Unfolding choices in digital writing: A functional perspective on the language of academic revisions

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Abstract: To date, research into functional descriptions of unfolding language has been almost entirely focused on speech. And whilst writing research has examined the revision of language units, it has backgrounded how these revisions contribute to the unfolding of a text's meanings. Therefore, using Systemic Functional Linguistics (SFL) as an underlying framework, and keystroke logging software (Inputlog) as a data collection tool, this paper takes a first step toward a dynamic description of written text in terms of the language structures, functions, and systemic choices found in the written revisions of two 2nd year UK undergraduates.

More specifically, in detailed textual analysis of four unfolding, digitally composed text, whose end products totalled approximately 1700 words, this paper focuses on the revisions made during consecutive writing sessions, which lasted anything from 8mins to 8hrs 37mins and totalled 56hrs 18mins of recordings. The findings suggest that certain language choices may play a key role when it comes to shaping academic essays, and it is proposed that this new model of analysis can provide an additional perspective on writing behaviour in terms of how meaning-making practices unfold in real time.

Keywords: Keystroke logging, revision, SFL, academic writing, computer composition

journal of WRITING RESEARCH

Bowen, N. (2019). Unfolding choices in digital writing: A functional perspective on the language of academic revisions. *Journal of Writing Research, 10*(3), 465-498. https://doi.org/10.17239/jowr-2019.10.03.03

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1. Introduction

In text linguistics, written text is often perceived as equivalent to speech, as if it was conceived of and realized in a single instance, rather than the product of hours, days, weeks, perhaps even years of deliberation, reflection, and revision. As Prior (2009) highlights:

> '[e]ven in some of the richest theoretical and empirical work, there remains a tendency to freeze writing [...] to see writing as a noun rather than a verb.' (p.22)

For example, although O'Donnell (2013), and others (Coffin & Donahue, 2012), highlight that Systemic Functional Linguistics (henceforth SFL) has the potential to examine written text as process (dynamic descriptions of paradigmatic choice), SFL research into text as process has concentrated almost exclusively on speech (O'Donnell, 1999; Ventola, 1987; Yang, 2010). Whilst those who have explored the unfolding of meaning (or logogenesis in SFL terms) have done so in relation to finished texts (Clarke, 2016; Klein & Unsworth, 2014). Keystroke logging software, however, has the potential to open up this area of investigation, where software such as Inputlog (Leijten & Van Waes, 2013), for example, allows an analyst to examine the unfolding of language features, functions, and meanings in written text in real-time, in a similar manner to examining unfolding speech via transcripts. This means that we can examine written changes in a text in terms of their sequence, location, form, and function. And because we can examine the writing process from start to finish, we are able to see choices that may not make it into the final draft, such as the initial form of a rephrased sentence, or a word that was deleted or substituted for another word.

Therefore, this study takes up the challenge of studying the language of written text as a dynamic artefact by bringing together two disparate yet complimentary approaches: a process methodology – Inputlog (Leijten & Van Waes, 2013) and an 'appliable' linguistic theory – SFL (Halliday, 2009). In bringing these approaches together, the study explores how two student writers shape the linguistic features (or meaning-making potential) of their texts in real-time. It does this by assuming that unfolding language choices in written text can be examined, in part, by exploring revisions at the morpheme level and above: i.e. the rank units of lexicogrammar as outlined in SFL (Halliday & Matthiessen, 2013). Ultimately, it seeks to explore the following questions:

a. What role do language choices play when revising academic text?

b. What can a dynamic description tell us that a synoptic description cannot?

2. Literature review

Over the past three decades, digital innovations have transformed how we interact, do commerce, and how we search for, access, and present information. However, the

traditional view of 'literacy' privileges alphabetic forms – e.g., words and their sequences — and is primarily a document-centric view that promotes a start-to-finish understanding of writing. This is somewhat at odds with the increasing prominence of digital text, where what constitutes a page is radically transformed via 'live' information (Kress, 2003, p.3). Moreover, as Trupe (2002) argues, digitally composed text draws on new ways of writing, where writers can represent themselves and their knowledge in a myriad of ways, ranging from words on a page to embedded charts, images, sounds, and the ability to use motion, zoom, and spatial arrangements (e.g., Prezi). In such dynamic workspaces, ideas, and the relationships between them, may be more representative of actual (non-sequential) thought patterns.

In writing, however, non-linear thought patterns need to be transformed into linear, sequential arrangements, where the organization of text and 'pointers' within that text tell us (the reader) where to look for connections and related ideas (Hyland, 2005). Research into these sequential arrangements of words in texts is extensive, and include quantitative (Biber, 2006), qualitative (Frances Christie, 2012), and increasingly both quantitative and qualitative investigations (Nesi & Gardner, 2012). These disparate, yet connected research programs are far-reaching, and have been invaluable in showing us how academic texts show discernible linguistic patterns that can be modelled in terms of registerial variation, communicative purpose, discourse 'moves', language functions (Frances Christie, 2012) and language structures (McCabe & Gallagher, 2008; Parkinson & Musgrave, 2014). Such research has shown that, although there are many differences between the texts of experienced writers and student writers (Aull & Lancaster, 2014; Gardner & Nesi, 2013; Thompson, 2009; Uccelli, Dobbs, & Scott, 2013), there are features common to both: namely, complex noun phrases or nominal groups (McCabe & Gallagher, 2008; McNamara, Crossley, & McCarthy, 2010; Nesi & Gardner, 2012), and abstract and impersonal markers such as conjunctions, passives, and post nominal/adverbial clauses (Biber & Conrad, 2009). However, there is little text linguistic based research into how these features are involved in the evolution of text from a blank page to a fully articulated meaning-making product.

One exception was O'Donnell (2013), who made tentative inroads with his study on the unfolding of discourse semantic structures. Drawing on three discourse semantic frameworks commonly used in text linguistics, O'Donnell (2013) used keystroke logging software (KSL) as a means to model text organization as it unfolded. O'Donnell's goal was to show how written text was an evolving process (dynamic) rather than a creationary product (synoptic) -- I use the term 'synoptic' here, and in following sections, to mean the analysis of text/language as a finished, complete product, rather than the analysis of text/language as an incomplete, unfolding process (dynamic). And I reserve the term 'process' in its traditional sense as it is used in writing process research; i.e. to refer to the activities and mechanisms involved in writing (planning, revision, etc.). Although O'Donnell's study involved relatively short, simple texts (>500 words each), it highlighted how unfolding meaning could be modelled dynamically. However, it also highlighted how analysing unfolding meaning in writing

can be very complex. Specifically, he had to modify what was essentially a discourse semantic framework designed for synoptic texts so that it could account for the non-linearity of computer composition. This involved complex modifications incorporating multi-nuclei and additional schemas with right branching bias, making his analysis quite cluttered.

In terms of writing process research, many studies have looked at how revision affects unfolding language choices. Fitzgerald (1987), for example, highlighted how local revisions made by novice writers can negatively affect higher level rhetorical functions (e.g. discourse organisation and flow), as they focus on surface level corrections rather than connections between stretches of text. Similarly, Flower et al. (1986) show how novice writers prefer a Detect/Rewrite strategy, while experienced writers prefer a Diagnose/Revise strategy. Campbell, Smith, and Brooker (1998) found that early undergraduates focused on form (spelling, punctuation and agreement) rather than meaning (semantic inconsistencies), as did Hacker, Plumb, Butterfield, Quathamer and Heineken (1994); whilst Piolat, Roussey, Olive, and Amada (2004) note how many students lack the ability to revise for improved coherence. And whilst Levy and Ransdell (1996) observed that higher rated essays were associated with 40% more reviewing and revision time, they also admit that their measures of text quality were relativistic and holistic. Overall, as Rijlaarsdam, Couzijn, and Van den Bergh (2004) note, 'revision in itself is not the decisive factor of text quality' (p.190), and, as evidenced in Galbraith and Torrance (2004), it may well be that 'poor' planners compensate with stronger revision skills, whereas 'good' planners may not need strong revision skills.

Mixed results aside, research into revision activity has been invaluable in developing our understanding of the writing process, and great inroads have been made into developing complex, multidimensional revision taxonomies to assist us in this understanding. Faigley and Witte's (1981) early taxonomy, for example, demarcated surface changes (form or meaning-preserving changes) and text-based (meaning) changes (microstructure or macrostructure changes). Whilst their paper made a valuable contribution, their taxonomy relied heavily on subjective judgements as to whether the writer meant to infer something or not, and their categorization of macrostructure changes seems to blur the line between revision and redraft/rewrite. Moreover, it was based on pen and paper composition which, as argued above, is radically different from digital composition. Consequently, several studies have modified this initial proposal and suggested taxonomies of computer-based revisions that are less subjective, and include revision location (based on the point of inscription), action (addition, deletion, substitution, etc.), domain (language unit affected) and orientation, or purpose, of revision in terms of preserving or changing meaning and/or form (e.g., Lindgren & Sullivan, 2006; Stevenson, Schoonen, & de Glopper, 2006).

Lindgren and Sullivan (2006), for example, outlined a detailed taxonomy based on KSL data and stimulated recall. As per Faigley and Witte (1981), they also made a

distinction between meaning-preserving and meaning-changing, and micro and macro revisions, yet they added a further distinction in terms of precontextual revisions:

> 'revisions at the point of transcription [...] that occur when the writer notices and decides something that has just been or is in the process of being transcribed needs adjusting.' (p.161)

and contextual revisions:

> 'undertaken when writers move away from the point of transcription to insert new text or to delete, substitute, or rearrange already written text.' (p.171)

Whilst coding revisions according to the leading edge seems logical, their terminology suggests a demarcation between planning/reviewing (what they deem 'contextual') and realization/transcription (what they deem 'precontextual'). Also, such a bifurcation does not consider the kind of movement a writer is making; i.e. is the writer moving forwards or backwards, and how far from the point of inscription are they moving?

Stevenson et al.'s (2006) taxonomy also made a distinction between external and internal revisions: external being changes observed in text (via KSL data), and internal being those reported in verbal protocols. In contrast to the LS Taxonomy, though, they adopted more transparent terminology, and it is used here as means to situate this study's classification of revisions.

The present study, then, seeks to build upon, and not replace, these previous taxonomies. Consequently, in many instances, it covers the same concerns as those outlined above. However, because of the data collection method – naturalized, non-experimental, and across several sessions/days – and the use of a fully developed theory of language (SFL) to situate language choices, it modifies and adds to these taxonomies in the following ways: (1) it only examines 'external revisions' (for reasons explained in the methodology section); (2) the current study focuses on unfolding meaning, and thus does not analyse any unit smaller than a morpheme. This means that false starts, incomplete words, typos, and form/spelling changes are not included; (3) because these previous studies involved just one writing session per writer, they were restricted in terms of examining only one draft; in the present study, two writers composed over multiple sessions, so the taxonomy of Revision Location (using Stevenson et al.s' term) incorporates revisions made during proofreading or subsequent drafting; i.e., those made ahead of the point of inscription, and further divides them based on movement within or between functional units (cf. Bowen & Van Waes, submitted, for a detailed breakdown). These functional units are based on a modified view of SFL's Theme. This modified view attempts to account for the management of how information is sequenced and organized in complex texts such as arguments. In this light, it also builds upon Spelman Millers' (2002) work on 'framing devices' as measures of revision placement, which, itself, drew on basic notions of Theme espoused in SFL.

Further comparisons can be made in terms of Stevenson et al.'s (2006) Revision Action, which they used to refer to addition, deletion, substitution, etc. In this study, Action can

be seen in the unfolding of choices (relative frequencies) in the discussion of dynamic text, where functions/meanings are either added/deleted or substituted. Similarly, Stevenson et al.'s Orientation (meaning preserving/changing) is modelled here in terms of retention ratios (RR) of unfolding functional choices; while Domain (revision units) is modelled in terms of 5 rather than 3 divisions, which are based on SFL's model of constituency (rank scale):

clause complex ←→ clause ←→ phrase/group ←→ word ←→ morpheme

The following section introduces the methodology that brings together KSL and SFL (expounded in Bowen & Van Waes, submitted). Following this, the results and discussion are merged on the basis that analysis was inductive, and thus it seemed more practical to present quantitative and qualitative findings together. The final section concludes the paper by situating the findings and provides suggestions for further research.

3. Methodology

3.1 The role of linguistic theory

In terms of text analysis, the study draws on SFL's overarching principle that language is a meaning-making resource. This principle is centred on the concept of paradigmatic choice as realized in system networks. An example of a basic system, POLARITY, is shown in Figure 1:

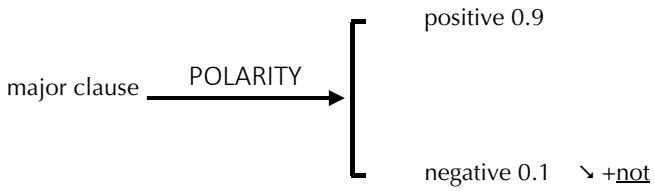


Figure 1: English POLARITY (from Halliday, 2009, p.65).

POLARITY has two features: 'positive' or 'negative'. The system also shows two further properties: (1) a feature's realization (indicated by a downward facing arrow), and (2) relative probabilities (in this instance, skewed toward positive). It also shows the entry condition is "major clause", and the arrowhead next to this indicates movement from left to right, symbolizing the process aspect of systems. This principle of paradigmatic choice means we describe the system and not just the realization (syntagm):

> '[w]e do not describe "negative", or "negation" [...] we describe POLARITY. […] We do not describe the "definite article"; we describe the system of NOMINAL DEIXIS [i.e. DETERMINATION]. And so on.' (Halliday, 2009, p.66)

SFL's second principle is that it sees language as a semiotic system that has evolved four functions: (1) the experiential, through which we construe experience or our naturalized reality; (2) the logical, through which we construe logical relations between entities, figures, or meanings; (3) the interpersonal, which serves to enact personal and social relationships; and (4) the textual, which maps the experiential (language as reflection), logical (language as iteration), and interpersonal (language as action) on to one another and on to the context in which language is being used. This means that each syntagm can be analysed for up to four separate strands of meaning, as shown in Figure 2:

<table>
<tr><td></td><td>Well,</td><td>usually</td><td colspan="2">means</td><td>mostly</td><td>or</td><td>regularly.</td></tr>
<tr><td>experiential</td><td></td><td>Token</td><td colspan="2">Process</td><td>Value</td><td></td><td>Value</td></tr>
<tr><td>logical</td><td></td><td></td><td colspan="2"></td><td></td><td>Conj</td><td></td></tr>
<tr><td rowspan="2">interpersonal</td><td rowspan="2"></td><td colspan="2">Mood</td><td colspan="2">Residue</td><td rowspan="2"></td><td>Residue</td></tr>
<tr><td>Subject</td><td>Finite</td><td>Predicator</td><td>Complement</td><td>Complement</td></tr>
<tr><td rowspan="2">textual</td><td colspan="2">Theme</td><td colspan="4" rowspan="2">Rheme</td></tr>
<tr><td>Textual</td><td>Topical</td></tr>
<tr><td>syntagm</td><td>Conjunction group</td><td>Adverbial group</td><td colspan="2">Verbal group</td><td>Adverbial group</td><td>Conj.</td><td>Adverbial group</td></tr>
</table>

Figure 2: Clause with four metafunctional strands of meaning (adapted from Halliday & Matthiessen, 2013, p.212).

Thus, whilst some constituents have multiple meanings and roles (e.g., 'usually' is a Token in experiential terms, Subject in interpersonal terms, and a topical (or Subject) Theme in textual terms), others have limited functions (e.g., 'or' only expresses logical meaning). These choices are represented in systemic terms at the intersection of rank (constituent) and function, and will be illustrated in upcoming sections where necessary.

3.2 The role of Keystroke logging

In terms of revision mechanics, the study draws on KSL software called Inputlog (Leijten & Van Waes, 2013). It records inputs made by a user (e.g., key presses), and logs these inputs against a time stamp. This study uses Inputlog to examine the frequencies of revisions, their position within text, movements between points of inscription (cf. Bowen & Van Waes, submitted), and ultimately the language choices being made.

Furthermore, although studies have used KSL's playback facility to implement stimulated recall interviews, allowing them to theorise about internal revisions, this study only focuses on external revisions. This decision was made because sometimes the writers worked spontaneously at various locations, and sometimes worked late at night, meaning that it was impractical to implement stimulated recall sessions directly after writing sessions.

3.3 Participants

Participants were two 19 year-old native speaking English females enrolled on the 2nd year of a BA in English language and literature at a UK university. To control for knowledge of genre, subject matter, and language fluency, participants were screened for having a 'high' achievement level (avg. of +65% in essays), and being free from any language impairments.

3.4 Raw data

One genre-family was selected for analysis: the Essay (Nesi & Gardner, 2012). This was a form of purposive sampling as it is both a high-stakes genre and the most frequently produced text-type across levels and disciplines at university.

Two types of data were collected:

Product data: Finished texts and grades

This data represented the students' final draft(s) of each essay, which they also handed in as part of their undergraduate assessment. All four essays were classified as Arguments, as they took the recognizable pattern of claim(s), evidence, and conclusion(s). Three essays discussed sociolinguistic concepts, and one the development of English. JD wrote three essays; BB wrote one. All four essays received grades over 70%[1].

Process data: Writing episodes

This data represented each student's interactions with their computer. It consisted of Inputlog recordings or 28 idfx files, or 56hrs 18mins of computer-based activity (11hrs 40mins of which was spent within MS Word). These files were anonymised as per the product data and used to generate other file types (.xml, .txt, etc.) using Inputlog's various analysis functions.

To prepare data for analysis, idfx files were filtered for activities that did not relate to the task of composing. For example, if a writer took a break to browse social media, this was coded as 'downtime' (Leijten, Van Waes, et al., 2014). Typos, spelling mistakes, and false starts were also omitted; only deletions, insertions, and substitutions made at, or above, the morpheme level were coded as functional revisions.

3.5 Data analysis

Text linguistics (bottom-up perspective) was used in tandem with discourse analysis (top-down perspective); both perspectives were informed by SFL, drawing on functional grammar (Halliday & Matthiessen, 2013) and discourse semantics (Martin & Rose, 2007). The analysis mapped functions (ideational, interpersonal, textual, and logical) across ranks (clause complex, clause, phrase/group, word, and morpheme).

The finished essays were initially coded in terms of a thematic analysis. This resulted in a set of 'synoptic texts' based on THEME/RHEME choices. This allowed revisions to be coded in terms of movement between functional positions related to textual meanings (i.e., the organization of information). This research is reported elsewhere (Bowen & Van Waes, Submitted). A snapshot of a synoptic text is shown in Figure 3:

T-unit	Point of departure: THEME ➡➡		⬅⬅⬅⬅⬅⬅⬅ Development of clause: RHEME		Theme selection			
	Theme	Subject Theme	Rheme	N-Rheme	text	Int.	Prog	M/U
1		Research	has looked at	how it has an effect on our daily interactions with family and friends.			HT	
2i	Although	there	are	many aspects of politeness,	+	-	EC	-
2ii		I	am particularly	interested in looking at face-threatening acts	-	-	-	-
2iii	and how	they	are	mitigated.	+	-	⎙	-

Figure 3: A synoptic text analysed for THEME/RHEME choices.

These synoptic texts were then 'transformed' into dynamic texts. This was done by using the Inputlog data to (re)enter linguistic realizations at the morpheme level and above that the writer had deleted during composition. This was a means to reconstruct the text's history of functional inscriptions. Specifically, Inputlog's 'Analyse' function was used to generate the following files for each dataset: Linear analyses, Revision matrix, and S-notation (Kollberg, 1998). This resulted in XML files that gave detailed information on mouse movements and keys pressed (linear analysis) deletions and insertions made (revision matrix), and locations where revisions were made (S-notation). In combination with Inputlog's playback facility, these files helped to (re)construct a detailed picture of what each writer externalised.

Once revision activity was isolated, revisions were then coded for rank (language unit), function (meaning), and systemic choice. To increase the robustness of the coding, I used the lexicogrammatical systems found in various SFL publications (Halliday & Matthiessen, 2013; Matthiessen, 1995). By cross-referencing rank with function, I could pinpoint which system(s) the revision involved. For example, consider revision 82 from BB:

T-unit	Content
21iv	and helped ensure the continued use of [82]{~~vernacular~~}$_{FP}$ {82} English [83]{~~at times~~}$_{FP}$ {83} during times it was greatly threatened, such as during the Norman Conquest.

Figure 4: Revision 82 (BB).

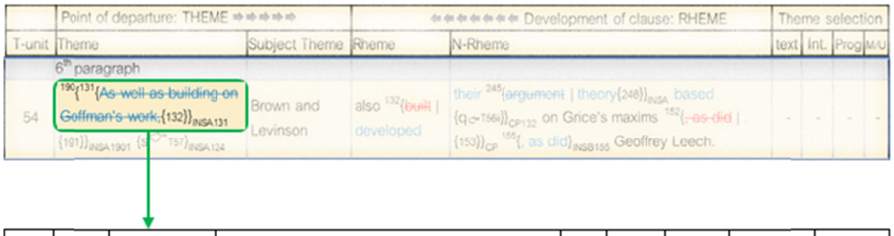
In terms of rank, revision 82 affects the nominal group, [the continued use of vernacular English]$_{NGrp}$. Functionally, it is experiential, because it orients to field (the construal of reality) as it deletes the modifier 'vernacular'. In terms of systemic choice, cross-referencing rank (nominal group) and function (experiential) tells us that this revision concerns one of the systems located in the corresponding square in Figure 5:

Rank	Class	Logical	Experiential	Interpersonal	Textual	(cohesive)
Clause			⇩			
group / phrase	nominal	→	THING TYPE, NUMERATION, CLASSIFICATION EPITHESIS & QUALIFICATION			
	verbal					
	adverb					
	prep.					
word						
info. unit						
tone grp						
		complexes	simplexes			

Figure 5: Function-rank matrix.

By a process of elimination, we know that 'vernacular' is not a Qualifier (QUALIFICATION) nor is it a head noun (THING TYPE) due to the syntax. Similarly, in terms of semantics, we know that is not a Numerative (NUMERATION). Therefore, it is either an Epithet or a Classifier. Upon closer examination, it is functioning as a descriptive modifier (EPITHESIS) rather than a categorizing modifier (CLASSIFICATION), and is thus coded as such.

The revision number (sequence), location (T-unit), content, linguistic analysis (rank, function, systemic choice), and type (movement) were extracted from the dynamic texts and entered in to a 'Revision analysis matrix' for each dataset, as shown in Figure 6:



Rev	T-unit	Content	Description	Loc.	Type	Rank	Function	System
131	54	As well as building on Goffman's work,	Adds 'As well as ...' = ~minor TRANSITIVITY: +[Circumstance ((non-finite clause): extending: accompaniment: additive], and = ~THEME SELECTION: +[marked Theme ((fronted dep. Clause)]	T	INSA	Phrase Clause	Exp. (+) Text. (+)	minor Theme

Figure 6: Creating a revision analysis matrix.

In Figure 6, the 1st column lists the revision number, the 2nd lists the T-unit where the revision took place, the 3rd contains the revision's content, the 4th the qualitative analysis, and so on. This matrix (Excel spreadsheet) was used to explore and quantify revision data.

4. Results and discussion

4.1 Part 1: Language choices in revision activity: a synoptic approach

In this section we look at revision as an end product. I.e., we take a synoptic approach to a dynamic process. We begin with a brief look at revisions to language structures, and then move on to functions involved in revisions. We end the section by looking at systemic choice in revision activity.

Figures 7 to 10 show a breakdown of language structures (constituents) involved in revision activity for each dataset:

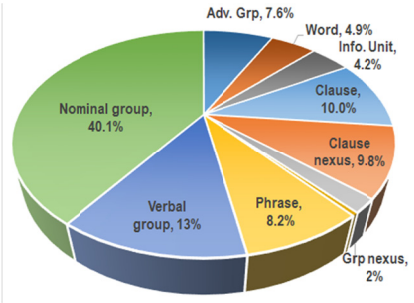


Figure 7: Revisions to constituents in JD1.

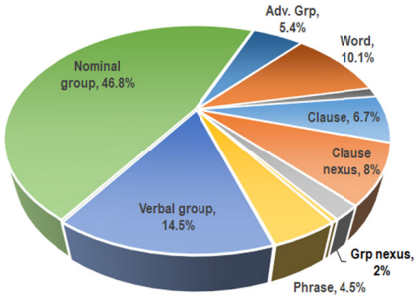


Figure 8: Revisions to constituents in JD2.

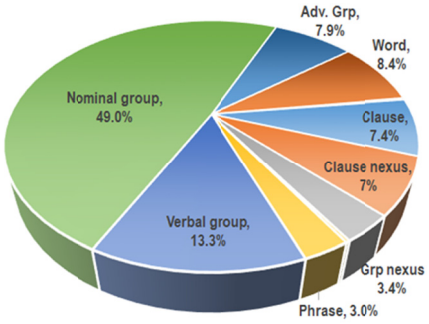


Figure 9: Revisions to constituents in JD3.

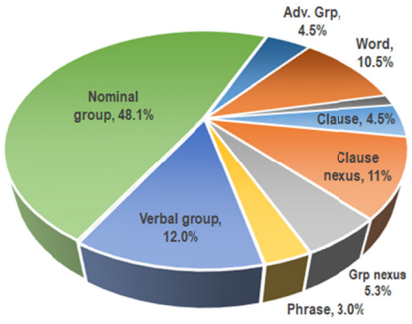


Figure 10: Revisions to constituents in BB.

From a total of 1428 revisions, 651 revisions involved the nominal group (NGrp), and figures 7 to 10 show that NGrp revisions ranged from 40.1% (n = 180) in JD1 to 48.1% (n = 64) in BB, with an average of 46.15% (*SD* = 4.2%). The second most frequently revised unit was the verbal group (VGrp, n = 192), which ranged from 12.03% (n = 16) in BB to 14.54% (n = 65) in JD2, with an average of 13.2% (*SD* = 1.1%). The frequencies for other constituents varied between datasets.

We now move on to functional choice in revision activity; Table 1 shows frequency counts for each dataset in terms of the four functions outlined in SFL and introduced above:

Table 1: Frequency of revision functions

	JD1		JD2		JD3		BB		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%
Experiential	211	46.99	225	50.34	235	58.90	66	49.62	737	51.46
Logical	58	12.92	53	11.86	49	12.28	24	18.05	184	13.78
Interpersonal	43	9.58	67	14.99	22	5.51	10	7.52	142	9.40
Textual	137	30.51	102	22.82	93	23.31	33	24.81	365	25.36
Total	449	100	447	100	399	100	133	100	1428	100

Table 1 shows that the number of experiential revisions (n = 737) is more than the other functions combined (n = 691), and ranges from 47% (n = 211) in JD1 to 58.9% (n = 235) in JD3, with an average across datasets of 51.46% (*SD* = 5.16%). This finding is perhaps unsurprising because the experiential function concerns the construal of experience (clause as representation), and academic text relies heavily on an accurate representation of the writer's (naturalized) reality to make sense to the reader (Halliday, 1998). Furthermore, experiential meanings are prototypically realized through segmental structure, which 'is the simplest kind of structure' (Halliday & Matthiessen, 2013, p.85); for example, the prosodic structures favoured by interpersonal meanings,

and the culminative structures favoured by textual meanings, are often 'tied' to other functions within the clause. Therefore, it may be the case that increased complexity in revising these other functions (or the structures they represent) is so demanding that it results in them being less frequent, and/or it may be that the seemingly easier experiential structures (or need to add content) draws the writer away from such concerns. Alternatively, it may be that other meanings are added in the planning or pre-drafting stage – as may be the case with textual meanings, for example, as they are key enablers of the organization of the other meanings (i.e. the text as a gestalt unit), as we shall see below.

Figures 11 to 14 visualize the data from Table 1:

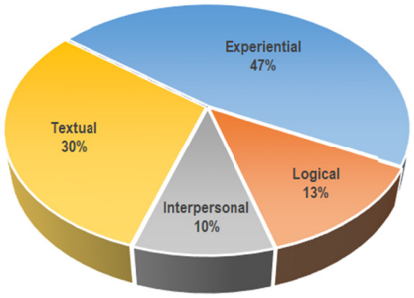


Figure 11: Functional choice in JD1.

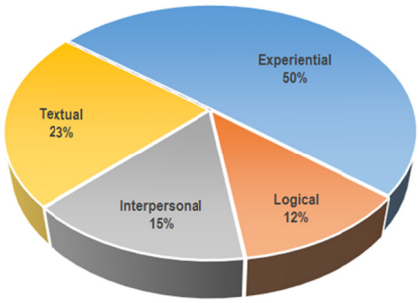


Figure 12: Functional choice in JD2.

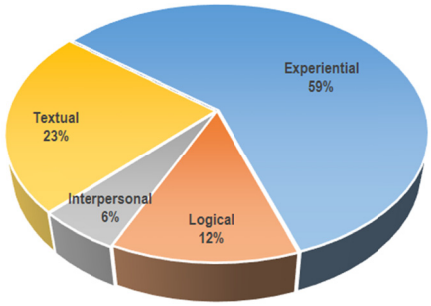


Figure 13: Functional choice in JD3.

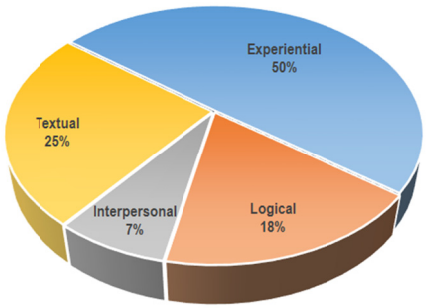


Figure 14: Functional choice in BB.

Figures 11 to 14 show how textual revisions were the second most frequent, ranging from 22.8% (n = 102) in JD2 to 30.5% (n = 137) in JD1, with an average of 25.4% (*SD* = 3.54%). Within SFL, the textual function mainly concerns the 'clause as message'. Consequently, it is often cited as an enabling function, bringing together other meanings in a given environment (Halliday & Matthiessen, 1999, p.398). There are numerous reasons as to why a writer would attend to textual meanings. Perhaps key

amongst them is the transformation from writer to reader, which can induce a writer to realign a text towards its intended purpose, making it easier for the reader to understand, follow, and, ultimately, accept or reject a premise (Lindgren et al., 2011). For instance, consider Example 1:

T-unit	Content
7	It has marked a woman's genitals with an internet map marker, frequently used on Facebook to check in to a place or destination.
8	[95]{By using social media, | ~~it uses~~ {95} | it gives}$_{CP}$ a sense of relating to the whole population.

Example 1: Revision that increases readability/understanding (JD3)

In this example, part of revision 95 adds 'By using social media'. This phrase functions as a marked Theme and a circumstance of enhancement (manner: means).

Moving to logical and interpersonal revisions, Figures 11 to 14 show their involvement in revision fluctuates between texts.

Logical meanings signify relations between complexes, and are realized via univariate, iterative structures (typically clause complexing). However, logical meanings also contribute to the textual function in several ways. For example, by sequencing tactic relations a writer can: (1) choose which element is given thematic prominence; (2) change what they present as New/Given, and (3) engender choices in cohesive relations via ellipses/substitution. Consequently, a logical revision is often tied to a revision in a textual system such as THEME, ELLIPSIS, INFORMATION, etc. Consider Example 2:

T-unit	Content
32	[47]{~~According to Bernstein this~~ | This}$_{CP}$ would mean the literacy practices learnt by children in the working-class communities{47} did not prepare them well for mainstream literacy practices in school.

Example 2: Change in logical meaning accompanied by a change in THEME (JD2)

Here, revision 47 deletes 'According to Bernstein', which represents four systemic choices: (1) a change in MINOR TRANSITIVITY (experiential): -[Circumstance (↘non-finite hypotactic clause): angle: source]; (2) a change in TAXIS (logical): -[hypotaxis (↘dependent clause: β)]; (3) a change in LOGICO-SEMANTIC TYPE (logical): -[projection: idea]; and (4) a change in THEME (textual): -[marked Theme (↘fronted dependent clause)]. Thus, indicating the complexity of a single revision in terms of the functions/meanings it affects.

We now move on to systemic choice (combination of function and rank), starting with JD1 (see Table 2).

Table 2 shows that not all function/rank mergers correlate with one system, and that some systems are more involved in revision than others. For example, Table 2 shows that at the juncture of experiential and NGrp, a writer can choose from seven lexicogrammatical systems: THING TYPE (n = 42) being the most frequent choice in JD1.

Table 2: Revision activity and systemic choice in JD1

		Metafunction (system)				
		Experiential	Logical	Interpersonal	Textual	Total
Rank	Clause	Transitivity 29		Mood 2	Theme 14	45
	Clause nexus		Taxis 44			44
	Phrase nexus		2			2
	Group nexus		9			9
	Phrase	minor Transitivity 33		minor Mood 4		37
	Verbal group	Event type 36	Tense 3	Polarity 1	Voice 3	43
		Aspect 0		Modality 11	Substitution 1	12
					Ellipsis 2	2
	Nominal group	Thing type 42		Person 1	Determination 50	93
		Pre-determination 2		Assessment 6	Reference 19	27
		Numeration 10			Substitution 3	13
		Classification 9			Ellipsis 1	10
		Epithesis 11				11
		Qualification 26				26
	Adverbial group	Circ. Type 3		Comment 6	Conjunction 25	34
	Word	Denotation 10		Connotation 12		22
	Info. Unit			Key 0	Info. Focus 19	19
	Total	211	58	43	137	449

Frequency counts were compiled for each dataset; the top five from each are shown in Table 3:

Table 3: Top five systems involved in revision activity for each dataset

JD1		JD2		JD3		BB	
1.	Determination 50	1.	Event type 40	1.	Thing type 56	1.	Determination 21
2.	Taxis (clause) 44	2.	Qualification 39	2.	Determination 45	2.	Qualification 14
3.	Thing type 42	3.	Thing type 37	3.	Event type 34		Taxis (clause) 14
4.	Event type 36		Taxis (clause) 37	4.	Qualification 32	3.	Thing type 11
5.	minor Trans. 33		Determination 37		Denotation 32	4.	Denotation 10
		4.	Connotation 28	5.	Taxis (clause) 28	5.	Event type 9
		5.	Reference 26				

Table 3 shows how four systems turn up in the top five regardless of the writer or text. These are DETERMINATION (n = 153), THING TYPE (n = 146), TAXIS (n = 123), and EVENT TYPE (n = 119). In three of the four datasets, QUALIFICATION showed up in the top five, and in JD1 it ranked 7th, giving QUALIFICATION a total count of n = 111 and making it the 5th most frequent system overall. We may tentatively say, then, that key linguistic features when revising academic essays for these writers are items such as determiners (the, their, etc.), things (nouns), tactic relations (e.g., conjunctions), processes (verbs), and qualifiers (e.g., prepositional phrases).

Given the previous results, it is perhaps somewhat unsurprising that three of these systems operate at the nominal rank. More specifically, research into academic writing repeatedly shows that meanings at the level of the clause ('figures') are condensed, distilled, and repackaged into constituents at lower levels, and that it is the NGrp where most of these condensed or 'down-ranked' figures are realized.

In Example 3 below, for instance, when 'relationship' is deleted, 'workforce' moves from being a Classifier (CLASSIFICATION) to Thing (THING TYPE). However, the Thing is also that element which is typically brought into focus (either Given or New via INFORMATION FOCUS).

T-unit	Content
41i	Although a manager and its workforce $^{88}\{$~~relationship~~$\}_{CP}$ are different in many ways to a parent-child relationship, {88}

Example 3: Fine-tuning a NGrp through THING TYPE (JD1)

In Example 3 above, then, what is presented as Given (the relationship) is also altered by the change in THING TYPE and becomes 'a manager and its workforce[2].
Through THING TYPE a writer can also alter a referent's specificity, as per Example 4:

T-unit	Content
21iii	a listener would need to see the pictures for [67]{the | ~~m~~ | ir stories}$_{INSA}$ to make sense.

Example 4: Increasing specificity through DETERMINATION & THING TYPE (JD2)

Here, revision 67 changes 'them' for 'their stories', which appears to be a simple change from a pronoun to possessive NGrp. However, the revision primarily alters textual meaning through added specification. Fundamentally, because 'them' and 'stories' refer to the same entity, there is no change in experiential meaning, but there is a change in how the writer projects the recoverability of the referent – 'their' being an anaphoric referent from the previous clause. In terms of QUALIFICATION, as Halliday and Matthiessen (2013) state:

> 'With only rare exceptions, all Qualifiers are **rankshifted**. What this means is that position following the Thing is reserved for those items that, in their own structure, are of a rank higher than or at least equivalent to that of the nominal group.' (p.382, *emphasis in original*)

Consequently, qualifiers can elaborate (reiterating relation), enhance (qualifying relation), extend (additive relation), or project upon the Thing. Consider examples 5 and 6:

T-unit	Content
7ii	and participants were aware of their right to withdraw [59]{from my study.}$_{CP}$

Example 5: Enhancement through QUALIFICATION (JD1)

In Example 5, revision 59 adds 'from my study', which represents +[Qualifier (↘prepositional phrase): circumstance: enhancing: location: (abstract) place].

T-unit	Content
12i	Bernstein also claims that the social class [59]{we are brought up in}$_{FP}$ has the biggest influence on socialization

Example 6: Elaboration through QUALIFICATION (JD2)

In Example 6, revision 59 adds an embedded (down-ranked) defining clause 'we are brought up in'. This elaborates upon 'social class' in relation to role/shape/guise.

Qualifiers can also fine-tune a referent by affording the writer a scale of gradation in terms of taxonomizing or describing (Fontaine, 2012, p.57). Consider revision 41 below:

T-unit	Content
3	Heath looked at literacy events [41]{within these communities;}$_{INS}$, 'occasions in which written language is integral to the nature of participants' interactions and their imperative process and interpretive processes and strategies'

Example 7: Expanding a referent's identity through QUALIFICATION (JD2)

In referential terms, adding 'within these communities' increases specificity by telling the reader that the Thing is identifiable in relation to the communities mentioned elsewhere. We know, in JD's mind at least, she is referring to communities she has already mentioned because she chooses the deictic 'these' (DETERMINATION: +[Deictic (↘determiner): specific: demonstrative, determinative: selective: plural, near]). QUALIFICATION, then, can also fine-tune a referent's identity by incorporating within it a choice in DETERMINATION.

DETERMINATION is the system for the deictic: 'The Deictic element indicates whether or not some specific subset of the Thing is intended' (Halliday & Matthiessen, 2013, p.365). I.e. It is the opposition between 'I am talking about a subset of the Thing that is identifiable from the context/co-text, e.g., 'this table', 'that apple', versus 'I am talking about some Thing, which may or may not be identifiable from the local context/co-text', e.g. 'a table', 'some apples'. This distinction between labelling a referent as recoverable or not has obvious implications for a text's cohesiveness, particularly when elements are being added/removed through revision.

From the dataset, we see that many revisions involved the non-selective deictics 'the' and 'a(n)'. For example, in JD1, 62% of revisions involving DETERMINATION concerned 'the' (n = 17) or 'a(n)' (n = 12). Similarly, in JD2, 65% of revisions involving DETERMINATION concerned 'the' (n = 17) and 'a(n)' (n = 7), and in JD3, 67% involved 'the' (n = 15) and 'a(n)' (n = 15). In BB, meanwhile, 17 of 21 revisions involving DETERMINATION (81%) concerned 'the'.

In shorter texts, we would expect to see more non-specific than specific deictics because if reference chains are needed, they will be short. Perhaps this is why we see a decrease in the use of specific determiners (e.g. 'the', 'my', etc.) and an increase in non-specific determiners ('a(n)', 'some', etc.) in all the datasets; i.e. this patterning primarily reflects new participants being introduced as content is added; consider Example 8:

T-unit	Content
19	Bernstein claimed that while the middle-class were likely to have access to both codes, [19]{some sections of}$_{CP}$ the working-class were {19} likely to have access only to the restricted code.

Example 8: Decreasing specificity through DETERMINATION (JD2)

In this example, revision 19 adds 'some' and 'sections of', thus decreasing the specificity of 'the working-class'.

Similarly, Example 9 illustrates how changing a determiner can decrease specificity:

T-unit	Content
33i	^{73}{~~The~~ | A}$_{INSA}$ command is threatening to the hearer, J.

Example 9: Decreasing specificity through DETERMINATION (JD1)

Here, revision 73 substitutes 'The' for 'A', creating a non-specific entity 'A command'. Initially, this appears strange, because 'command' has already been introduced in T-unit 32ii ('N makes a command'). However, in Example 10 below, JD notices this and adds 'n order or'.

T-unit	Content
33i	A^{75}{n order or}$_{CP}$ command is threatening to the hearer, J^{74}{'s negative face,{75}}$_{CP}$

Example 10: Introducing a referent through DETERMINATION (JD1)

In the majority of cases, we see that each writer's main concern when revising NGrps for textual meaning was making a distinction between recoverable (presuming) and non-recoverable (presenting) referents via 'the' and 'a(n)'. However, as was the case with qualifiers, these writers also used other nominal modifiers to indirectly fine-tune textual meanings by creating generic referents (these referents do not rely on DETERMINATION because they are technically bereft of a need for being held in a referential space).

4.2 Part 2: Languages choice in revision activity: a dynamic approach

In the previous section, we examined revision in terms of overall numbers. Here, there was no reference to the passing of time. Instead the process of text production was examined at its end only. This is what I defined earlier as a synoptic approach—examining an activity or a text as a finished product. In this section, however, we examine how revision contributed to unfolding meaning in terms of the experiential, logical, interpersonal, and textual functions. For example, a writer may start a session by writing two or three sentences in one burst that contain textual, experiential, and interpersonal meanings. They may then go back and make a revision. This revision may add an experiential meaning, increasing the number of experiential meanings in what that writer has written so far by a count of one. In other words, in this section we take a dynamic approach to examining the functions of revisions in relation to the passage of time. I.e., we will look at how revisions added, deleted, or substituted meanings. And

whilst this approach does not account for the overall number of functional choices in finished texts, it should give insights into which kinds of meanings these writers focused on when revising, when during the writing process they are called upon, and if certain meanings are more likely to be added/deleted, whilst others are more likely to be substituted as the text evolves.

Figure 15, below, takes a dynamic approach for the JD1 dataset. The X-axis shows the sequencing of revisions through time, from the first revision to the last[3]. The Y-axis displays a relative frequency count, showing how a revision contributed to (added) or subtracted from (deleted) the text's number of language functions at that time in its construction. For example, during session 1 of writing, JD initially deleted several logical meanings that could be found in text she had written during normal production – this is shown in Figure 15 by the blue line falling into negative numbers, indicating that revision was negatively impacting on the number of logical meanings at this stage in the writing process. JD then reintroduced some logical meanings via revision, deleted some, and then added some.

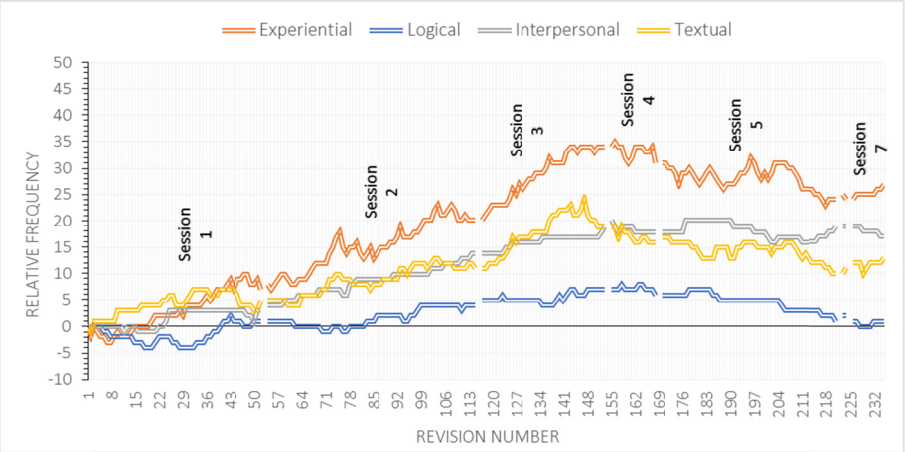


Figure 15: The unfolding of language functions in revision (JD1)

Figure 15 shows a steady increase in all functions during the first 3 sessions. This is perhaps to be expected because it is where most composition took place: JD typed 2068 words during these sessions and her word count at the end of session 3 was 1533 (see Appendix, A1-A4, for a breakdown of each dataset; and Bowen & Van Waes, submitted). In session 4, however, writing activity decreased (JD typed 120 words) and the number of interpersonal and logical revisions levelled off, whilst experiential and textual meanings continued to rise. Session 5 saw an increase in writing activity (314 words typed), but a decrease in experiential and textual meanings added through revisions. Moreover, the essay's word count increased by only 56 words from 1601 at

the end of session 4 to 1656 at the end of session 5. Therefore, during session 5 it appears that JD switched from adding text/content to fine-tuning text/content.

In our exploration of systemic choice above (cf. Table 2), 137 revisions involved textual systems (DETERMINATION, CONJUNCTION, etc.). These findings were based on a synoptic approach that counted overall revision activity. Figure 15 above, however, is based on a dynamic approach, and it tells us that the relative contribution of revisions to textual meanings in JD1 is +13; i.e. despite JD making 137 textual revisions, the overall number of textual meanings in the text increased by just 13 through revision. Consequently, if we look only at the figures from the synoptic description, we may think that augmenting textual meanings was particularly important when JD revised this text; conversely, if we were to look only at the relative frequency +13, we may think that revising textual meanings was not so important when editing this text. However, by combining synoptic and dynamic descriptions, we can see that JD, for the most part, played out a delicate balancing act of substituting one textual choice for another (cf. examples 8, 9, and 10).

Let us now consider interpersonal revisions (grey line in Figure 15). Here, we see that revisions steadily added to the number of interpersonal meanings, peaking at +20 (revision 153) and finishing on +16. However, from our findings above, we saw that 48 revisions (+33, -15) involved interpersonal systems (MOOD, COMMENT, etc.). Here, then, we have a direct contrast in how JD used revisions to add meanings (interpersonal) as opposed to fine-tune meanings (textual). Essentially, 48 interpersonal revisions resulted in a final count of +16, which means that for every 3 interpersonal revisions made, one interpersonal meaning was added to the text. This gives what I call a retention ratio (RR) of 3:1 (RR is the no. of revisions divided by the relative end count: in this instance 48/16).

Textual revisions, however, had a RR of 10.5:1. To explain this difference, let us examine a few examples:

T-unit	Content
3	I am also interested in looking at the people who have had major influences in this field of work, namely Geoffrey Leech, Erving Goffman and [22]{the highly influential} INSB Penelope Brown and Stephen Levinson.

Example 11: Fine tuning appraisal through COMMENT and ASSESSMENT (JD1)

In Example 11, revision 22 pre-modifies 'Penelope Brown and Stephen Levinson' via DETERMINATION ('the'): +[Deictic (↘definite article): specific], COMMENT ('highly'): +[comment Adjunct (↘adverb): intensity: degree: high], and ASSESSMENT ('influential'): +[Attitudinal Epithet (↘adjective)]. This revision, then, adds two interpersonal meanings that make it into the final draft (comment Adjunct and attitudinal Epithet) and one textual meaning.

Overall, there were 20 insertions in JD1 like Example 11 that involved interpersonal meanings at, or above, the group level. However, there were also 16 interpersonal deletions at, or above, the group level. It would seem, then, that the increased RR of interpersonal meanings stems from revisions below the group level. More specifically, in JD1, 12 revisions involved CONNOTATION (a word level system), as illustrated in Example 12:

T-unit	Content
26ii	and this type of mockery is something that happens often so is [218]{~~taken on the chin~~ |

Example 12: Fine-tuning register (i.e. mode) through CONNOTATION (JD1)

Of the 12 connotative revisions, 7 were forward insertions (cf. Bowen & Van Waes, submitted). Hence, we may consider that many of the interpersonally based revisions in JD1 could reflect alignment with a (virtual) reader's registerial expectations; i.e. that academic text should not contain slang or other informal words, and in many instances this was the case.

Moving on to logical revisions, Figure 15 shows that logical meanings added/removed by revision remained relatively low. Specifically, despite there being 55 logical revisions overall (TAXIS, TENSE, etc.), the number of logical meanings contributed by revision came to rest at +2. Combining our synoptic and dynamic descriptions, then, we can say that, in this instance, logical revisions were less likely to increase the overall number of logical meanings in the text.

Finally, we have experiential revisions. Figure 15 shows that experiential meanings increased by 27 through revision. However, the overall number of experiential revisions was 211, which as we saw above, accounts for 47% of all revisions in JD1. These frequency counts, then, give us a RR of 7.8:1. I.e., although the overall number of experiential revisions was very high, we still have a relatively high RR. Ultimately, then, JD appears to be using experiential revisions to not just fine-tune existing text, but also to continually add support for her thesis[4].

Figure 16 shows how revision activity in JD2 unfolded in terms of language functions. As per JD1, Figure 16 shows that although 53 revisions involved logical meanings, deletions somewhat balanced out additions, resulting in a negative end count of -7 (7.6:1 RR).

In terms of textual revisions, however, we see a different pattern than in JD1. Specifically, in JD2, textual meanings added through revision rarely peaked above 0 and ended on -4. However, 102 textual revisions were made, giving a RR of 25.5:1. This suggests that textual meanings were added during normal production and then fine-tuned through revision. This would be consistent with organizing old text to accommodate new text through the manipulation of thematic components, referential chains, etc.

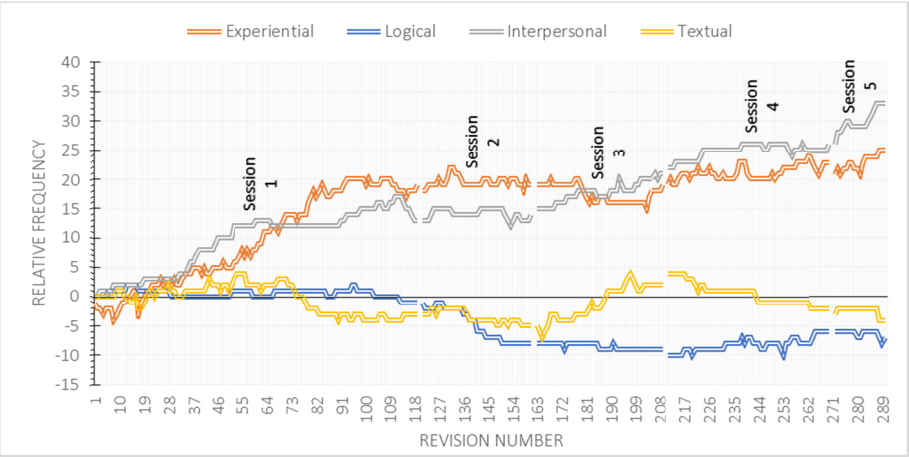


Figure 16: The unfolding of language functions in revision (JD2)

Interpersonal revisions (n = 75), meanwhile, steadily added meanings, ending at +33 (+54, -21) and a RR of 2.3:1. Interpersonal revisions, then, appear to be more measured in JD2 in much the same way as in JD1 (interpersonal RR = 3:1). We could look to the essay's prompt to explain this: 'Argue for or against the claim that there are cultural differences in […]'. Here, we have a prompt that calls for an argument to be constructed, and arguments typically call on increased interpersonal meanings via ASSESSMENT, MODALITY, etc. (Nesi & Gardner, 2012).

Table 4: Breakdown of interpersonal revisions in JD2

			Revision type: Addition (+) or deletion (-)										
			FP		CP		INSA		INSB		INS		
		System	+	-	+	-	+	-	+	-	+	-	Count
Rank	Clause	Mood		1	1	1		2					-3
	Phrase	minor Mood						1					-1
	Verbal group	Polarity	1		1		1		1				4
		Modality		4	2	2	2	2		2	1		-5
	Nominal group	Person		1									-1
		Assessment	2	1	2		2	1					4
	Adverbial group	Comment	2					1		1	1		1
	Word	Connotation	7	1	3		12		5				26
	Info. Unit	Key											0
		Totals	12	8	9	3	17	7	6	3	2	0	
		Count		4		6		10		3		2	25

However, if we look at the breakdown of interpersonal revisions, as shown in Table 4, we see how CONNOTATION once again played a key role in JD2 as per in JD1. This Table shows how CONNOTATION was the most frequent interpersonal system in JD2's revision activity (n=26), and was typically used to increase formality, as examples 13 and 14 show:

T-unit	Content
23	If a child is told that he/she is not good at a language the child may give up trying to ^{225}{~~do better~~ | improve}$_{INSA}$.

Example 13: Fine-tuning registerial expectations (i.e. mode) through CONNOTATION (JD2)

T-unit	Content
20	Bernstein conducted an experiment using five year old lower working-class and middle-class children who were given pictures to create a ^{213}{~~story~~ | narrative}$_{INSA}$ from

Example 14: Fine-tuning registerial expectations (i.e. mode) through CONNOTATION (JD2)

Both these examples involve forward insertions, which are conducive to proofreading (cf. Bowen & Van Waes, submitted), and suggests that CONNOTATION may play a key role when proofreading academic text (42% of connotative revisions were forward insertions). However, MODALITY also played a role in fine-tuning JD2. This may be because as JD is writing, she is also learning more about the subject and, consequently, the claims she makes are being toned down. Figure 17 shows unfolding revision functions in JD3:

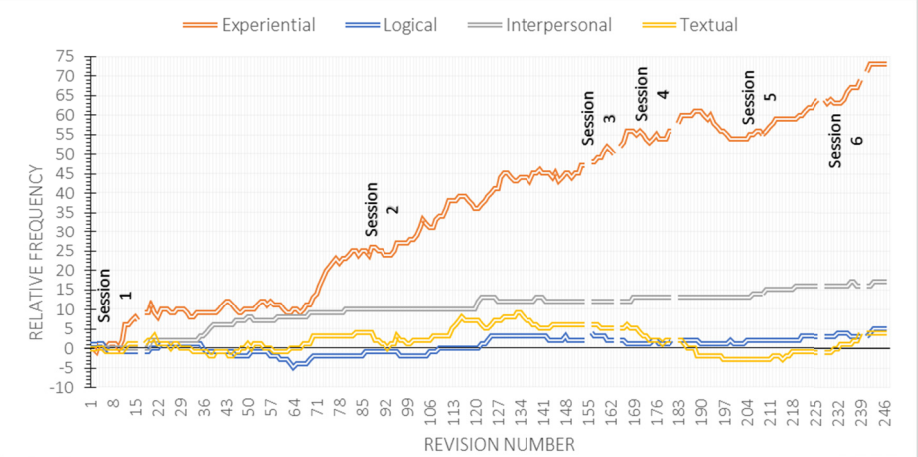


Figure 17: The unfolding of language functions in revision (JD3)

Figure 17 shows a marked difference in how revisions contributed to meanings in JD3 as compared to JD1 and JD2. Once again, experiential meanings were steadily added through revision. However, whereas they levelled off midway through JD1 and JD2, in JD3, experiential meanings added through revision continued to rise, ending on +73.

As per the other datasets, experiential revisions were quite high (n = 235), but this time the RR was much higher (3.2:1). From the essay title, 'Using 3-5 images from any genre to illustrate your arguments, discuss […]', we see that this essay references '3–5 images', and it is here that we find the key difference between this text and the others. Specifically, JD frequently points the reader toward an image (deictic metadiscourse) or describes some aspect of an image (informational specificity), as per the examples below:

T-unit	Content
20	This ^{234}{lack of colour}$_{CP}$ gives the images {234} a negative impact.

Example 15: Modifying a Subject via THING TYPE and QUALIFICATION (JD3)

Revision 234 adds a Thing ('lack') and Qualifier ('of colour'), which describes an aspect of 'the images' she refers to.

T-unit	Content
48iX	This is demonstrated in my Figures, ^{141}{particularly Figure 2.}$_{INSA}$

Example 16: Adding a referent via CLASSIFICATION and THING TYPE (JD3)

In this example, revision 141 adds an endophoric (metadiscoursal) deictic, 'Figure 2', and tells the reader to pay 'particular' attention to it. Whilst many of these revisions[5] might be classed as a form of interactive metadiscourse, because they primarily serve the textual function – creating referents that point to other parts of the document – they are also experiential because they provide description, increase informational specificity, add ancillary information, etc. Their incorporation thus goes someway to explaining why JD3's revisions called so heavily on experiential meanings.

In a similar manner to JD's other datasets, interpersonal revisions in JD3 resulted in an increase of +17 interpersonal meanings and a very high RR of 1.6:1; a breakdown of JD3's interpersonal revisions is shown in Table 5:

Table 5: Breakdown of interpersonal revisions in JD3

			Revision type addition (+) or deletion (-)										
			FP		CP		INSA		INSB		INS		
		System	+	-	+	-	+	-	+	-	+	-	Count
Rank	Clause	Mood							1				1
	Phrase	minor Mood											0
	Verbal group	Polarity	1										1
		Modality	3	2	1		3		2		1		8
	Nominal group	Person							1				1
		Assessment	2	1			1						2
	Adverbial group	Comment					1		1		1		3
	Word	Connotation	1										1
	Info. Unit	Key											0
		Total	7	3	1	0	5	0	5	0	2	0	
		Count	4		1		5		5		2		17

Table 5 shows that most interpersonal revisions in JD3 involved verbal group (VGrp) systems; particularly, MODALITY (+10, -2). MODALITY concerns the likelihood of a proposition or desirability of a proposal, and revisions involving MODALITY mainly involved the addition of mood Adjuncts such as 'only', 'often', and 'commonly'.

The surprise here is that JD made significantly less use of CONNOTATION than in her other datasets. There appears to be no logical explanation for this. For example, we could say that the increased use of CONNOTATION in JD1 may be the result of JD working alongside a transcript of speech that may have influenced her vocabulary during normal composition. However, JD2 saw a higher usage of CONNOTATION, yet JD made no use of a transcript in JD2. We could also say that JD3 saw the lowest occurrence of forward insertions across all JD's datasets, and that this could reflect less effort/time proofreading, which is somewhat supported by the lower occurrence of revision activity in the second half of JD3.

Moving to the logical function, as per JD1 and JD2, logical revisions did not contribute greatly to the number of meanings present in the final text. Figure 17, for example, shows that logical meanings contributed through revisions remained relatively stable: 49 logical revisions were made resulting in a RR of 8.2.

Lastly, in JD3 there were 93 textual revisions (+49, -44), resulting in a RR of +18.6:1. Once more, then, we see that textual revisions are seemingly used to fine-tune, rather than add new meanings. Furthermore, the majority of this 'fine-tuning' came via choices in DETERMINATION, and mainly concerned choices between ‘the’ or ‘a/an’, as discussed above. Figure 18 shows BB's revision activity in terms of unfolding functional choice:

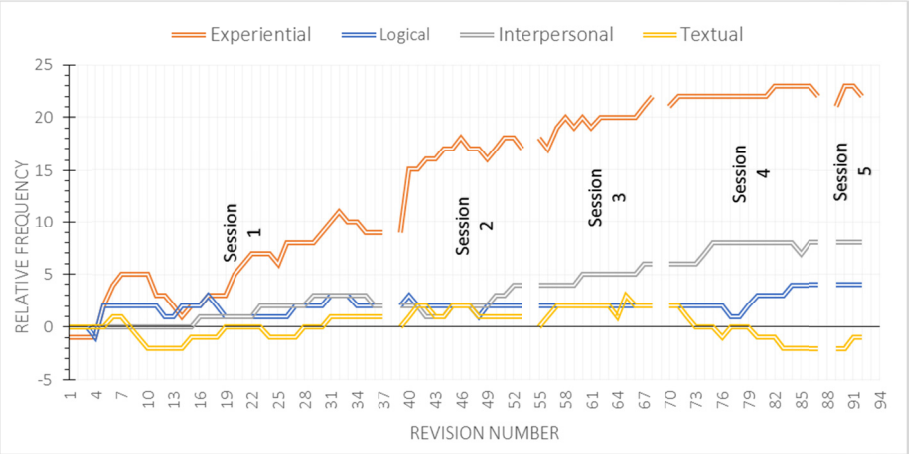


Figure 18: The unfolding of language functions in revision activity (BB)

As Figure 18 indicates, BB was primarily an online reviser, meaning that she revised as she wrote and rarely revised previous drafts. However, there were some similarities between her and JD in terms of the functional choices they made.

For example, as per JD, the number of logical meanings contributed by BB's revisions remained relatively flat, resulting in a final figure of +4. Similarly, textual meanings added/removed by revision remained relatively flat, resulting in an end count of -1. And although interpersonal meanings showed a slight increase during the final stages of writing (from revision 47 onwards), resulting in +8, many of these were last-minute citations. What is perhaps most evident from BB's functional revision profile is the increased level of experiential meanings, which rose to +18 during the first half of writing and ended at +24. As per many of JD's experiential revisions, BB's appear to increase descriptive detail and add more participants (referents).

Ultimately, whilst this examination into unfolding revision functions has been brief, and limited to 2 writers and 4 texts, it has shown that some meanings appear to take precedence over others when it comes to revising academic text, and that these meanings may be influenced by the task's demands (i.e. essay rubric/title) and registerial expectations. Furthermore, it has shown that some functions seem to be more involved in 'fine-tuning', whilst others are more involved in augmenting meanings, as illustrated in Figure 19:

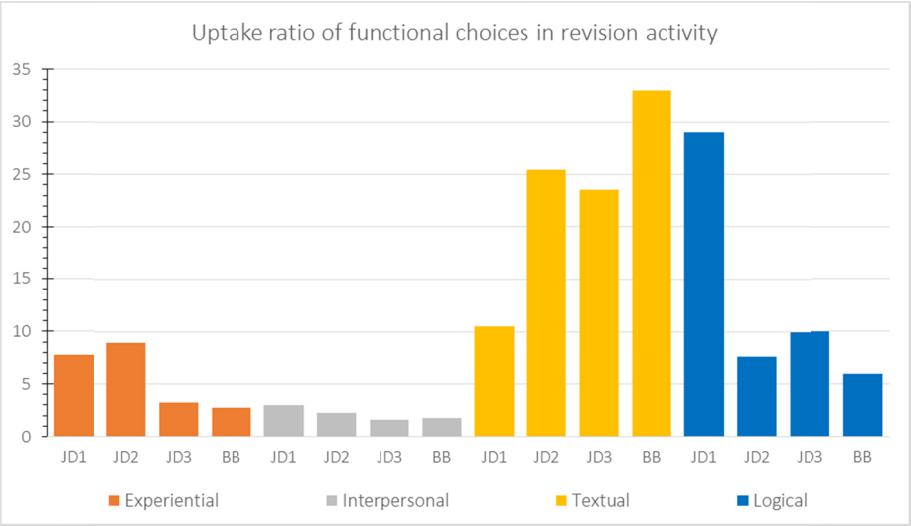


Figure 19: Comparison of retention ratios across the four datasets

Figure 19 shows the RRs for each function for each dataset. This graphical comparison, and the discussion that preceded it, show how interpersonal revisions and, to a lesser extent, experiential revisions, appear to lead to additions being made. More specifically, although the number of interpersonal revisions is low, they are likely to contribute to the number of interpersonal meanings found in the text – evidenced by the high RRs, ranging from 1.6:1 (JD3) to 3:1 (JD1). Similarly, despite experiential revisions being the most frequent across all datasets, they are also likely to lead to an increase in experiential meanings, with RRs ranging from 2.75:1 (BB) to 9:1 (JD2). The lower RRs for textual revisions, on the other hand, suggest that the kind of meanings they provide are more likely to fine-tune unfolding text. As for logical revisions, the RRs for three datasets (JD2, JD3, and BB) are remarkably close, ranging from 7.6:1 to 8.2:1, and in isolation could be taken as indicative of a pattern. However, the RR for JD1 is very low at 29:1, and makes drawing any conclusions (however tentative) unwise.

5. Conclusion

The primary contribution of this study was that it combined two different, yet complimentary, approaches to writing research: KSL (process approach) and SFL (text linguistic approach). The combination gave valuable insights into how revision activity contributed to unfolding meaning. In this light, the study can be broadly situated within research that aims to explicate what writers do when they digitally compose text (Leijten, Van Waes, Schriver, & Hayes, 2014), how what they do contributes to meaning-making practices (Frances Christie, 2012), how material and symbolic spaces

come to affect the writing process (Mills, 2016), and how technology mediates writing (Haas, 1996). The findings also provide insights into how we can improve the teaching of academic writing (Coffin et al., 2003), particularly with respect to the importance of NGrps (Fang et al., 2006; McCabe & Gallagher, 2008), and to the importance of using detailed revision taxonomies (e.g. Lindgren & Sullivan, 2006).

A secondary contribution of this study was that it builds upon the rarity with which the unfolding of written text is examined in functional terms. Fundamentally, research into unfolding meaning has primarily focused on spoken conversation (Clarke, 2016; O'Donnell, 1999; Ventola, 1987; Yang, 2010), whilst research into the unfolding of meaning in written text has been decidedly retrospective (Clarke, 2016; Klein & Unsworth, 2014; Martin, 2011). Consequently, with the exception of O'Donnell (2013), there has been no research into how lexicogrammatical choice unfolds as text is being written. This study attempted to fill this void via an analysis of the revisions made during the evolution of four academic essays.

Thirdly, this study adds to research that examines the language of schooling through the lens of SFL (Achugar & Colombi, 2008; F. Christie & Derewianka, 2008); specifically, it adds an additional/alternative perspective to those which examine academic texts from a synoptic standpoint (Aull & Lancaster, 2014; Hood, 2010; Martin, 2013; Wignell, 2007). In this vein, it provides further evidence that NGrp complexity plays a key role in academic writing, as findings showed that the NGrp was the most frequently revised constituent, which accords with the oft-cited finding that academic writing tends to include high numbers of complex NGrps.

With respect to the first research question, 'What role do language choices play when revising academic text?' the findings showed that the NGrp was the constituent where most revision took place, and that five lexicogrammatical systems were most prominent when it came to revision. These were, in order of frequency: DETERMINATION (textual, NGrp), THING TYPE (experiential, NGrp), TAXIS (logical, clause nexus), EVENT TYPE (experiential, VGrp), and QUALIFICATION & MODIFICATION (experiential/interpersonal & logical, NGrp). We saw how two of these systems (DETERMINATION and QUALIFICATION) contributed to NGrp complexity in terms of specification and informational density. The fourth most frequently involved system, EVENT TYPE, concerned choices involving the process. However, choices in EVENT TYPE represent more than just synonymy. For example, changes involving EVENT TYPE typically led to the relationship between major participants being construed in a different manner. Here, we have choices at the group level (EVENT TYPE) closely tied to choices at the clausal level (TRANSITIVITY), and, thus, by necessity, choices at the semantic level (syntagmatic reconstruals of figures via changes in logico-semantic type). This means that changes to PROCESS TYPE are much more complex than changes to THING TYPE, and, therefore, a more delicate level of analysis is needed. Such a detailed examination was beyond the scope of this paper, but further research would do well to make use of Neale's (2019) taxonomy of process types. Here, we may see a tendency for the inclusion of certain processes over others as

revision unfolds, such as the oft-cited remark that academic writing makes extensive use of relational processes.

With respect to the second research question, 'What can a dynamic description tell us that a synoptic description cannot?' The concept of 'retention ratios' (RR) was used as a means to examine how revisions shaped unfolding meaning. More specifically, we saw how experiential and interpersonal meanings were more likely to be added through revision activity, whilst the overall number of logical and textual meanings was more likely to remain the same. This difference reflects a fundamental difference between meanings that have evolved a communicating function (experiential and interpersonal), and meanings that have evolved an enabling/organizing function (logical and textual), as explicated by Halliday (1975). Fundamentally, adding content (orienting to field) and presenting opinions (orienting to tenor) draws heavily on experiential and interpersonal meanings. Organizing this content/opinion, though, relies on the textual function (orienting to mode) and the construal of logical connections (connecting figures in sequences). It appears to be the case, then, that the addition of new content (experiential and interpersonal meanings) subsequently relies upon a reorganization of text and connections within it (textual and logical meanings).

Ultimately, by examining how these two students revised for meaning (language choices) rather than how they revised in general (writing mechanics), this study has pointed toward the possibility of a new perspective into examining the writing process: one based on semogenesis through revisions activity. It may be that by using such an approach, we can increase our understanding of what student writers deem as important when (a) adding new meanings to their texts, (b) fine-tuning existing meanings, and (c) bringing these meanings together in light of an underlying goal/purpose.

6. Limitations and further research

Because of the ever-changing nature of technology, this study is very much a product of its time. For example, the very earliest writing (scriptua continuum) was simply a means to represent speech, and lacked the potential to distil, organize, and present information in a way that we now take for granted. As Smart (2012) highlights, this is what the internet (and by association computers) initially represented: a medium constrained by 'the metaphors of a previous era' (p.456). However, this technology is now undergoing a transformation of its own, moving from a document-centric to a data-centric mode. This move may very well engender the first step toward IT becoming a true extension of mind, rather than a disconnected resource. This would, no doubt, once more transform how we consume and disseminate information, which could, in turn, fundamentally alter how we produce texts[6].

Moreover, to fully explore unfolding meaning in a sufficient number of complex texts such as the Essay would require a huge amount of time and effort[7]. And it may well be that by the time such a study was complete, the concept of what an 'Essay' was/is may have changed. Consider the increasing use of voice software recognition,

and the ever-changing nature of word processing programs (e.g., the ability to integrate various 'add-ons'). This equates to a medium of composition that is constantly changing in subtle ways, which, in turn, could have unforeseen results for both how texts are produced and how texts are received. Secondly, the current system of submitting paper copies of essays for assessment may be phased out because of not only the increasing integration of online databases, but also the increasing drive for environmental conservation. If essays were to become 'electronic' rather than paper, this could engender a move toward an increase in other modalities besides words, such as colours, images, videos and sound.

In terms of the linguistic analysis, there were clear limitations regarding the level of detail that could be covered. For instance, whilst selections in THING TYPE and EVENT TYPE were amongst the top five systems involved in revision activity, it was not feasible to examine these selections at the lexical level. For example, by examining more closely selections in EVENT TYPE, the analysis may have revealed interesting shifts toward a particular process type. A more fine-grained analysis might also reveal interesting patterns regarding the verbs and nouns involved in revision in terms of their frequency of occurrence in English; such an analysis may show an increase in infrequent lexis through revision, which would coincide with the belief that infrequent lexis can contribute to the impression of a text's complexity.

Notes

1. Essays were independently rated according to the students' university analytic scoring rubric.
2. *'its'* was deleted in a later revision, leaving just 'a manager and workforce'.
3. Writing sessions are demarcated via gaps in the lines and marked as Session 1, Session 2, etc.
4. This evidence comes in the form of the writer describing their own data (transcripts).
5. Cf. also revisions 54, 55, 60, 79, 82-92, 99, 104, 121, 142, 144, 146, 152, 155, 167, 170, 173, 177, 183, 190, 202, 222, 223, 226, 227, 228, 235, 250.
6. Writing from sources or 'patch writing', for example, may well become the new norm, where intertextual 'borrowings' become the basis for much of our writing.
7. Nesi and Gardner's (2012) study, for example, took over eight years and involved a full research team, yet it only explored texts in terms of synoptic descriptions.

Acknowledgements

I owe a great deal of thanks to the Inputlog team at the University of Antwerp for their continued help and advice. Without which, this paper would not have been possible. I would particularly like to thank Luuk Van Waes for the many hours of time he has

given up to answer my emails and questions. I would also like to thank Lise Fontaine for her continued support and advice. Finally, I would like to thank the two anonymous reviewers who provided detailed feedback on the article during the publication process.

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