

# **A Corpus-based, Longitudinal Study of Syntactic Complexity, Fluency, Sentence Variety, and Sentence Development in L2 Genre Writing**

Nicholas Wood and Nicolai Struc

## ***Abstract***

*The findings and expectations of four broadly-drawn approaches to the investigation of syntactic complexity frame and inform this corpus-based examination of narrative and argumentative texts written by 22 L2 learners at a university in Japan. A suite of conventional and novel metrics is used to explore complexity, fluency, sentence variety, and sentence development over a two-year period and to compare texts in the two genres. Longitudinal gains in fluency and decreases in fragment use were largely as anticipated for both genres, but significant gains in complexity and increases in sentence variety were unexpectedly limited to narrative texts. In comparing genres, the expected higher value MLTU, the greater complexity of argumentative texts, the differences in clause usage, and the significant divergence in sentence variety values contrast with the surprisingly similar values for MLT. It is suggested that longitudinal changes in the syntactic construction of text are strongly influenced by the constraints and affordances of usage-derived genre, the form, function, and exponents of narrative writing being relatively easier at this level.*

*The difficulties posed by argumentation may be compensated for by the use of formulaic constructions and templates. We conclude that understandings of cognition, structure, function, and patterns of acquisition and usage need to be incorporated into a coherent paradigm in order to fully appreciate L2 writing and its development.*

**Keywords:** corpus analysis, L2 writing, genre, syntactic complexity, fluency, sentence development

**Acknowledgement:** This research was made possible through a research grant provided by Reitaku Linguistic Research Center (Reitaku University).

## **Introduction**

Syntactic (or grammatical) complexity has attracted considerable interest, not least because it has been seen as representative of both linguistic processing and product, or, to borrow Halliday's (1991) terms, of both "system" and "instance". In the field of second language (L2) studies, the development of syntactically complex writing has been viewed as a reflection of target language acquisition (Wolfe-Quintero, Inagaki, & Kim, 1998; Ortega, 2003; Lu, 2011), with complexity research utilized to explore the relationships between different production skills (Xinhua, 2008) and between planning, task and performance (Ishikawa, 1995; Foster & Skehan, 1996; Ellis, R., & Yuan, 2004; Deng, 2005; Kuiken, Mos & Vedder, 2005; Ishikawa, 2006), to examine age differences (Navés, Torras, & Celaya, 2003), accuracy differences (Bardovi-Harlig & Bofman, 1989), and sex differences in writing (Waskita, 2008), to assess pedagogic interventions, and to inform teaching methods and materials (see Polio, 2001).

The aim of this paper is to briefly present the key findings of four broadly-drawn approaches to the investigation of the phenomenon in order to contextualize and inform a corpus-based, longitudinal study of syntactic

complexity, fluency, sentence variety, and sentence development in L2 genre writing, a study that uses a suite of conventional and novel metrics that have previously revealed significant differences in the construction of genres by L2 writers (Struc & Wood, 2011).

### **Formal linguistic and psycholinguistic approaches**

The two approaches share a broad concern for the “mental processes” (Chomsky, 1965) and “cerebral language-data processing mechanisms” (Lenneberg, 1967) that are responsible for the creation of syntactically complex language. Analyses of complexity have generally employed the units of generative grammar, with the degree of complexity determined either structurally or operationally: structurally, by, for example, the locality and depth of nesting or embedding in a text (Babyonyshev & Gibson, 1999; Warren & Gibson, 2002), the ratio of non-terminal to terminal nodes (Miller & Chomsky, 1963), node counts (Ferreira, 1991, Hawkins, 1994), relative length and structure of syntactic units (Hawkins, 1994, 2004, 2009; Jackendoff & Wittenberg, 2012), frequencies of embedded clauses (Bader & Haussler, 2012), or calculations based on a synthesis of grammatical units (see Cheung & Kemper, 1992; Szmrecsányi, 2004); operationally by processing demands indicated by phoneme monitoring and reading times (see Gibson, 1998), comprehension error rates, volume of neural tissue activated, and pupillary responses (Just, Carpenter, Keller, Eddy, & Thulborn, 1996), reaction times, and the location and extent of cortical hemodynamic responses (Friederici, Fiebach, Schlesewsky, Bornkessel, & von Cramon, 2006; Meltzer, McArdle, Schafer, & Braun, 2009; Newman, Hauser, Newport, & Bavelier, 2010).

The overall findings suggest that, on the one hand, syntactic complexity is measurable structurally, and on the other, increases in complexity increase the neural activity required for its computation (storage, integration, and

processing). In short, greater complexity demands greater processing.

Due in part to the ubiquity of constructions such as idioms that defy generative analysis (Jackendoff & Pinker, 2005), formal linguists have considered other factors that might impact on the production of syntactic complexity. Hawkins (2004, 2009, 2012) suggests that communicative imperatives can result in the preferential use of conventionalized syntactic structures. Similarly, it has been suggested that both linguistic and non-linguistic factors mediate the social interactions of individuals, affecting the complexity of constructions and the extent of their use within a population (Culicover and Nowak, 2003; Culicover, Nowak, & Borkowski, 2003).

### **Genre and functional approaches**

From these perspectives language is considered as primarily functional, its effectiveness dependent on "its appropriateness to the communicative context" (Faigley, 1980, p. 299). Appropriateness, in turn, is contingent on the writer's engagement with genre - the routinized, culturally formulated, socially recognized patterns of language use which reflect and respond to evolving social norms and expectations (Hanks, 1987; Hyland, 1990, 2003; Berkenkotter & Huckin, 1993; Ramanathan & Kaplan, 2000) and which provide the rhetorical and textual structures appropriate for subject, purpose, audience, and context (Faigley, 1980; Bazerman, 1988; Hyland, 1990; Swales, 1990; Bhatia, 1993; Guenther & Knoblauch, 1995). Consequently, as users actively (re)construct genre, it is the social, pragmatic function of text that drives the structuring of the written form (Waugh, 1995; Purcell-Gates, Duke, & Martineau, 2007). Argumentation, exposition, narration, and description represent specific forms of written genres, "modes of production" (Perron, 1976), or "modes of discourse" (Halliday & Hasan, 1985).

Analyses of syntactic complexity in written genres have used a range of

metrics that include unit frequencies and ratios, prominent among them the sentence, Hunt's T-unit (1965), the clause and clause types, and ratios based upon them, including mean length of sentence (MLS), mean length of T-unit (MLTU), mean length of clause (MLC), mean number of clauses per sentence (C/S), and clauses per T-unit (C/TU).

Research utilizing these metrics has revealed recurrent patterns in the construction of genre writing of relevance to the present work. Seegars' (1933) study of clause usage, for example, shows how the tasks of argumentative and expository writing produce more complex structures than narratives or descriptions. Subsequent L1 studies have consistently found that the syntactic complexity of text increases with grade level and that MLTU is significantly greater in argumentative writing than in narrative or descriptive texts (Perron, 1976, 1977; Crowhurst & Piche, 1979; Crowhurst, 1980; Stomberg & Kurth, 1982; Beers & Nagy, 2009). C/TU, as a measure of subordination, has been found to be significantly higher in argumentative texts than narratives (Perron, 1976; Beers & Nagy, 2009, 2010). Conversely, narrative and descriptive texts have been found to be significantly longer than argumentative texts (Stomberg & Kurth, 1982; Beers & Nagy, 2009), while Beers and Nagy (2010), contrary to Perron (1976), found that MLC, as an indication of denser syntax, was longer in descriptive than persuasive writing. In the field of L2, Yau and Belanger (1984) found learners produced longer narratives than expository texts, the latter significantly more complex as measured by MLC and MLTU, and approached significance for C/TU.

Overall, these findings suggest that the social, functional, and rhetorical imperatives of argumentation, exposition, and persuasion necessitate the more frequent elaboration of complex relationships between ideas (e.g., causality), the consequent employment of a higher proportion of subordinate clauses, and hence longer and more complex T-units. Conversely, the relatively

less complex construction of narrative writing results in longer text lengths (Crowhurst, 1980; Stomberg & Kurth, 1982; Beers & Nagy, 2009).

### **Second language learning and developmental approaches**

As a feature of the textual development of L2 learners, syntactic complexity has been defined as “the range of forms that surface in language production and the degree of sophistication of such forms” (Ortega, 2003, p. 492), with increasingly elaborate language and a greater range of syntactic patterning used as learners extend their knowledge and experience of restructuring language (Foster & Skehan, 1996).

Using metrics that include those employed in genre studies (see Wolfe-Quintero, et al., 1998; Ortega, 2003), it has been found that L2 argumentative texts typically exhibit significantly greater complexity than narrative essays (Lu, 2011; Struc & Wood, 2011).

In terms of longitudinal change, a review by Wolfe-Quintero, et al. (1998) indicates that, overall, MLTU, MLC, mean length of error-free T-unit (MLEFTU), C/TU, dependent clauses per clause (DC/C), and dependent clauses per T-unit (DC/TU) “consistently increased in a linear relationship to proficiency level across studies” (p. 97). A review by Ortega (2003) suggests that that C/TU can differentiate between college-level L2 writing groups, but for substantial changes in the syntactic complexity of L2 writing as measured by MLTU to be observed, a period of roughly a year of instruction is required. Lu's (2011) study of texts written by L2 college writers at four proficiency (school) levels found seven measures (including MLC, MLS, and MLTU) showed a linear increase across the levels, and five measures (including MLC, MLS, and MLTU) discriminated between adjacent levels. Struc and Wood (2011) found significant gains in syntactic complexity and fluency were made after a year's tuition, but these gains are largely limited to narrative texts.

Finally, Wolfe-Quintero, et al. (1998) extrapolate from previous findings and tentatively suggest a six-stage model for the development of complexity indicated by the presence of specific syntactic structures: 1) fragments, 2) main clauses, 3) coordinate clauses, 4) adverbial/subordinate clauses, 5) adjective/relative and nominal/noun clauses, and 6) adjectival, adverbial and nominal verb phrases. These "stages" would overlap in any actual writing sample; the model only suggesting "the emergence of a certain type of structure at the expense of other structures at a certain stage of development" (p. 73).

### **Emergentist and usage-based approaches**

Emergentist and usage-based expectations have been informed by key concepts developed in the study of complex systems (Kauffman, 1991; Holland, 1992, 2006; Waldrop, 1992; Plsek and Greenhalgh, 2001; Miller & Page, 2007; Van Geert & Steenbeck, 2008; Verspoor, Lowie, & de Bot, 2009). Locating language use and learning by individuals and communities within interconnected complex and dynamical systems that evolve over time, emergentism has emphasised the ways in which the structures of language and cognitive organization emerge and develop through interactions with the sociolinguistic environment (Larsen-Freeman, 1997; MacWhinney, 1998, 2009; Lee & Schumann, 2005; Ellis & Larsen-Freeman, 2006; Larsen-Freeman, 2006; Ellis, 2008; Bybee, 2008; Lieven & Tomasello, 2008).

Two proposals from these perspectives are apposite to this study. First, the production of syntactically complex text by language learners (as individual agents) will not exhibit discrete, linear, stages of progression (Larsen-Freeman, 2006). Larsen-Freeman's study of texts written by five L2 learners used four conventional metrics (including MLTU, C/TU, and EFTU/TU). The group made overall gains (though the statistical significance is not reported), but the disaggregated data revealed widely diverging patterns of

development, confirming that descriptive group data (e.g. means) can obscure individual differences (Sidman, 1960) and that "individual developmental paths, each with all its variation, may be quite different from one another" (Larsen-Freeman, 2006, p. 594).

Second, the processes by which linguistic behaviour emerges suggest specific affordances for the syntactic construction of text and genres. Language acquisition is, Ellis (2002) suggests, "exemplar based" and "frequency-biased", with usage patterns abstracted from within the wider speech community (Goldberg, 1995; Langacker, 2008; Verspoor, et al., 2009) as "people construct relational and semantic categories in order to make sense of the world and in order to communicate with one another" (Abbot-Smith & Tomasello, 2006, p. 282). Acquisition is, therefore, inherently social, associative and probabilistic, involving a sequence from formula, through lowscope pattern, to construction (see Ellis, 2001, 2002). Frequency and repetition bring about form and the emergence of formulaic lexical constructions. Prior experience of these constructions can accelerate processing (Ellis, Simpson-Vlach, & Maynard, 2008), suggesting that their use could expedite production in limited timed conditions. Also instrumental in production may be usage-based argument structure constructions, "a subclass of constructions that provides the basic means of clausal expression in a language" (Goldberg, 1995, p. 3). These "skeletal syntactic constructions" may facilitate the logical construction of multi-clause sentences (e.g. X because Y) and provide a further link between syntactic structure, text construction, and the recreation of genres.

## **Summary**

Drawing firm conclusions from previous research is problematized by, for instance, the absence of a precise, agreed definition of syntactic complexity (Szmrecsányi, 2004; Sinnemäki, 2012), and considerable variation in

definitions of measures, units of production, calculations of complexity, task types, time constraints, sample sizes, and statistical treatments (Ishikawa, 1995; Polio, 1997; Wolfe-Quintero, et al., 1998; Lu, 2011). Nevertheless, the approaches reviewed above offer a cluster of relevant insights:

- Structurally, the degree of syntactic complexity appears related to the amount and type of embedding and to the relative length and structure of units. Greater complexity takes longer to compute, and this may restrict the length of texts produced in a limited time. However, the use of formulaic and skeletal constructions may counteract this constraint.
- The interpersonal and discourse functions of genre may be realized through clause options and the logical structuring of sentences, with different genres characterized by relatively higher frequencies of particular clause and sentence types.
- The generic and probabilistic features of argumentation are expressed in significantly greater MLTU and C/TU than in narrative writing. Conversely, narrative texts can be expected to be relatively longer, with potentially longer MLC.
- Syntactic complexity can be expected, overall, to increase with proficiency (or grade level), as indicated by increases in MLTU, MLS, MLC, C/TU, DC/C, and DC/TU.
- The development of syntactic complexity in L2 writing may proceed through "stages" though these would overlap in any actual writing sample.
- Regularized patterns of language usage within a group (or by one learner) may emerge as aggregate behaviour, but the development of individual learners is likely to be variable and non-linear.

## Research Design

### Terminology

**Syntactic complexity and fluency.** Although fluency has been considered a feature of syntactic complexity (Ortega, 2003), we take the two to be distinct but interrelated phenomenological dimensions of a lexicogrammatical system. Syntactic complexity, as an indicator of process, refers to the regularized patterns by which words are sequenced and structured to form conceptually complete units and the potential of such patternings to engender textual forms that range from the simple and singular to the complex and multi-componential. Fluency, as a measure of productive output, refers to the length of textual units (regardless of their complexity) and demonstrates “that more words and more structures are accessed in a limited time” (Wolfe-Quintero, et al., 1998, p. 25).

**Genre.** Operationally, we take genre to correspond to Perron's modes of production (1976), that is, argumentative writing uses language that argues a point of view, defends a position, expresses inclination, or tries to persuade; narrative writing uses language that tells a sequence of events, observances, or experiences.

**Orthographic and reconstructed sentences.** To investigate complexity and fluency within and across orthographic boundaries, two types of sentence structure are investigated: orthographic and reconstructed sentences (OS and RS). The OS respects the text of each writer as produced, being “a unit of writing that begins with a capital letter and ends with a full stop, question mark, or exclamation mark” (Nunberg, Briscoe, & Huddleston, 2002, p.1728). The RS is a unit that combines a preceding and/or a following OS that is

syntactically related to a main OS and is included in a T-unit that crosses OS boundaries, a T-unit being defined as consisting of “one main clause plus the subordinate clauses attached to or embedded within it” (Hunt, 1965, p. 49). For instance, [I can study other things too. For example, culture, food, music, sports, building and so on.] is comprised of two OS, one T-unit, and one RS. The reconstruction of text into RS and the division into T-units provide a means by which learner text can be “objectively” demarcated within and across given orthographic boundaries (Struc & Wood, 2011) in order to investigate indicators of complexity “wherever they occur” (Voss, 2005).

**Sentence variety.** Based on the importance of sentence variety for readability (Beers & Nagy, 2009), Foster and Skehan's proposition (1996) that, as L2 learners develop, their texts will present “a greater variety of syntactic patterning”, and Ortega's (2003) definition of syntactic complexity as “the range of forms that surface in language production”, the term here is used specifically to describe the range and distribution of the four basic sentence types deployed by a writer within one text (Struc & Wood, 2011). A text that presents a limited range of or skewed distribution of types can be said to show less variety, while a text presenting a greater range and a more equal distribution of types can be said to show greater variety.

## **Aims**

The aims of this research are twofold: 1) to use a suite of 12 metrics to examine, describe and compare evidence of syntactic complexity, fluency, sentence variety, and sentence development in the texts of 22 university L2 learners written in two genres (argumentative and narrative) at the starts of their first, second, and third years, and 2) discuss the results within the context of the findings of previous studies.

### **Corpus and annotation**

This study interrogates a longitudinal corpus compiled by Struc and Wood (2009, 2010) with data from the same 170 English Writing Program (EWP) students in first and second years (56,382 words), with additional data from 22 of these students at the start of their third year (5,856 words), providing a corpus comprised of writing samples in two genres (narrative and argumentative) from each of the 22 students at three points in time over two years ( $\Sigma = 14,761$  words). The samples were produced by the learners in the same controlled, time-limited conditions (20 minutes per task), with the same instructions and writing prompts presented in L1 (Japanese) on all three occasions (see Struc & Wood, 2011).

The digitized corpus was manually annotated and proofread. Tags were used to indicate sentence type, clause function, and whether a sentence was syntactically complete or a fragment. Sentence types consisted of simple, compound, complex, and compound-complex. Clause functions included two types of main or superordinate clause: independent clause and framing clause, the latter being an independent clause that frames direct speech; and three types of dependent clause: subordinate (or adverbial) clause, relative (or adjectival) clause, and nominal (or noun) clause.

### **Population and Educational Environment**

The 22 L2 learners were enrolled in the EWP at a private university in Japan. The EWP specifically aims to foster academic writing skills but a range of approaches and variety of texts can be used by instructors delivering the course once a week over two 15-week semesters (amounting to 45 hours of tuition). All the learners also received instruction in English language communication skills in two classes a week, with higher level instruction delivered by English native speakers (NS), lower levels delivered by both NS

and Japanese English speakers. Learners' experience of English variously included living and studying in English-speaking communities abroad, attendance of private English conversation classes, contact with NS assistant language teachers in secondary education, English language classes at junior and senior high schools, and experience of English language cultural artefacts (films, songs, websites, etc.). The educational environment, and to a lesser degree the language experiences of the population, can, thus, be characterized as one of diversity.

### **Metrics**

**Syntactic complexity.** Five syntactic complexity ratio metrics were employed: clauses per orthographic sentence ( $C/OS$ ) as a sentence complexity ratio (Ishikawa, 1995),  $C/TU$  as a measure of depth of clauses (Wolfe-Quintero, et al., 1998),  $DC/T$  and  $DC/C$  as measures of subordination (Wolfe-Quintero, et al., 1998), and T-units per reconstructed sentence ( $TU/RS$ ), as an adaptation of the conventional measure of coordination reported by Wolfe-Quintero, et al. (1998).

**Fluency.** Five fluency metrics indicate the mean number of words in a production unit: mean length of orthographic sentence (MLOS), mean length of reconstructed sentence (MLRS), MLC, MLTU, and mean length of text (MLT).

**Sentence variety.** A statistically-based Sentence Variety Index (SVI) was devised and used for analysing each text. The index ranges from 0 to 100, 0 indicating no variety (i.e., all sentences of one type) and 100 indicating maximum variety (i.e., all four sentence types equally represented).

## **Expectations**

There are two broad sets of expectations:

1. After two years of instruction, the texts of L2 learners will, in general, show evidence of a) increased syntactic complexity as measured by ratios per unit, b) increased fluency in longer production units, c) a decrease in the production of fragments as indicated by a convergence of MLOS and MLRS, and d) increased sentence variety.
2. The exposition of genre will be reflected in a) significantly greater MLTU and C/TU in argumentative essays than narratives, b) narrative texts being significantly longer than argumentative texts, c) distinct differences in sentence variety, and d) distinct differences in the types of clauses used.

## **Results**

The two writing samples collected from each of the 22 learners at the three points in time (T1, T2, and T3, i.e., six samples) were submitted to longitudinal analyses within each genre as well as a comparison between the two genres at each point in time. The analyses and results are presented as follows: 1) longitudinal analyses of syntactic complexity, fluency, sentence development (as indicated by MLOS and MLRS values), sentence variety, and distribution of clause types in narrative and argumentative texts, and 2) comparison of syntactic complexity and fluency, sentence development, sentence variety, and distribution of clause types in the two genres at three points in time.

### **Longitudinal Analyses**

**Syntactic Complexity.** The first analysis examines the development of complexity longitudinally over two years in the two genres. Table 1 shows

the development of complexity in narrative writing at three time points across two years. The mean values for all measures (C/OS, C/TU, TU/S, DC/C, and DC/TU) consistently increase over time suggesting increasing deployment of both conjunction and subordination by writers.

Table 1  
*Mean Complexity Values in Narrative Writing*

	T1		T2		T3	
	Mean	SD	Mean	SD	Mean	SD
C/OS	1.414	.406	1.485	.326	1.659	.471
C/TU	1.209	.171	1.231	.190	1.233	.210
TU/S	1.206	.212	1.236	.200	1.350	.236
DC/C	.158	.113	.170	.120	.170	.116
DC/TU	.209	.171	.231	.190	.233	.210

The development of complexity in argumentative writing is less straightforward. Table 2 shows an increase in all complexity measures after the first year. However, between the second and third point (T2-T3) of data collection, values for C/OS, TU/S, and DC/C decline, while the mean values for C/TU and DC/TU continue to increase. This suggests that subordinating clauses were deployed more and conjunction somewhat less at T3 in comparison to T1.

Table 2  
*Mean Complexity Values in Argumentative Writing*

	T1		T2		T3	
	Mean	SD	Mean	SD	Mean	SD
C/OS	1.509	.456	1.626	.384	1.611	.481
C/TU	1.470	.437	1.482	.276	1.485	.405
TU/S	1.111	.205	1.138	.157	1.095	.118
DC/C	.276	.168	.305	.116	.292	.141
DC/TU	.470	.437	.482	.276	.485	.405

Table 3 shows the results of a longitudinal analysis of the complexity values obtained from three samples in each genre from the 22 writers using Repeated Measures ANOVA. Narrative writing exhibits few significant gains. Of all the measures, only TU/S and C/OS in narrative writing show significant gains, which would indicate increased preference for conjunction rather than subordination in narrative writing. The Bonferri post-hoc tests for comparison of pairs of time points suggest that rather than being attributed to one particular time period, it appears that the cumulative gains over two years (T2-T1, T3-T2, T3-T1) have contributed to the significant overall effect of year in program.

Table 3  
*RM ANOVA on Complexity Measures in Narrative and Argumentative Writing*

	Narrative / Year				Argumentative / Year			
	Mean difference			Main effect	Mean difference			Main effect
	T2-T1	T3-T2	T3-T1	F	T2-T1	T3-T2	T3-T1	F
C/OS	.071	.175	.245	3.469*	.116	-.015	.102	1.283
C/TU	.022	.002	.024	.149	.012	.003	.015	.012
TU/S	.029	.114	.143	4.174*	.027	-.042	-.016	.440
DC/C	.012	.000	.013	.131	.030	-.014	.016	.316
DC/TU	.022	.002	.024	.149	.012	.003	.015	.012

Note. \*= $p < .05$ , \*\*= $p < .01$ , \*\*\*= $p < .001$

In argumentative writing, there was no significant overall effect of year in program for any of the complexity measures. Therefore, the clausal structure of argumentative writing appears to remain mostly unchanged.

**Fluency.** Fluency measures in narrative writing (Table 4) show a continuous increase in most measures (MLT, MLOS, MLRS) with the exception of MLC and MLTU which appear to decline slightly at T2 but increase again at T3.

Table 4  
*Mean Fluency Values in Narrative Writing*

	T1		T2		T3	
	Mean	SD	Mean	SD	Mean	SD
MLT	91.95	45.14	103.18	33.99	132.86	42.02
MLOS	8.39	2.55	8.96	3.43	11.59	5.57
MLRS	8.83	2.55	9.13	3.34	11.70	5.51
MLTU	7.46	1.56	7.42	1.86	8.56	2.69
MLC	6.21	1.07	6.04	1.26	6.88	1.19

Fluency measures in argumentative writing (Table 5) show an overall increase in all measures between the first and third points of data collection. However, as with narrative writing, MLTU and MLC measures show a slight decline at T2 after which they increase again at T3.

Table 5  
*Mean Fluency Values in Argumentative Writing*

	T1		T2		T3	
	Mean	SD	Mean	SD	Mean	SD
MLT	97.68	57.65	108.82	36.73	136.45	43.91
MLOS	10.26	3.59	11.01	3.21	11.91	3.40
MLRS	11.30	4.07	11.51	3.14	12.17	3.25
MLTU	10.52	3.26	10.31	2.03	11.18	2.68
MLC	7.18	1.11	7.01	1.09	7.63	1.23

Table 6 shows the results of a longitudinal analysis of the fluency values derived from three samples in each genre from the 22 writers using Repeated Measures ANOVA. For narrative writing, the year in program appears to have a significant overall effect for MLT, MLOS, MLC and MLRS but not for MLTU. It should be noted that for all the overall significant gains observed, the significant gains are made in the second year (T3-T2). The gains made in MLTU between T2 and T3 were not enough to counteract the initial decline in after the first year (T2-T1). On the other hand, the MLC values, while initially declining after the first year, increase enough in the second year for an overall significant effect of year in program to be observed.

Table 6  
*RM ANOVA on Fluency Measures in Narrative and Argumentative Writing*

	Narrative / Year				Argumentative / Year			
	Mean difference			Main effect	Mean difference			Main effect
	T2-T1	T3-T2	T3-T1	F	T2-T1	T3-T2	T3-T1	F
MLT	11.227	29.682*	40.909**	9.583**	11.136	27.636*	38.773*	6.546**
MLOS	.582	2.261*	3.203*	7.167**	.747	.903	1.650*	5.205*
MLTU	-.045	1.145	1.100	3.522	-.204	.864	.660	.791
MLC	-.170	.842*	.672	4.536*	-.177	.621	.444	2.700
MLRS	.294	2.576*	2.870	6.774*	.209	.661	.870	.907

Note. \*= $p < .05$ , \*\*= $p < .01$ , \*\*\*= $p < .001$

For argumentative writing, fluency gains are only observed for MLT and MLOS but not for MLTU, MLC or MLRS. This suggests that while fluency increases for the overall text length and sentences, the writers continue to use independent and subordinate clauses of similar length over the three time points.

**Sentence Convergence – MLOS and MLRS.** One expectation of the study is that as control and accuracy of syntactic structuring increases fewer fragments would be produced and, as a result, the length of orthographic sentences (MLOS) and reconstructed sentences (MLRS) would converge. Table 7 shows the mean differences between MLOS and MLRS in the six writing samples obtained and the results of paired samples t-tests. The mean differences all indicate equal or larger MLRS values than MLOS due to sentence fragments being associated with an adjacent sentence containing an independent clause.

Table 7  
*MLOS/MLRS Convergence in Narrative and Argumentative Writing*

Genre/Time	Mean Difference	SD	t
Narrative T1	.450	.726	2.908**
Narrative T2	.163	.451	1.689
Narrative T3	.117	.271	2.025
Argumentative T1	1.036	2.409	2.017
Argumentative T2	.498	.894	2.613*
Argumentative T3	.257	.688	1.749

Note. \*=p<.05 , \*\*=p<.01, \*\*\*=p<.001

The mean differences between MLOS and MLRS in both narrative and argumentative writing appear to diminish steadily across the three time points. The non-significant differences in both genres at T3 indicate that the values converge. Significant differences were observed for narrative writing only at T1 and for argumentative writing only at T2. It appears that there is a trend toward convergence with both narrative and argumentative writing exhibiting diminishing mean differences across two years and non-significant differences after two years.

**Sentence Variety.** Figure 1 shows the distribution of four sentence types as a mean percentage of total sentences in the writing samples in each genre at the three time points. This graph provides a visual representation from which the increase and decrease of certain sentence types is apparent. In both narrative and argumentative writing at T1, simple sentences comprise the majority of sentences in texts with values exceeding 50% (65.8% and 59.5% respectively). In narrative writing, the composition of the four sentence types moves toward a more balanced distribution, whereas in argumentative writing,

the same trend is only observed until T2 after which it appears to revert to a distribution similar to that observed at T1.

Figure 1  
*MLOS/MLRS Convergence in Narrative and Argumentative Writing*

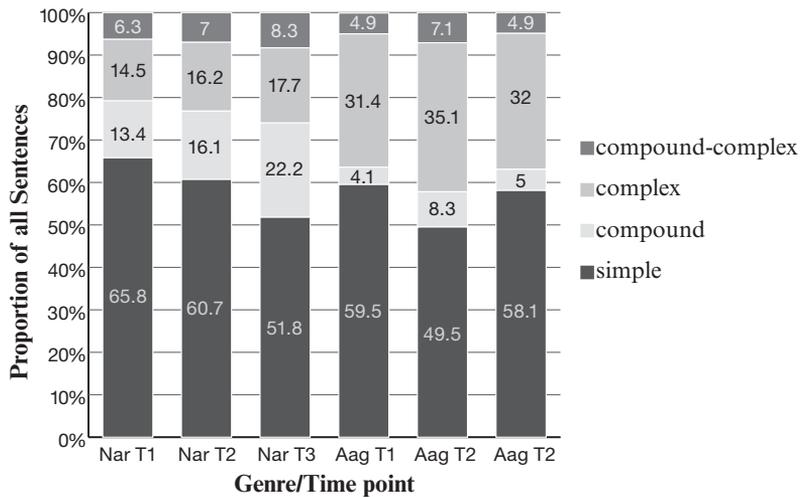


Table 8 shows the mean Sentence Variety Index (SVI) values and standard deviations for each genre at each time point. The distributions seen in Figure 1 are reflected in increasing SVI values across the three time points for narrative writing but, for argumentative writing, an increase only at T2 followed by a slight decrease at T3.

Table 8  
*Mean Sentence Variety Index Values in Narrative and Argumentative Writing*

	T1		T2		T3	
	Mean	SD	Mean	SD	Mean	SD
Nar.	36.44	23.49	43.39	21.52	52.38	19.21
Arg.	33.73	20.59	41.34	21.23	38.38	15.48

Table 9 shows the results of a Repeated Measures ANOVA conducted on the SVI values for the 22 samples across 3 three points in time in both genres. A significant overall effect was observed for narrative writing but not for argumentative writing. The post-hoc pairwise comparison shows that the difference between T1 and T3 contributed most strongly to this result. Because the analysis of DC/TU and C/TU in narrative writing did not show any significant gains longitudinally, it appears that the increasing contribution of compound sentences shown in the overall gains in TU/S (See Table 3), have contributed to the observed higher mean SVI value in narrative writing.

Table 9  
*Repeated Measures ANOVA for Mean differences in SVI Values in Narrative and Argumentative Writing*

	Mean Difference			Main effect
	T2-T1	T3-T2	T3-T1	F
Nar.	6.593	8.990	15.943*	4.801*
Arg.	7.610	-2.965	4.644	1.027

Note. \*=p<.05 , \*\*=p<.01, \*\*\*=p<.001

**Clause Distribution.** An analysis of the distribution of clause types allows a view of the sentence types distribution in higher definition. Table 10

and 11 show the classification of independent clause types as further distinguished by Independent Clause (IC) and Framing Clause (FC), and dependent clause types further distinguished as Subordinate clause (SC), Relative Clause (RC), and Noun Clause (NC) represented as proportions of total clauses in narrative and argumentative writing at three time points. In addition, the text coverage (Texts %) indicates the proportion of all texts in which each clause type appears allowing for a description of how widely each clause type is deployed among the writers at each stage.

Table 10  
*Distribution of Clause Types in Narrative Writing*

Clause type	T1		T2		T3	
	frequency (%)	texts (%)	frequency (%)	texts (%)	frequency (%)	texts (%)
IC	77.27	100	80.49	100	77.05	100
FC	5.71	37	2.44	23	4.77	27
SC	6.36	36	5.15	55	6.59	64
RC	6.97	50	8.40	73	6.59	68
NC	3.64	41	3.52	41	5.00	55

The clause construction of narrative writing appears to follow a consistent pattern at all three time points. Independent clauses predominate comprising between 77-81% of all clauses. The dependent clause distributions, while cumulatively contributing between 13-18% of all clause types, show greater preference for SCs and RCs than NCs. The text coverage values show wider deployment of dependent clauses of various types after the first time point. On the other hand, use of FC appear to decline somewhat from the first time point suggesting that alternative syntactic structures are chosen for narrative writing across time. The distributions at T1 and T3 appear to be

fairly similar but the range of writers deploying these clauses appears to have increased.

Table 11 shows the clause distribution and text coverage for argumentative writing at three time points. Here, again, there is very little difference in the relative composition of clause types across the three time points except for a doubling of RCs between T2 and T3. As with narrative writing, the text coverage shows that more writers are deploying various sentence types over the 3 time points. Deployment of SCs increases from 77% to 100% between T1 and T3. RCs, while only evident in 32% of texts at T1 and T2, are present in 64% of texts at T3. NCs while initially present in 60% of texts, appear in 82% of texts by T3. Notable is the minimal use of FCs.

Table 11  
*Distribution of Clause Types in Argumentative Writing*

Clause type	T1		T2		T3	
	frequency (%)	texts (%)	frequency (%)	texts (%)	frequency (%)	texts (%)
IC	70.16	100	68.53	100	69.65	100
FC	-	-	0.29	5	-	-
SC	13.77	73	13.82	86	12.93	100
RC	2.95	32	3.24	32	6.72	64
NC	13.11	60	14.11	91	10.69	82

### Genre differences

**Complexity and Fluency.** The observed complexity and fluency values in argumentative and narrative writing were compared to determine whether the writers responded to the different requirements posed by the argumentative and narrative genres. Table 12 shows the mean differences in fluency and

complexity values in both genres at the 3 three time points. These pairs were submitted to paired samples t-test.

Table 12  
*Comparison of Fluency and Complexity Mean Differences between Narrative and Argumentative Writing*

	Fluency				Complexity		
	T1 (A-N)	T2 (A-N)	T3 (A-N)		T1 (A-N)	T2 (A-N)	T3 (A-N)
MLT	5.73	5.64	3.591	C/OS	.096	.141*	-.048
MLOS	1.878**	2.043**	.325	C/TU	.261*	.252***	.252***
MLRS	2.464**	2.379***	.464	TU/S	-.096*	-.098**	-.255***
MLTU	3.053***	2.894***	2.613***	DC/C	.118**	.135***	.121***
MLC	.977**	.970**	.749	DC/TU	.261*	.252***	.252***

Note. \*= $p < .05$  , \*\*= $p < .01$  , \*\*\*= $p < .001$

Fluency values were consistently higher in argumentative writing at all three time points. All measures show significantly greater values in argumentative writing at T1 and T2 with the exception of MLT, which shows no significant differences at any of the three time points. However, the mean differences for MLOS, MLRS, and MLC diminish and fail to reach significance at T3 after two years of writing instruction.

The complexity values comparison between narrative and argumentative writing at the three time points show consistent significant differences at all three time points for C/TU, TU/S, DC/C and DC/TU. However, for C/OS, significant difference is only observed at T2. The observed differences show higher values in argumentative values for C/TU, DC/C and DC/TU, but consistently lower values for TU/S. Referring to the sentence distribution presented in Figure 1, this pattern can be attributed to the higher incidence of compound sentences in narrative writing and more frequent deployment of

complex sentences in argumentative writing.

**Genre and Sentence Variety.** Figure 1 showed the contrast between narrative and argumentative writing in the distribution of sentence types. The SVI values in narrative and argumentative writing were compared to determine whether writers used greater or less variety in sentences in response to these respective genres. Table 13 shows the results of paired samples t-tests of SVI values between the two genres at each time point.

Table 8 showed that both narrative and argumentative SVI means increase between T1 and T2. The SVI means at these two points are not significantly different; however, as the narrative writing SVI continues to increase at T3, it decreases for argumentative writing. This divergence results in a significant difference observed in the mean SVI values at T3 (See Table 13).

Table 13  
*Mean Differences between SVI Values of Narrative and Argumentative Writing*

T1 (A-N)		T2 (A-N)		T3 (A-N)	
Mean	SD	Mean	SD	Mean	SD
2.71	23.56	2.05	26.76	14.01**	22.82

Note. \*= $p < .05$ , \*\*= $p < .01$ , \*\*\*= $p < .001$

**Genre and Clause distribution.** Table 14 shows a side-by-side comparison of clause distribution patterns in narrative and argumentative writing at three time points. Some consistent differences are immediately apparent. At all three time points, narrative writing shows a higher proportion of ICs including FCs, which are mostly absent in argumentative writing. Argumentative writing exhibits proportionally twice as many SCs and NCs at all three time points. RCs, on the other hand, are deployed more frequently in narrative

writing at T1 and T2 but increase at T3 argumentative writing to leave very little difference between the genres at T3.

Table 14  
*Distribution of Clause Types in Argumentative and Narrative Writing*

Clause type	T1		T2		T3	
	Nar.	Arg.	Nar.	Arg.	Nar.	Arg.
IC	77.27	70.16	80.49	68.53	77.05	69.65
FC	5.71	-	2.44	0.29	4.77	-
SC	6.36	13.77	5.15	13.82	6.59	12.93
RC	6.97	2.95	8.40	3.24	6.59	6.72
NC	3.64	13.11	3.52	14.11	5.00	10.69

### Discussion

The scope of this research is inevitably limited. A comprehensive investigation of the corpus texts would require not only a complete appraisal of accuracy, lexis, morphology, syntax, semantics, pragmatics, and discourse (Lu, 2011) but also an examination of the relationships, if any, between syntactic complexity, fluency, and the subjective quality of texts (see Crowhurst, 1983; Hillocks, 1986; Polio, 2001; Rimmer, 2009). However, despite its limitations, corpus-derived quantitative data can be used to examine assumptions about what is typical of certain language varieties and actual language usage (Oostdijk & de Haan, 1994), and provide a basis for testing explanatory hypotheses in second language acquisition (Houssen, 2002). Furthermore, a corpus-based study that specifically addresses syntactic complexity “has the potential to reconcile the tension in theoretical linguistics between grammar as being sentence-bound and grammar as discourse”

(Rimmer, 2006, p. 497). Finally, the results provide usage profiles based on ratios and frequencies which not only reflect the “inherently probabilistic” (Halliday, 1991) character of grammar and the language system but also provide a “common currency” (Ellis, 2002) for researchers of language acquisition from different disciplines.

Of our two broad areas of concern the results for longitudinal changes are a departure from previous findings. There was no significant increase in the syntactic complexity of argumentative texts as measured by the five complexity ratios. The only significant gains were in the narrative genre. These were limited to TU/S and C/OS, indicating a significantly greater use of coordination. This is confirmed by the increase in the proportion of compound sentences in text at the three points of time (13.4%, 16.1%, and 22.2%), whilst increases in the proportions of all non-simple sentence types in text are reflected in a significant overall SVI gain.

At first glance, the significant decrease in the production of fragments (indicated by the convergence of MLOS and MLRS values), the decrease in the proportion of single-clause sentences and the greater use of coordination in narrative texts appear to support the developmental stages proposed by Wolfe-Quintero, et al. (1998). However, there are two problems with this interpretation. First, the longitudinal pattern is not typologically restricted but universal, that is to say, there is a steady increase in the use of all non-simple sentence types rather than an increase over time in first, compound sentences, then complex sentences, and so on. Learners used coordination significantly more often in narratives, but not, it would appear, because they were unwilling or unable to use subordination. This leads to the second point: as no similar or significant pattern of change is apparent in the argumentative writing, the implication is that longitudinal changes in the syntactic construction of text are as strongly influenced by the constraints and

affordances of usage-derived genre as they are by writing proficiencies. The production and development of argumentative writing in this particular environment, it would seem, was subject to greater constraints and fewer affordances, with the result that the syntactic and sentential structuring of text remained roughly the same over the two years.

The constraints of genre are less apparent in the longitudinal results for fluency, as the affordance is to produce more whether the same forms of textual construction are used or not. Both narrative and argumentative texts increased significantly in length, and there were significant gains in the length of orthographic sentences in both genres. However, only narrative texts had significantly longer clauses, and this is perhaps a further reflection of the relatively greater use of independent rather than dependent clauses.

As to whether individual trajectories in complexity or fluency over the two years were linear or not, little can be said. However, standard deviations (SD) do provide an indication of the degree of within-group variation. If we consider length of text as an example, the means and SDs for narratives over two years are: T1: 91.95, 45.14; T2: 103.18, 33.99; and T3: 132.86, 42.02; and for argumentative: T1: 97.68, 57.65; T2: 108.82, 36.73; and T3: 136.45, 43.91. Deviations from the mean are substantial. So, whilst the overall trend (the aggregate behaviour) is a linear increase in both complexity and fluency values, this may well obscure the variability of individual developmental paths suggested by emergentism (e.g. Larsen-Freeman, 2006).

Differences between the two genres appear to confirm the functional demands on text construction. In the argumentative genre, with its demand for the propositional and supportive content of sentences, there was a relatively higher proportion of complex sentences used over the two years, and consequently, not only was C/TU (as expected) higher than in narrative texts but also DC/C and DC/TU. In contrast, in narrative texts, TU/S was

significantly higher, indicating the greater use of coordination in the creation of descriptive writing, and to a lesser but significant degree, the inclusion of direct speech. The profile of specific clause usage for each genre also suggest clear functional differences; the relatively higher percentages of independent and relative clauses in narrative texts pertaining to descriptive and referential writing, the higher percentages of subordinate and nominal clauses in argumentative texts pertaining to its propositional content. These significant differences in the construction of genre are reflected in distinct differences in sentence variety, significantly so after two years.

In addition to argumentative texts being more syntactically complex, they also had consistently higher fluency values than narrative texts, with MLTU, as expected, significantly higher across the two years. Unexpected was any lack of difference in text length. Based on previous studies, narratives were anticipated to be significantly longer, but the MLT of argumentative texts over the two years was consistently higher, though not significantly so. This surprising result poses a question: If, premised on a cognitive/structural expectation, simpler syntactic constructions are easier to process, compute, and produce (thus leading to longer production units), why is it that narratives, with a far higher proportion of simple and compound sentences, were not, as a consequence, significantly longer than argumentative texts, with their higher frequencies of subordination? Perhaps the simplest explanation is that the degree of syntactic complexity in texts of both genres is too low to have any impact on text length. Over half the sentences in both are single-clause, and the majority of clauses used in both are independent. There are no strictly comparable studies against which to match our results, but the findings of Beers and Nagy (2009) strongly suggest an inverse correlation between complexity and text length. For argumentative essays, they found  $C/TU$  was 2.0,  $MLT$  141.5, while for narratives  $C/T$  was 1.5,  $MLT$  192.0. Our T3 data

present argumentative C/TU as 1.49, MLT 136.45, narrative C/TU 1.23, MLT 132.86, indicating lower levels of complexity (and overall fluency), and less difference between the genre values for both C/TU and MLT.

An alternative explanation is suggested by a qualitative issue with argumentative essays found by Beers and Nagy (2009): "many of the essays started with a sentence of the form 'I think X because Y', and many repeated this formula a number of times" (p. 197). The issue here is not simply stylistic. Language acquisition, as noted above, is argued to be associative and probabilistic, with formulaic construction intrinsic to learning and usage. In argumentative writing, these constructions may also have a compensatory function, the economy of repetition facilitating the ordering of conceptually demanding text. Hawkins (2009) suggests that, though there is an assumption that increases in the frequency of units, rules, and representations indicate greater complexity, there can be trade-offs so that simplicity in one part of text results in complexity in another. The textual patterning of argumentative texts over two years may represent a trade-off between complexity and fluency – a limited set of structures is repeated (with the practice effect possibly reinforcing the use of established formulaic constructions), the degree of cognitive complexity is reduced, and writers are able to produce a greater number of units in a limited time. This possibility clearly points to the need for a detailed investigation of formulaic language usage in the corpus, be it in the form of syntactic templates or multi-word chunks.

The investigation of genre differences is further complicated by the necessity to draw on findings from both L1 and L2 research. Silva (1993) notes that there are "salient and important differences" between L1 and L2 writing processes, and studies contrasting L1 and L2 texts by the same writers reveal unique structuring of their L2 compositions (Kohro, 2009). Hinkel (2011) points out that rhetorical and textual features may be subject to distinct

linguistic and cultural norms, and “it is crucially important that comparative analyses of discourse and language features employed in L1 and L2 prose be carried out on the basis of similar or proximate written genres” (p. 526). This, too, suggests a direction for further research.

### **Conclusion**

Our findings show very different patterns of longitudinal change in the production of L2 argumentative and narrative texts, with significant gains in the former limited to two measures of fluency, but significant gains in the latter reflected in seven complexity, fluency, and sentence variety metrics. These differences suggest greater constraints on the conceptual and syntactic structuring of argumentative writing at this level and the repetitive use of textual forms to achieve fluency. The findings argue for developmental models of language acquisition to not only take into account learners' syntactic proficiencies at the sentence level but also the efficacy of those proficiencies to enable successful engagement in genres at the level of discourse.

Significant differences between argumentative and narrative genres were highlighted in complexity ratios, and specific clause and sentence type usage. The unexpected similarity in text lengths of the two genres may be accounted for by the greater use of formulaic language in argumentative writing. This, and the need for comparisons with L1 texts of similar or proximate written genres, offers directions for future interrogation of the corpus.

Finally, the size of the corpus, the particular research design, the specificities of the pedagogic programs and the institutional environment which the learners experienced, and the dimensions of their individual L2 language experiences will inevitably limit the degree to which generalizations

can be drawn from the data. However, the observed relationships between syntactic complexity, fluency, and genres may be indicators of commonalities in text creation. Syntactic complexity can be viewed formally as a structural feature of language, yet the specific clause functions we have seen used and the sentence types created in the construction of text can be convincingly interpreted as a realization of Halliday's (1969) "fourth option": the logical structuring of functional text. Thus the construction of a complex sentence, for example, is not simply an arrangement of proposition and qualification that exists in isolation but a vital element in the purposeful creation of text, the probability of its creation contingent upon the writer's experiences, proficiencies, and active engagement with the expectations of genre.

We framed this research within four broadly-drawn approaches and our findings, as a whole, highlight the need to incorporate understandings of cognition, structure, function, and patterns of acquisition and usage into a coherent paradigm in order to fully appreciate L2 writing and its development.

### References

- Abbot-Smith, K. & Tomacello, M. (2006). Exemplar-learning and schematization in a usage-based account of syntactic acquisition. *The Linguistic Review*, 23, 275–290. doi:10.1515/TLR.2006.011
- Babyonyshev, M. & Gibson, E. (1999). The complexity of nested structures in Japanese. *Language*, 75, 423-450.
- Bader, M. & Häussler, J. (2012, March). *Constraints on center-embedding as revealed by corpus-data*. Paper presented at the Workshop on Formal Linguistics and the Measurement of Grammatical Complexity, University of Washington, Seattle, WA. Abstract retrieved from <https://depts.washington.edu/lingconf/abstracts/Bader&Haussler.pdf>

- Bardovi-Harlig, K., & Bofman, T. (1989). Attainment of syntactic and morphological accuracy by advanced language learners. *Studies in Second Language Acquisition*, 11, 17-34.
- Bazerman, C. (1988). *Shaping written knowledge: The genre and activity of the experimental article in science*. Madison, WI: University of Wisconsin Press.
- Beers, S. F. & Nagy, W. E. (2009). Syntactic complexity as a predictor of adolescent writing quality: Which measures? Which genre? *Reading and Writing*, 22, 185–200. doi: 10.1007/s11145-007-9107-5
- Beers, S. F. & Nagy, W. E. (2010). Writing development in four genres from grades three to seven: syntactic complexity and genre differentiation. *Reading and Writing*, 24, 183-202. doi: 10.1007/s11145-010-9264-9
- Berkenkotter, C. & Huckin, T. (1993). Rethinking genre from a sociocognitive perspective. *Written Communication*, 10, 475-509.  
doi: 10.1177/0741088393010004001
- Bhatia, V. K. (1993). *Analysing genre: Language use in professional settings*. Harlow: Longman.
- Bybee, J. (2008). Usage-based grammar and second language acquisition. In P. Robinson & N. C. Ellis (Eds.), *Handbook of cognitive linguistics and second language acquisition* (pp. 216-236). New York: Routledge.
- Cheung, H. & Kemper, S. (1992). Competing complexity metrics and adults' production of complex sentences. *Applied Psycholinguistics*, 13, 53-76.  
doi: 10.1017/S0142716400005427
- Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, Mass.: MIT Press.
- Crowhurst, M. (1980). Syntactic complexity in narration and argument at three grade levels. *Canadian Journal of Education*, 5, 6-13.
- Crowhurst, M. (1983). Syntactic complexity and writing quality: A review.

*Canadian Journal of Education*, 8, 1-16.

- Crowhurst, M. & Piche, G. L. (1979). Audience and mode of discourse: Effects on syntactic complexity in writing at two grade levels. *Research in the Teaching of English*, 13, 101-109.
- Culicover, P. W. & Nowak, A. (2003). *Dynamical grammar*. Oxford: Oxford University Press.
- Culicover, P. W., Nowak, A., & Borkowski, W. (2003). Linguistic theory, explanation and the dynamics of language. In J. Moore and M. Polinsky (Eds.) *The nature of explanation in linguistic theory*. Stanford, CA: CSLI Publications.
- Deng, X. (2005). A case study of task complexity and individual learner's oral production. *US-China Foreign Language*, 3, 49-54.
- Ellis, N. (2001). Constructions, chunking, and connectionism: The emergence of second language structure. In C. J. Doughty & M. H. Long (Eds.), *Handbook of Second Language Acquisition* (pp. 63-103). Oxford: Blackwell.
- Ellis, N. (2002). Frequency effects in language processing: A review with implications for theories of implicit and explicit language acquisition. *Studies in Second Language Acquisition*, 24, 143–188. doi: 10.1017/S0272263102002024
- Ellis, N. C. (2008). The dynamics of second language emergence: Cycles of language use, language change, and language acquisition. *The Modern Language Journal*, 92, 232-249. doi: 10.1111/j.1540-4781.2008.00716.x
- Ellis, N. C. & Larsen-Freeman, D. (2006). Language emergence: Implications for applied linguistics – Introduction to special issue. *Applied Linguistics*, 27, 558-589. doi: 10.1093/applin/aml028
- Ellis, N., Simpson-Vlach, R., & Maynard, C. (2008). Formulaic language in native and second language speakers: Psycholinguistics, corpus

- linguistics, and TESOL. *TESOL Quarterly*, 42, 375-396.
- Ellis, R., & Yuan, F. (2004). The effects of planning on fluency, complexity, and accuracy in second language narrative writing. *Studies in Second Language Acquisition*, 26, 59-84. doi: 10.1017/S0272263104261034
- Faigley, L. (1980). Names in Search of a Concept: Maturity, Fluency, Complexity, and Growth in Written Syntax. *College Composition and Communication*, 31, 291-300.
- Ferreira F. (1991). Effects of length and syntactic complexity on initiation times for prepared utterances. *Journal of Memory and Language*, 30, 2110-2233. doi: 10.1016/0749-596X(91)90004-4
- Foster, P. & Skehan, P. (1996). The influence of planning and task type on second language performance. *Studies in Second Language Acquisition*, 18, 299-323. doi: 10.1017/S0272263100015047
- Friederici, A. D., Fiebach, C.J., Schlesewsky, M., Bornkessel, I.D., & von Cramon, D. Y. (2006). Processing linguistic complexity and grammaticality in the left frontal cortex. *Cerebral Cortex*, 16, 1709-1717. doi:10.1093/cercor/bhj106
- Gibson, E. (1998). Linguistic complexity: Locality of syntactic dependencies. *Cognition*, 68, 1-76. doi: 10.1016/S0010-0277(98)00034-1
- Goldberg, A. E. (1995). *Constructions: A construction grammar approach to argument structure*. Chicago: University of Chicago Press.
- Guenther, S. & Knoblauch, H. (1995). Culturally patterned speaking practices: The analysis of communicative genres. *Pragmatics*, 5, 1-32.
- Halliday, M.A.K. (1969). Options and functions in the English clause. *Brno Studies in English*, 8, 81-88.
- Halliday, M. A. K. (1991). Language as system and language as instance: The corpus as a theoretical construct. In J. Svartvik (Ed.) *Directions in corpus linguistics: Proceedings of Nobel Symposium 82*, Stockholm,

- 4-8 August (pp. 61-78). Berlin: Mouton De Gruyter.
- Halliday, M.A.K., & Hasan, R. (1985). *Language, context and text: Aspects of language in social-semiotic perspective*. Geelong, VIC, Australia: Deakin University Press.
- Hanks, W. (1987). Discourse genres in a theory of praxis. *American Ethnologist*, 14, 668-692.
- Hawkins, J. A. (1994). *A performance theory of order and constituency*. Cambridge: Cambridge University Press.
- Hawkins, J.A. (2004). *Efficiency and complexity in grammars*. Oxford: Oxford University Press.
- Hawkins, J. A. (2009). An efficiency theory of complexity and related phenomena. In D. Gil, G. Sampson & P. Trudgill (Eds.) *Complexity as an evolving variable* (pp. 252-268). Oxford: Oxford University Press.
- Hawkins, J. A. (2012, March). *Two major contributions from formal linguistics to the complexity debate*. Paper presented at the Workshop on Formal Linguistics and the Measurement of Grammatical Complexity, University of Washington, Seattle, WA. Abstract retrieved from [https://depts.washington.edu/lingconf/abstracts\\_hawkins.php](https://depts.washington.edu/lingconf/abstracts_hawkins.php)
- Hillocks, G. (1986). *Research on written composition: New directions for teaching*. Urbana: ERIC Clearinghouse on Reading and Communication Skills.
- Hinkel, E. (2011). What research on second language writing tells us and what it doesn't. In E. Hinkel (Ed.) *Handbook of Research in Second Language Teaching and Learning, Volume 2* (pp. 523-538). New York: Routledge.
- Holland, J. H. (1992). Complex adaptive systems. *Daedalus*, 121, 17-30. Retrieved from <http://www.jstor.org/stable/20025416>
- Holland, J. H. (2006). Studying complex adaptive systems. *Journal of Systems Science & Complexity*, 19, 1-8. doi: 10.1007/s11424-006-0001-z

- Housen, A. (2002). A corpus-based study of the L2-acquisition of the English verb system. In S. Granger, J. Hung, & S. Petch-Tyson (Eds.), *Computer learner corpora, second language acquisition and foreign language teaching* (pp. 77-116). Amsterdam: John Benjamins.
- Hunt, K. W. (1965). Grammatical structures written at three grade levels. Champaign, IL: The National Council of Teachers of English, Research Report 3.
- Hyland, K. (1990). A genre description of the argumentative Essay. *RELC Journal*, 21, 66-78. doi: 10.1177/003368829002100105
- Hyland, K. (2003). Genre-based pedagogies: A social response to process. *Journal of Second Language Writing*, 12, 17-29. doi:10.1016/S1060-3743(02)00124-8
- Ishikawa, S. (1995). Objective measurement of low proficiency EFL narrative writing. *Journal of Second Language Writing*, 4, 51-70.
- Ishikawa, T. (2006). The effect of task complexity and language proficiency on task-based language performance. *The Journal of Asia TEFL*, 3, 193-225.
- Jackendoff, R. & Pinker, S. (2005). The nature of the language faculty and its implications for evolution of language (Reply to Fitch, Hauser, and Chomsky). *Cognition* 97, 211–225. doi:10.1016/j.cognition.2005.04.006
- Jackendoff, R. & Wittenberg, E. (2012, March). *Even simpler syntax: a hierarchy of grammatical complexity*. Paper presented at the Workshop on Formal Linguistics and the Measurement of Grammatical Complexity, University of Washington, Seattle, WA. Abstract retrieved from <https://depts.washington.edu/lingconf/abstracts/Jackendoff&Wittenberg.pdf>
- Just, M. A., Carpenter, P. A., Keller, T.A., Eddy, W. F., & Thulborn, K. R. (1996). Brain activation modulated by sentence comprehension.

- Science*, 274, 114-116.
- Kauffman, S. A. (1991). Antichaos and Adaptation. *Scientific American*, August, 78-84.
- Kohro, Y. (2009). A contrastive study between L1 and L2 compositions: Focussing on global text structure, composition quality, and variables in L2 writing. *Dialogue*, 8, 1-19.
- Kuiken, F., Mos, M., & Vedder, I. (2005). Cognitive task complexity and second language writing performance. *Eurosla Yearbook*, 5, 195-222. Amsterdam: John Benjamin.
- Langacker, R. W. (2008). Cognitive grammar as a basis for language instruction. In P. Robinson & N. C. Ellis (Eds.), *Handbook of cognitive linguistics and second language acquisition* (pp. 66-88). New York: Routledge.
- Larsen-Freeman, D. (1997). Chaos/complexity science and second language acquisition. *Applied Linguistics*, 18, 141-165.
- Larsen-Freeman, D. (2006). The emergence of complexity, fluency, and accuracy in the oral and written production of five Chinese learners of English. *Applied Linguistics*, 27, 590-619. doi: 10.1093/applin/aml029
- Lee, N., & Schumann, J. (2005, August). The interactional instinct: *The evolution and acquisition of language*. Paper presented at the Congress of the International Association for Applied Linguistics, Madison, Wisconsin.
- Lenneberg, E. H. (1967). *Biological foundations of language*. New York: John Wiley & Sons, Inc.
- Lieven, E. & Tomasello, M. (2008). Children's first language acquisition from a usage-based perspective. In P. Robinson & N. C. Ellis (Eds.), *Handbook of cognitive linguistics and second language acquisition* (pp. 168-196). New York: Routledge.

A Corpus-based, Longitudinal Study of Syntactic Complexity, Fluency, Sentence Variety, and Sentence Development in L2 Genre Writing (Nicholas Wood and Nicolai Struc)

- Lu, X. (2011). A corpus-based evaluation of syntactic complexity measures as indices of college-level ESL writers' language development. *TESOL Quarterly*, 45, 36-62. doi: 10.5054/tq.2011.240859
- MacWhinney, B. (1998). Models of the emergence of language. *Annual Review of Psychology*, 49, 199-227.
- MacWhinney, B. (2009). The emergence of linguistic complexity. In T. Givón & M. Shibatani (Eds.), *Syntactic complexity: Diachrony, acquisition, neuro-cognition, evolution* (pp. 405-432). Philadelphia: John Benjamins Publishing Company.
- Meltzer, J. A., McArdle, J. J., Schafer, R. J., & Braun, A. R. (2009). Neural aspects of sentence comprehension: Syntactic complexity, reversibility, and reanalysis. *Cerebral Cortex*, 20, 1853-1864. doi:10.1093/cercor/bhp249
- Miller, G. A. & Chomsky, N. (1963). Finitary models of language users. In R. D. Luce, R. R. Bush, and E. Galanter (Eds.) *Handbook of mathematical psychology, Vol. 2* (pp. 419-91). New York: John Wiley.
- Miller, J. H. & Page, S. E. (2007). *Complex adaptive systems: An introduction to computational models of social life*. Princeton, N. J.: Princeton University Press.
- Navés, T., Torras, M. R., & Celaya, M. L. (2003). Long-term effects of an earlier start: An analysis of EFL written production. In S. Foster-Cohen & S. Pekarek (Eds.), *Eurosla Yearbook*, 3, 103-130. Amsterdam: John Benjamin.
- Newman, A.J., Supalla, T., Hauser, P., Newport, E.L., & Bavelier, D. (2010). Dissociating neural subsystems for grammar by contrasting word order and inflection. *Proceedings of the National Academy of Sciences*, 107, 16, 7539-7544. doi: 10.1073/pnas.1003174107
- Nunberg, G., Briscoe, T., & Huddleston, R. (2002). Punctuation. In R.

- Huddleston & G. K. Pullum (Eds.), *The Cambridge Grammar of the English Language* (pp. 1724-1764). Cambridge: Cambridge University Press.
- Oostdijk, N., & de Haan, P. (1994). Clause patterns in modern British English: A corpus-based (quantitative) study. *ICAME Journal* 18, 41-79.
- Ortega, L. (2003). Syntactic complexity measures and their relationship to L2 proficiency: A research synthesis of college-level L2 writing. *Applied Linguistics*, 24, 492-518. doi: 10.1093/applin/24.4.492
- Perron, J. D. (1976). The impact of mode on written complexity: Part I - Third grade. Department of Language Education, *Studies in Language Education, Report 24*, 2-32. Athens, Georgia: University of Georgia.
- Perron, J. D. (1977). Written syntactic complexity and modes of discourse. *Annual Meeting of the American Educational Research Association*, New York, April, 1977.
- Plsek, P. E., & Greenhalgh, T. (2001). The challenge of complexity in health care. *British Medical Journal*, 323, 625-628.
- Polio, C. G. (1997). Measures of linguistic accuracy in second language writing research. *Language Learning*, 45, 101-143.
- Polio, C. (2001). Research methodology in second language writing research: The case of text-based studies. In T. Silva and P. K. Matsuda (Eds.), *On second language writing* (pp. 91-115). Mahwah, NJ: Lawrence Erlbaum.
- Purcell-Gates, V., Duke, N. K., & Martineau, J.A. (2007). Learning to read and write genre-specific text: Roles of authentic experience and explicit teaching. *Reading Research Quarterly*, 42, 8-45. doi:10.1598/RRQ.42.1.1 Retrieved from: <http://www.reading.org/>
- Ramanathan, V. & Kaplan, R. B. (2000). Genres, authors, discourse communities: Theory and application for (L1 and) L2 writing instructors. *Journal of Second Language Writing*, 9, 171-191.

A Corpus-based, Longitudinal Study of Syntactic Complexity, Fluency, Sentence Variety, and Sentence Development in L2 Genre Writing (Nicholas Wood and Nicolai Struc)

- Rimmer, W. (2006). Measuring grammatical complexity: the Gordian knot. *Language Testing*, 23, 497–519. doi:10.1191/0265532206lt339oa
- Rimmer, W. (2009). Can What Counts in Complexity Be Counted? In L.J. O'Brien & D.S. Giannoni (Eds.), *Language Studies Working Papers, 1*, 25-34. Reading: University of Reading.
- Seegars, J. C. (1933). The form of discourse and sentence structure. *Elementary English*, 10, 51-54.
- Sidman, M. (1960). *Tactics of scientific research*. New York: Basic Books, Inc.
- Silva, T. (1993). Toward an understanding of the distinct nature of L2 writing: The ESL research and its implications. *TESOL Quarterly*, 27, 657-677.
- Sinnemäki, K. (2012, March). *What is complexity?* Paper presented at the Workshop on Formal Linguistics and the Measurement of Grammatical Complexity, University of Washington, Seattle, WA. Abstract retrieved from <https://depts.washington.edu/lingconf/abstracts/Sinnemaki.pdf>
- Stomberg, L. & Kurth, R. J. (1982). Mode of Discourse Effects on Written Syntactic Complexity. *American Reading Forum*, 2, 113-115. Retrieved from [http://www.americanreadingforum.org/Yearbooks/82\\_yearbook/pdf/56\\_Stomberg.pdf](http://www.americanreadingforum.org/Yearbooks/82_yearbook/pdf/56_Stomberg.pdf)
- Struc, N., & Wood, N. (2009). Using a learner corpus to develop language profiles. *Reitaku Review*, 15, 53-82.
- Struc, N., & Wood, N. (2010). A corpus-based analysis of Japanese university-level learners' L2 writing development over a one-year period. *Reitaku University Journal*, 90, 155-183.
- Struc, N. & Wood, N. (2011). A corpus-based investigation of syntactic complexity, fluency, sentence variety, and sentence development in L2 genre writing. *Reitaku University Journal*, 93, 45-79.
- Swales, J. (1990). *Genre analysis*. Cambridge: Cambridge University Press.
- Szmrecsányi, B. M. (2004). On Operationalizing Syntactic Complexity. *JADT*

- 2004: Journées internationales d'Analyse statistique des Données Textuelles, 7, 1031-1038.
- Van Geert, P. & Steenbeck, H. (2008). Understanding mind, brain, and education as a complex, dynamic developing system: Measurement, modelling, and research. In A. M. Battro, K. W. Fischer, and P.J. Léna (Eds.), *The Educated Brain: Essays in Neuroeducation* (pp. 71-94). Cambridge: Cambridge University Press.
- Verspoor, M. H., Lowie, W. M., & de Bot, C. L. J. (2009). Input and second language development from a dynamic perspective. In T. Piske and M. Young-Scholten (Eds.), *Input Matters in SLA* (pp. 62-80). Bristol: Multilingual Matters.
- Voss, M. J. (2005) Determining Syntactic Complexity Using Very Shallow Parsing. CASPR Research Report. Artificial Intelligence Center, The University of Georgia, Athens, Georgia.
- Waldrop, M. M. (1992). *Complexity: The emerging science at the edge of order and chaos*. London: Penguin.
- Warren, T. & Gibson, E. (2002). The influence of referential processing on sentence complexity. *Cognition*, 85, 79-112. doi: 10.1016/S0010-0277(02)00087-2
- Waskita, D. (2008). Differences in men's and women's ESL academic writing at the University of Melbourne. *Jurnal Sosioteknologi*, 14, 448-463.
- Waugh, L. R. (1995). Reported speech in journalistic discourse: The relation of function and text. *Interdisciplinary Journal for the Study of Discourse*, 15, 129–173. doi:10.1515/text.1.1995.15.1.129
- Wolfe-Quintero, K., Inagaki, S., & Kim, H-Y. (1998). Second language development in writing: Measures of fluency, accuracy & complexity. Honolulu: University of Hawai'i Press.
- Xinhua, Z. (2008). Is syntactic maturity a reliable measurement to investigate

A Corpus-based, Longitudinal Study of Syntactic Complexity, Fluency, Sentence Variety, and Sentence Development in L2 Genre Writing (Nicholas Wood and Nicolai Struc)

the relationship between English speaking and writing? *The Asian EFL Journal*, 10, 133-153.

Yau, M. S. S. & Belanger, J. (1984). The influence of mode on the syntactic complexity of EFL Students at three grade levels. *TESL Canada Journal/Revue TESL du Canada*, 2, 65-76. Retrieved from <http://www.teslcanadajournal.ca/>