEFR	B2 CEFR

3.4 Instruments

Data for the research came from multiple sources and was collected by diverse methods. The primary data for the present study were participants' written argumentative compositions which were collected at 4 points (T1, T2, T3, and T4) over the 4-month period. I used four IELTS-type writing prompts (See Appendix 1.) which were taken from the IELTS Testbuilder (McCarter & Ash, 2003). The secondary data were the participants' responses during in-depth semi-structured interviews collected at two points (T2 and T4) over the 4-month period. The aim of the interviews was to find out more information about the participants' opinions, problems and difficulties in connection with second language learning, focusing especially on writing. I also wanted to find out how the participants form syntactic structures and how they choose a particular word to use. The secondary data served for triangulation purposes when commenting on the primary data.

3.5 Data collection procedure

The writing prompts were emailed directly to the participants so they could spend a week writing the essays. The request was to write four 250-word essays at four points in time responding to the given writing prompt. The participants could use dictionaries and spellchecker programs to help their writing. The dates of the interviews were chosen at the first meeting with the participants on 25th February in 2013. The two interviews were held at the school on 15th April and on 10th June. The interviews were semi-structured in order to allow flexibility and create a pleasant and relaxed atmosphere. The interviews lasted for 10-15

minutes in the participants' target language (English). However, I asked the participants to choose the language they felt more comfortable with in order to elicit as much information as possible.

Table 2.

The Time Frame of the Writing Prompts and Interviews

T1	March	Writing prompt 1	
T2	April	Writing prompt 2	Interview 1
T3	May	Writing prompt 3	
T4	June	Writing prompt 4	Interview 2

3.6 Measures of written performance

A comprehensive range of measures was selected to evaluate the syntactic features of students' writing (See Table 3.). The length of production unit was measured by the mean length of T-unit (MLTU). Sentence complexity was gauged by the Sentence complexity ratio (C/S). Subordination was measured by dependent clause per T-unit (DC/T). Coordination was measured by coordinate phrases per T-unit (CP/T). In addition, the complex nominals per T-unit (CN/T) index was also calculated. These measures were computed by Synlex L2 Syntactic Complexity Analyzer (Lu, 2010).

To measure lexical variability I adopted the measure of textual lexical diversity (MTLD), found to be the least affected by text length (Jarvis, 2012; McCarthy, 2005). MTLD was computed by Coh-Metrix 3.0 (Graesser, McNamara, & Kulikowich, 2011). Lexical sophistication was measured by log frequency of content words estimated by Coh-Metrix 2.0

(Graesser, McNamara, Louwse & Cai, 2004) and based on the CELEX lexical database corpus.

Table 3.

Summary of the measures used in the study

Lexical Indices	Lexical variability	Measure of Textual Lexical Diversity (MTLD)
	Lexical sophistication	Log frequency of content words
Syntactic Indices	Length of production unit	Mean length of T-unit (MLTU)
	Sentence complexity	Sentence complexity ratio (C/S)
	Subordination	Dependent clauses per T-unit (DC/T)
	Coordination	Coordinate phrases per T-unit (CP/T)
	Particular structures	Complex nominals per T-unit (CN/T)

3.7 Data analysis

I had to deal with both macro- and micro-level perspectives. At the macro-level, quantitative measures were used to explore how the system changes and organises over time. At the micro-level, the participants' performance was examined from a qualitative standpoint.

Numerous software packages were used to analyse the syntactic and lexical features of the written argumentative compositions. These packages were Coh-Metrix 2.0 (Graesser et al., 2004) and Coh-Metrix 3.0 (Graesser et al., 2004; Graesser et al., 2011) and Synlex L2 Syntactic Complexity Analyzer (Lu, 2010).

4 Results

The different trajectories in Figure 1 clearly reflect the interindividual variability. Some individual performances show regression, progress, and others remain unchanged over time.

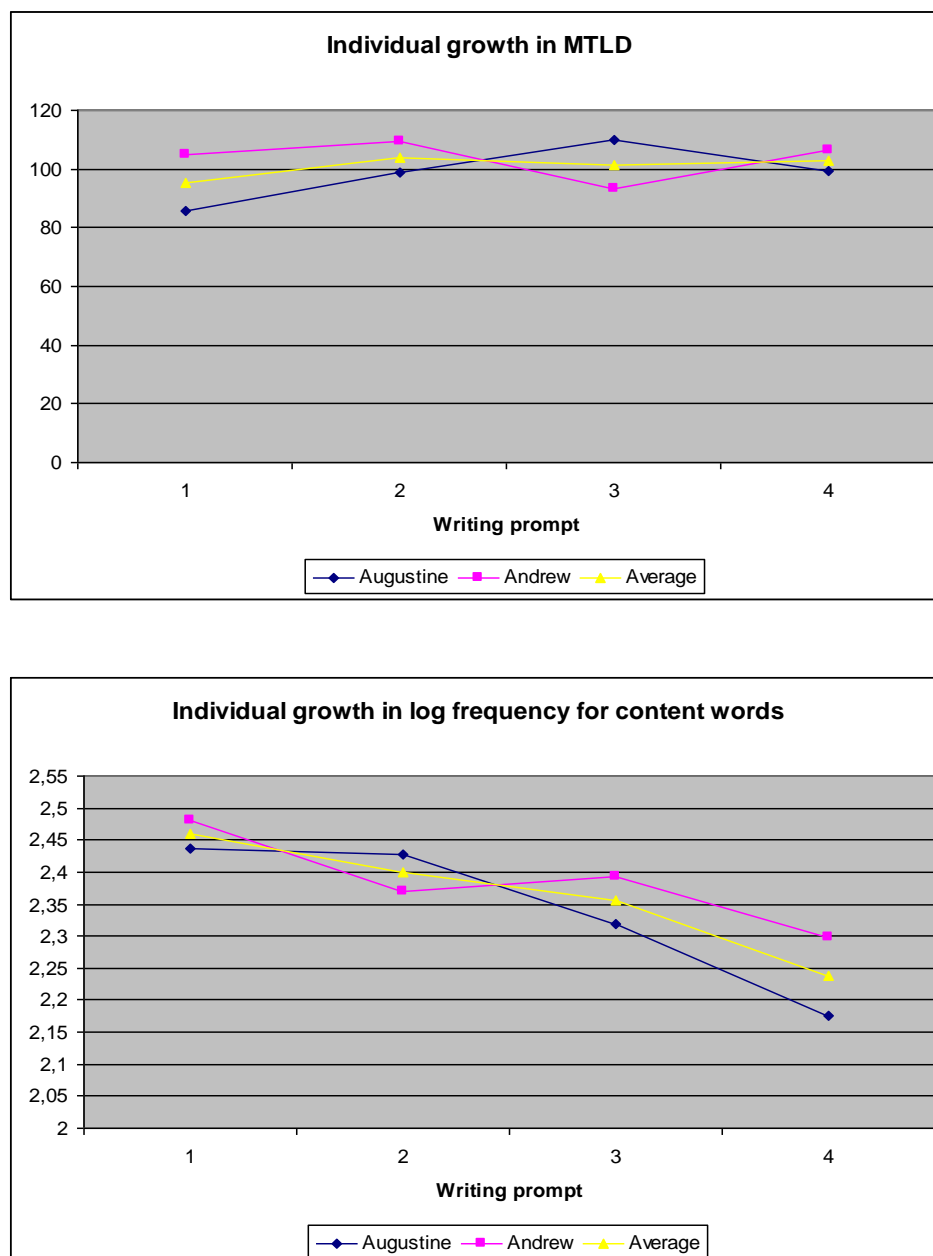


Figure 1. Interindividual variation over time on all indices

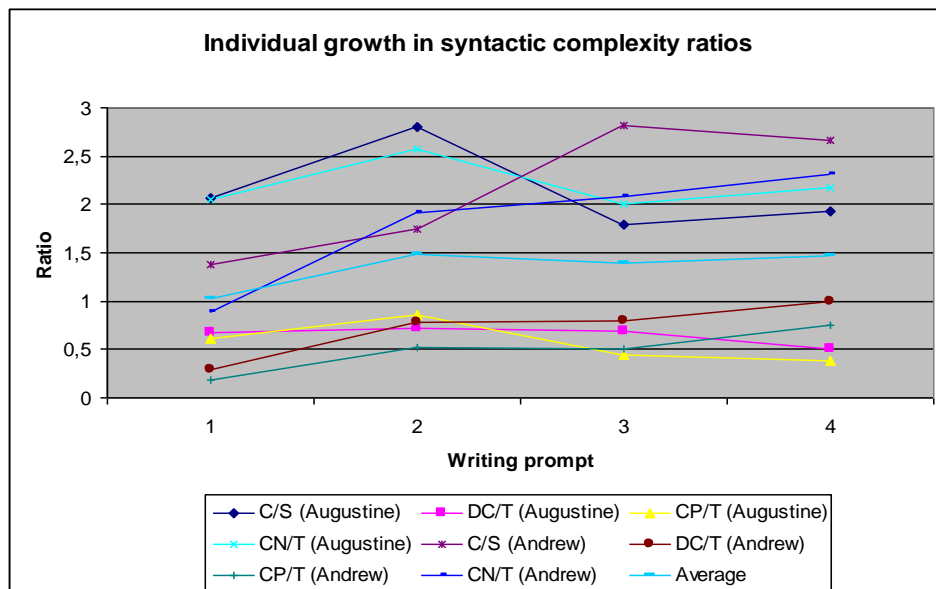
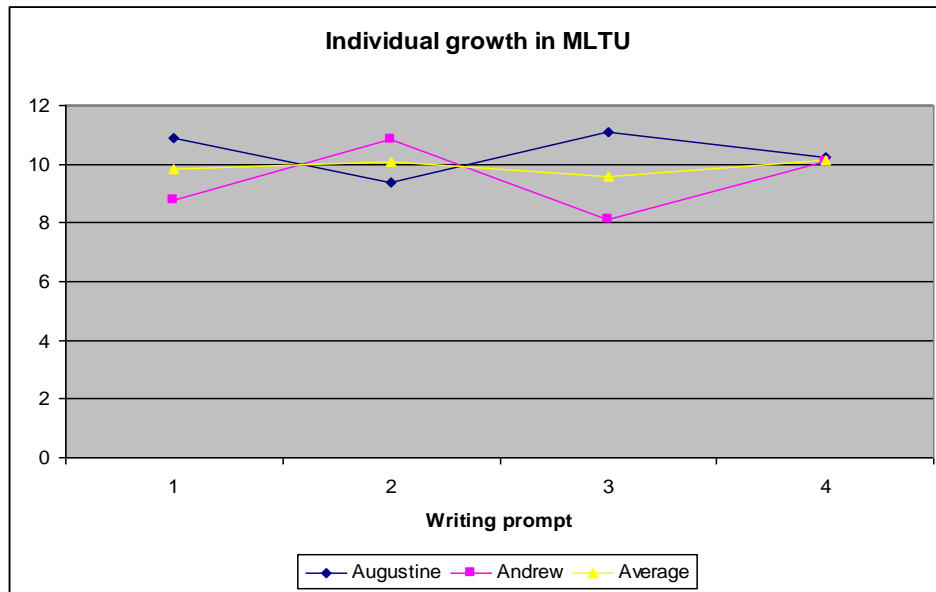


Figure 1. Continued

Whereas intraindividual variability was considered as a form of measurement error in traditional SLA analysis, from a dynamic systems approach, intraindividual variability is a fundamental source of information about the developmental process (van Geert & Steenbeek, 2005). The data were collected from another vantage point to highlight the intraindividual differences at differing data collection points. Figure 2. shows both participants' performance over time. The performance measures were transformed to z-scores in order to make the

comparability possible across the two indices of lexical complexity (MTLD, FREQ) and the five indices of syntactic complexity (MLTU, C/S, DC/T, CP/T, CN/T). Individual differences might be obscured by averaged data but averaged data within the individual might provide a true description of the behaviour of the individual (Sidman, 1960).

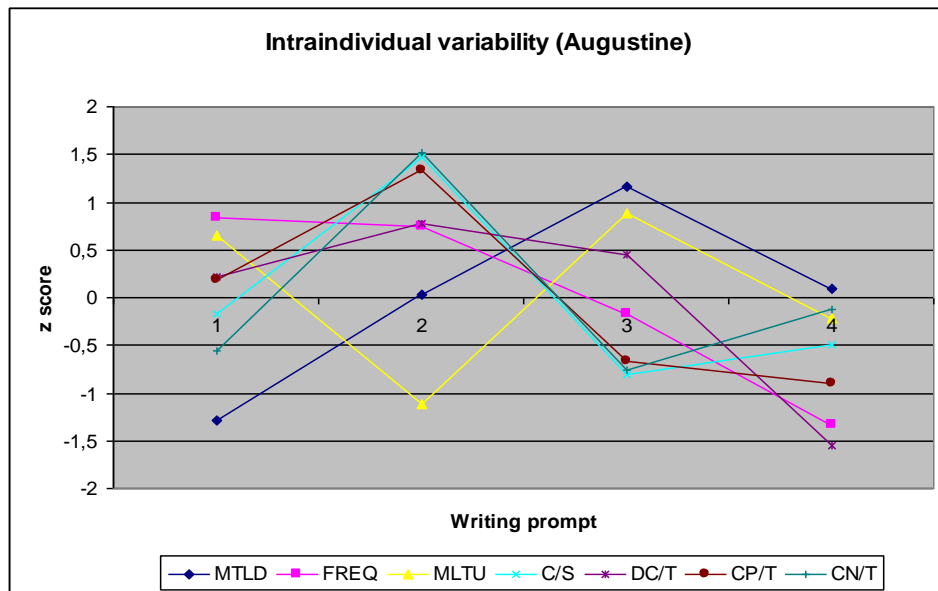
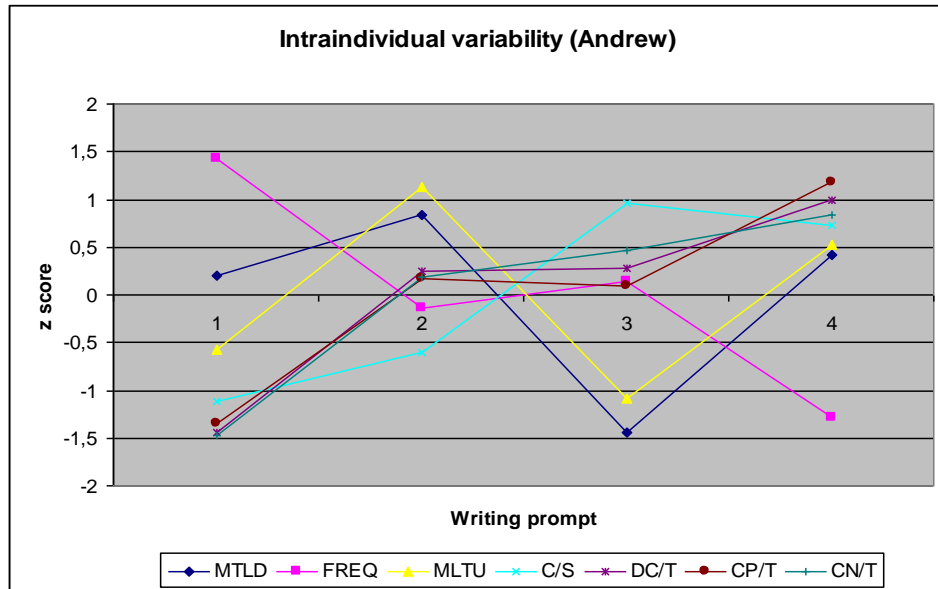


Figure 2. Intraindividual variation over time for both participants on all indices

While Figure 2. shows that there is intraindividual variability from one time to the next, Figure 3. demonstrates the identifications of attractors or preferred paths within

individual performances. The performance of both participants was mapped on two of the indices. When MTLT is plotted against MLTU and MTLT is plotted against DC/T (Figure 3.), it is clear that both participants have focused on lexical complexity rather than on syntactic complexity.

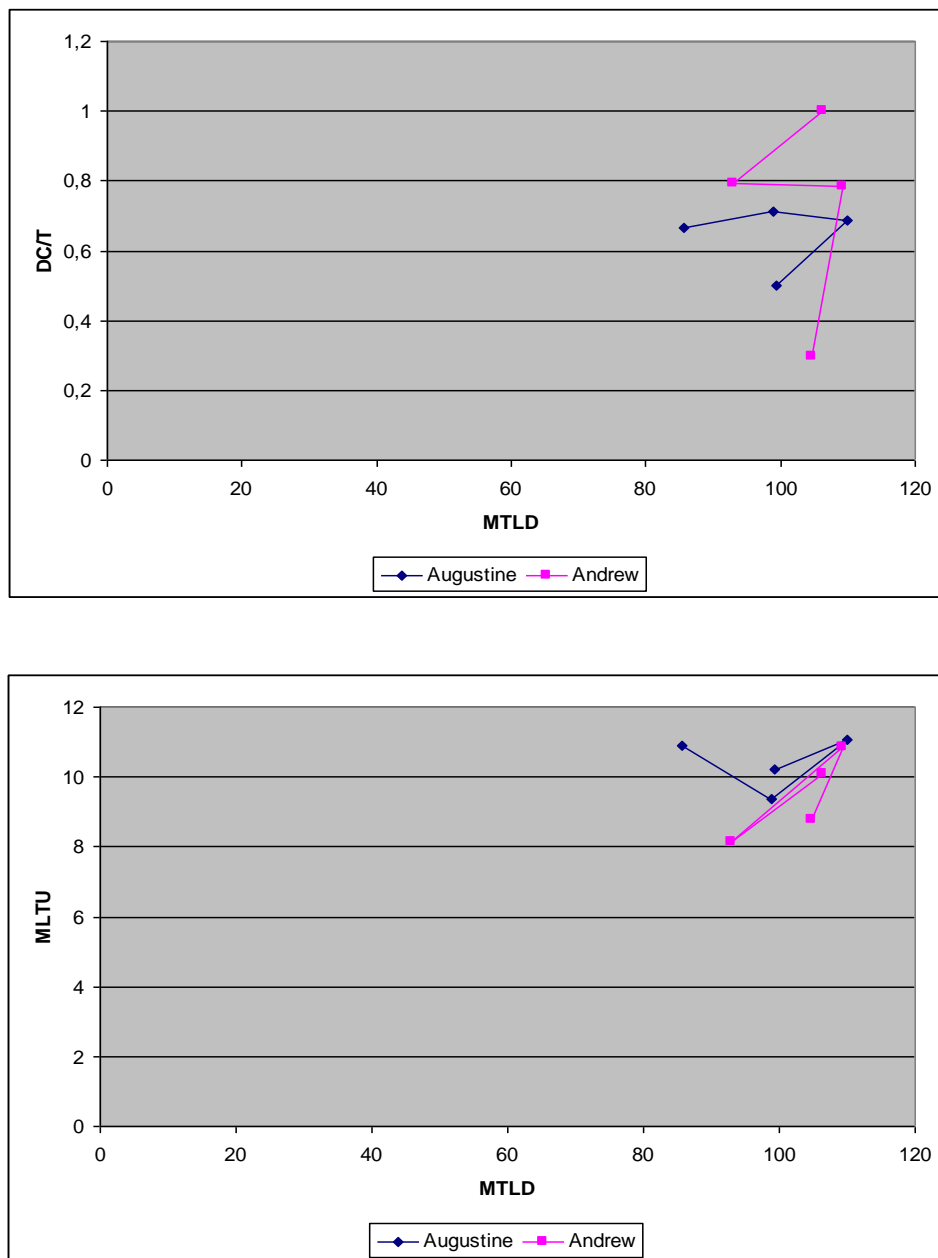


Figure 3. Change of MLTU compared with MTLT and the change of DC/T compared with MTLT for both participants

Since this is an exploratory study, techniques from L1 research were borrowed to display the same data from other perspectives. The rate of change over time was calculated

and this proved to be useful from a dynamic systems approach (e.g., Larsen-Freeman, 2006). The rate of change was calculated by setting the first data collection point (i.e. Writing prompt 1) as the baseline, with a value of 0. The rate of change is calculated by taking the difference between the next point of data collection (i.e. Writing prompt 2) and the previous point and dividing it by the previous data point. For example, as can be seen in Figure 1. Augustine's MTLD score at the first data collection point is 85.74. At the second data collection point, the score is 98.86, so the rate of change is $(98.86-85.74)/85.74 = 0.15$, which is plotted as the second data point in the graph, that is for Writing prompt 2. The results can be seen in Figure 4.

The rate of change fluctuates for both participants at different times. Figure 4. also reveals that the largest rate change occurs for CP/T for both participants. However, DC/T and CN/T also demonstrate a large rate of change in Andrew's graph at the second data collection point (Writing prompt 2).

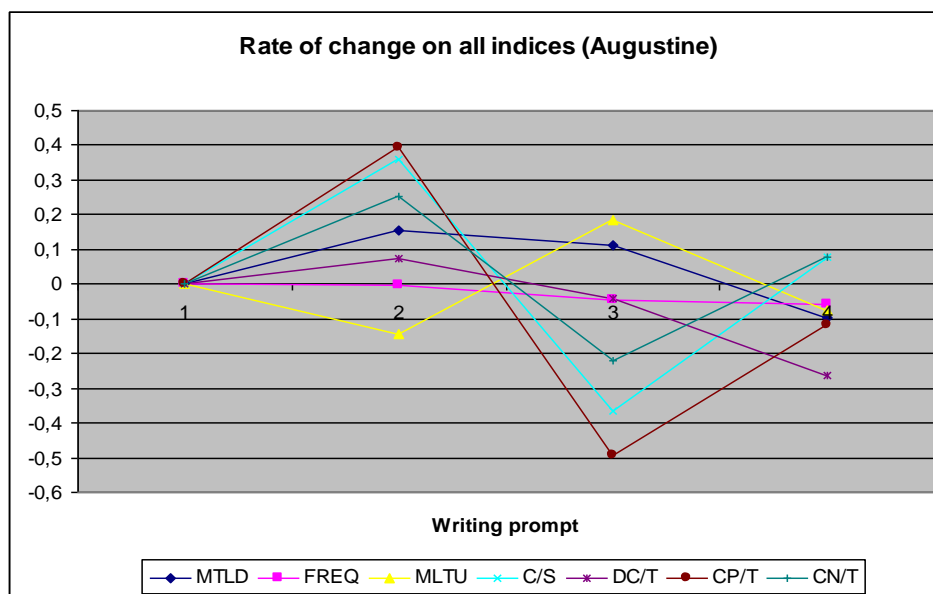


Figure 4. Rate of change on all indices for both participants over time

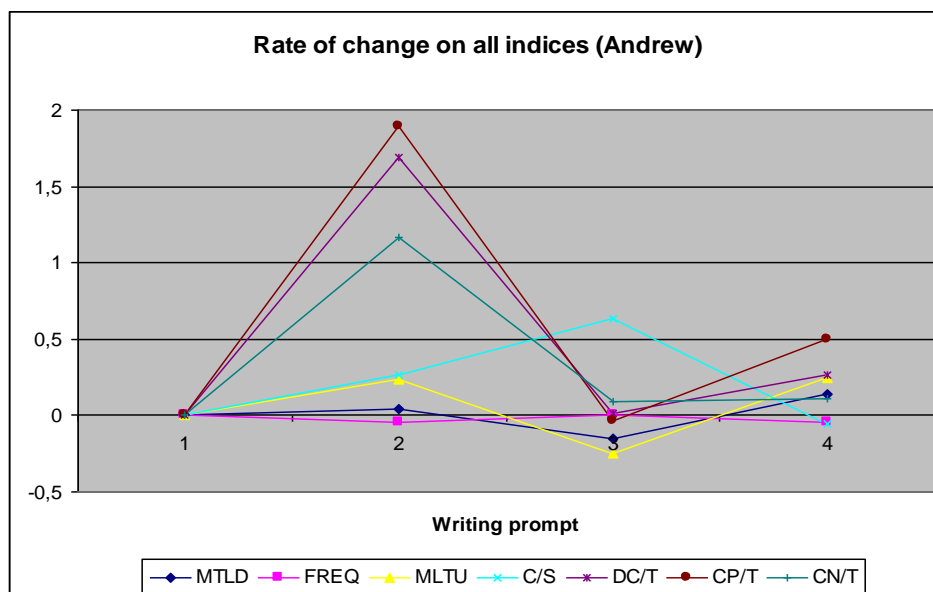


Figure 4. Continue

Both participants were interviewed twice at T2 and at T4. Before the interviews, a Lexical and Syntactic Complexity Profile (LSCP) was created which served as a stimulus during the interviews. Certain lexical items, which were deemed interesting, were highlighted, specifically less frequent words. Longer and more syntactically complex sentences were highlighted to explore the composing strategies the participants employed during the writing process.

The first set of data comes from Augustine, a 19-year-old Hungarian writer who has been learning English for 12 years. Table 4. contains lexical items and the original sentence structures taken from Augustine's written data. It was revealed that lexical items such as *exaggeration*, *emphasis*, *disregard*, *off the beaten track* were learnt from the coursebook he used during the course at the language school, while lexical items such as *ponder*, *cease*, *zealous* were taken from the online thesaurus. Table 4. also shows sentences taken from Augustine's texts. It was found that Augustine first thought about the sentences in his mother tongue and then he translated them into English. Therefore, his longer sentence structures seem unnatural to an English reader.

Table 4.

Augustine's Lexical and Syntactic Complexity Profile

Writing prompt	Lexical complexity	Syntactic complexity
1.	reckon exaggeration excessively ponder	Nowadays, a lot of people question whether computers are indispensable or hindrance. Moreover, youngsters are really keen on sitting in front of their computers and chatting with friends but this aspect easily can be a problem if teenagers hanging on the computer for long hours, especially instead of learning.
2.	benefits or perks gratitude money emphasis crucial problem re-evaluate declination cease	It is a really common problem all around the world and in Hungary as well. In my view it is not a good solution that doctors get some bonus as a 'gratitude money', since other human beings get other benefits or perks, in addition they are usually provided fringe benefits, such as company company car, company computer or shopping coupons.
3.	deliberately intervene intimate proportion disregard deterrent zealous neutral	It is indispensable finding a balanced way of it. The main drawback is that many journalists are curious about the most intimate facts and moments of famous people and for the most part they do not respect human rights and write outrageous things and stories about stars, such as musicians, footballers.
4.	adolescent detrimental off the beaten track refrain	Third, the effects of drug abuse are well known. As a conclusion, the only reasonable way to solve this global issue to bring child up according to decent and acceptable habits, which would give a hand for them to acquire a good attitude, included not to prone to drugs, alcohol and other harmful habits.

The interview data collected from Augustine explained the stabilization in the MTLTD and MLTU curves. Augustine understood the importance and the benefits of the writing

tasks. He was a motivated learner from the beginning. Therefore, he invested time and energy in the exercise. The excerpts from the interviews prove these findings:

Excerpt 1: 15 April (Augustine)

I found the writing exercise really useful since I wanted to take a C1 level language exam in the summer. I think by writing these essays I can really improve my writing skills. I used an online thesaurus to vary my vocabulary. I also wanted to learn new words and I thought using an online thesaurus would be really helpful.

Excerpt 2: 10 June (Augustine)

I mainly focused on grammar and vocabulary. The writing prompts weren't always easy. In some cases, I had to wait for minutes to be able to write anything. It can be really stressful at exams.

The second set of data comes from Andrew, an 18-year-old Hungarian writer who has been learning English for 10 years. Table 5. shows Andrew's lexical and syntactic complexity profile. It was found that the lexical items *indispensable*, *garble*, *drastic measures*, *exaggerate* were acquired from the coursebook he used during the language course. Lexical items such as *aggregate*, *flagrant* and *albeit* were taken from an online monolingual dictionary, while the lexical item *uprising* was learnt from his teacher from his secondary school when they were told to talk about the Hungarian Uprising of 1956. Table 5. clearly demonstrates that Andrew improved his vocabulary over the four months because he started using less frequent lexical items in Writing prompt 3 and 4. This finding is confirmed by the quantitative measurements in Figure 4 (Log frequency for content words) where the declining curve shows that Andrew started to use less frequent lexical items. As far as

Andrew's syntactic complexity development is concerned, his longer sentence structures seem unnatural and in some cases (Writing prompt 2, 3, and 4) are incorrect in English. The interviews revealed that first he thought about the sentence structures in Hungarian and then he translated them into the target language.

Table 5.

Andrew's Lexical and Syntactic Complexity Profile

Writing prompt	Lexical complexity	Syntactic complexity
1.	investment indispensable engagement aggregate ignore	This investment simplified our lives. I think in the past like in the 18 th or 19 th century everyone was patient because they had to be that.
2.	garble undervalue extinguish reverence drastic measures uprising claim	Everyone likes music or movies or sport. Nowadays without any doubt, we can't live without doctors or nurses because for instance when we got ill or something disease no one knows better what medicines are essential or solution for our problems or when something very serious accident happens with ourselves there is no other way to be healthy again than a doctor save and expert treatment.
3.	disrespectful disturbance dismissive disregard notorious exaggerate sensationalist flagrant hindrance	They are must get used to being chased. Here it is a good example to confirm this statement: one of the members of the former band called Beatles mentioned that he has never known when he had the chance for to rub his ass because wherever he wanted to go at least a camera pursued him.
4.	albeit evolve compulsory anxiety abandon tremble endurance	Furthermore it takes the lead over their life. It means that the exaggerated amount of obligations that this generation get from their education or the compulsory work from their home might cross their endurance line and if they can't get rid of the feeling of being under pressure it provides them to try drugs.

The interview data explained the large rate of change (DC/T and CN/T) in Andrew's graph (Figure 4.) at the second data collection point (Writing prompt 2).

Excerpt 3: 15 April (Andrew)

When I had to submit the first essay, I felt it like a burden. I had many different tasks to do at school. Although I liked going to private English classes, I didn't want to do more exercises for extra classes, for example writing essays.

Excerpt 4: 10 June (Andrew)

When composing the third and the fourth essays I paid more attention to it. I took it more seriously. Augustine told me that these tasks could improve our writing. I realised that I might learn how to write essays in English which would be very useful at the language exam.

The qualitative data reveals that Andrew focused more on writing at the end of the study. He paid more attention to the composing processes.

To summarize, the DST approach revealed both interindividual and intraindividual variability over the four months. It was found that both lexical and syntactic indices showed variability. The log frequency for content words index showed a gradual decline which suggests that both participants started to use less frequent lexis in their writing. When MTLT was plotted against MLTU and MTLT against DC/T, it was found that both participants concentrated on lexical complexity rather than on syntactic complexity. The rate of change on all indices was larger in Andrew's text than in Augustine's.

5 Discussion

The goal of this study was to gain insight into the dynamic process of L2 writing development. The results are in line with the main features of the DST outlined in the previously.

I found stabilization when I averaged the progress of the two participants (Figure 1.) over the four-month-period. However, when I looked at the same data points for individuals, it was found that the lines were not stabilized at all. The lines sometimes went up and sometimes they went down. The graphs (Figure 1.) clearly show that the participants in this study followed different routes in SLA. Traditionally, such variability was considered as a form of measurement error in SLA. However, from a DST approach, variability is an essential source of information about the underlying developmental process. Although there is variability from one time to the next, attractors or preferred paths can also be identified within individual performances. When MTLD was plotted against DC/T, it appears that both participants worked on vocabulary at the expense of syntactic complexity (Figure 3.). This finding was confirmed by the interviews which revealed that participants focused more on vocabulary. In SLA, variability was explained by external sources. However, from a DST perspective a degree of variability cannot be explained by the effects of the external factors since some variability is an intrinsic and central characteristic of a self-organizing, dynamic system. The amount of variability constantly changes and that progress and regression follow each other, demonstrating nonlinear patterns of development.

The rate of change calculations shows that the system develops from an initial state and goes through iterations on the basis of available resources. As a consequence, there is no development without variability. The amount and type of variability can explain whether development took place or not. Therefore, it is essential to look at intraindividual variability

since it reveals the developmental dynamics which were ignored traditionally in SLA. The results show that even for an advanced learner, Augustine, the system can be far from stable. Although, a general increase over time is apparent for the index log frequency for content words, the development of all indices is nonlinear, showing moments of progress and regression.

6 Conclusion

This study investigated how two EFL Hungarian students' second language writing evolved over four months. It was found that both participants focused on vocabulary rather than on syntax. The DST perspective facilitated the interpretation of the interindividual and intraindividual variation over time. The multi-wave research design facilitated to investigate the changes in the syntactic and lexical systems of the participants. In addition, the mixed methods design facilitated the explanation of how the syntactic and lexical systems evolve over time.

In SLA it is quite frequent to compare macro-level group averages at different points in time. If reliable differences are found in mean levels of performance SLA researchers tend to conclude that development has occurred. The micro-level description of the individual's development is rarely addressed. In this study the graphs show that it is essential to ask if individual participants follow the same developmental pathways.

However, there are several limitations of this study. First, the four different writing prompts used in this study elicited different lexis which makes comparison difficult. Therefore, in future studies the writing prompts should be more carefully selected to control for the confounding effect of task characteristics. It is fundamental that the topic of the essays is controlled for because the topic might influence word choice and lexical measures. Second, in future studies the writing prompts should be written under controlled settings. The use of

dictionaries influences the lexical measures. If writers could not use dictionaries during the writing process, the actual vocabulary knowledge might be revealed. Third, it has to be noted that the syntactic complexity measurements used in this study - especially MTLU, DC/T – were found ineffective to measure the development of syntactic complexity in second language writing (Wolfe-Quintero, 1998; Ortega, 2003). Therefore, more genre-specific measurements are necessary (Biber, Gray, & Poonpon, 2011). For example, future studies should include ratios of conditional clauses, prepositional phrases, relative clauses, infinitive clauses, simple and complex postmodifiers which are characteristic of academic genre (Mazgutova & Kormos, in press). Fourth, lexical complexity cannot be measured by only two indices (MTLD and log frequency for content words) as in this study. Future studies should consider Jarvis's (2013) construct and include other dimensions of lexical diversity in the measurements such as evenness, volume, dispersion, or disparity. In this study only variability and rarity were measured. Finally, this study relied heavily on computational data analysis. Further studies should include human raters to measure syntactic and lexical complexity.

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Appendix

IELTS-type writing prompts

Writing prompt 1.

You should spend about 40 minutes on this task. Present a written argument or case to an educated reader with no specialist knowledge of the following topic:

Some people believe that computers are more a hindrance than a help in today's world. Others feel they are such indispensable tools that they would not be able to live or work without them.

In what ways are computers a hindrance?

What is your opinion?

Use your own ideas, knowledge and experience and support your arguments with examples and with relevant evidence. You should write at least 250 words.

Writing prompt 2.

You should spend about 40 minutes on this task. Present a written argument or case to an educated reader with no specialist knowledge of the following topic:

Some people feel that certain workers like nurses, doctors and teachers are undervalued and should be paid more, especially when other people like film actors or company bosses are paid huge sums of money that are out of proportion to the importance of the work that they do.

How far do you agree?

What criteria should be used to decide how much people are paid?

Use your own ideas, knowledge and experience and support your arguments with examples and with relevant evidence. You should write at least 250 words.

Writing prompt 3.

You should spend about 40 minutes on this task. Write about the following topic:

Many newspapers and magazines feature stories about the private lives of famous people. We know what they eat, where they buy their clothes and who they love. We also often see pictures of them in private situations.

Is it appropriate for a magazine or newspaper to give this kind of private information about people?

Give reasons for your answer. Write at least 250 words.

Writing prompt 4.

You should spend about 40 minutes on this task. Present a written argument or case to an educated reader with no specialist knowledge of the following topic:

People in all modern societies use drugs, but today's youth are experimenting with both legal and illegal drugs, and at an increasingly early age. Some sociologists claim that parents and other members of society often set a bad example.

Discuss the causes and some effects of widespread drug use by young people in modern day society. Make any recommendations you feel are necessary to help fight youth drug abuse.

Use your own ideas, knowledge and experience and support your arguments with examples and with relevant evidence. You should write at least 250 words.