Writing objectively: Functional grammar as a tool to improve engineering students' writing style

Claire Simpson-Smith[a]

The University of South Australia[a],
Corresponding Author Email: claire.simpson-smith@mymail.unisa.edu.au

ABSTRACT

CONTEXT

Professional writing skills are fundamental for engineers. Engineering degree program outcomes include the development of students' written communication ability as part of their professional competencies. The need to improve the effectiveness of curriculum in this area has been acknowledged for several decades, however, a gap remains between the expectations of employers and graduate ability. Making progress in this area remains challenging for both students and engineering academics and written assignments across the curriculum do not necessarily enable to students to master the skills required to write high quality engineering documents.

PURPOSE AND METHODOLOGY

Applied linguistics methodologies can offer robust strategies for making writing practices explicit so that students can learn to write effectively and appropriately for both academic and professional purposes. For example, analytical techniques drawn from Systemic Functional Linguistics (SFL) have been used to investigate how grammar is used to enact social relationships such as those between engineer and client. This paper investigates the writing style of professional engineering reports using methodologies provided by SFL.

RESULTS AND DISCUSSION

The results demonstrate clear differences in the use of particular aspects of grammar depending on the type of professional relationship between the engineer and their client. These results highlight the need to make the function of grammar explicit to students, to enable them to develop control of the appropriate professional writing style. Some suggestions are made in terms of integration of explicit functional grammar content in the engineering curriculum.

KEYWORDS

Professional Communication, Writing, Systemic Functional Linguistics

Introduction

Effective and appropriate written communication skills are essential in professional engineering practice (Australia, 2019; Yong & Ashman, 2019). As such, engineering degree programs place a high emphasis on graduating students who know how to write appropriately for the industry, along with possessing sound technical ability. However, an ongoing globally recognised 'skills gap' exists in terms of the communication abilities of engineering graduates and the expectations of employers (Clippinger et al., 2019; King, 2008; Male et al., 2015). This skills gap persists, despite several decades of acknowledgement of the need to improve the effectiveness of higher education engineering courses in developing appropriate professional writing skills in graduates (Conrad, 2017; Gwiasda, 1984; O'Brien, 2000).

The teaching of professional written communication skills varies from one course and institution to another, and includes a range of implicit and explicit pedagogic models and practices. Opportunities for practicing appropriate writing can be significantly limited, and little guidance may be given in terms of 'what or how to write, and for whom' (Goldsmith et al., 2019, p. 73) Engineering lecturers may limit consideration only to technical content (Smith, 2003, p. 73) or feel ill-equipped to support students in terms of their writing (Strauss & Grant, 2018, p. 4). Engineering lecturers may also feel that development of writing skills is not part of their role, or even that writing is not an area of knowledge that can be developed, leaving students with the view that writing is separate from actual engineering practices and only a component of academic study (Goldsmith et al., 2019, pp. 72-73).

Additionally, variable connections between engineering programs and the industry means that students may not be exposed to contemporary industry practice (King, 2008, p. iii), including appropriate writing styles. Engineering courses may expose students only to academic texts such as journal articles, which differ from industry writing, and writing instruction can encourage generalisation from the academic context into industry (Conrad, 2017, p. 68). There is also relatively little research into engineering writing or the literary practices actually used by engineers in the workplace (Giroux & Moje, 2017) on which to base teaching materials.

The style of professional engineering writing can be seen to be particularly challenging for a novice writer. Engineering documents need to use an objective style that foregrounds the detached presentation of evidence, be persuasive in order to convince the reader to agree with the findings or recommendations (Winsor, 2006), and also be framed specifically for the needs of the particular intended audience (O'Brien, 2000). Writing advice often offers such prompts as 'identify your readers' (van Emden, 2005, p. 3) to encourage consideration of the reader's needs and perspectives. However, the challenge for educators and students alike is how to translate the contextual requirements of a document into the actual words and sentences on the page.

Purpose

One successful approach to teaching engineering writing is to draw on Applied Linguistics methodologies to work with students and educators to deconstruct writing practices, so that students can be taught to analyse their own writing and that of professionals (Curry & Hanauer, 2014, p. 3). This paper draws on research methodologies from Systemic Functional Linguistics (SFL) to explicitly identify features of language which are important to the enactment of an appropriate writing style for professional engineering purposes. In particular, this paper presents an example of the use of grammar to enact the social relationship between the writer and reader (that is, the engineer and intended audience). This example is taken from the findings of a larger project.

https://doi.org/10.52202/066488-0007

Methodology

This study investigates the writing style of 26 publicly available professional engineering reports using a combination of qualitative and quantitative discourse analysis, founded in SFL theory. The included texts were chosen on the basis that they were written by a professional engineer in the Australian context from 2010 onwards and were written for the broad social purpose of giving advice to a governing body or client on the need for engineering work or as part of the approval process for a proposed project. The types of reports include environmental impact statements, traffic impact statements, structural condition reports and a variety of investigation reports. Some shorter reports were analysed in full, while cohesive portions of longer reports were selected. The total amount of text analysed was 62941 words.

The reports were analysed using SFL linguistic methodologies. A key idea in SFL is that language is a system of choices, and that particular choices are made in order to fulfil a function. A strength of SFL in terms of researching writing style is that SFL conceptualises language as making meanings in a social context: language makes meaning concurrently at different levels and across different functions (Halliday & Matthiessen, 2014). The conceptualisation that language makes meaning on different levels at the same time is useful in terms of explaining the relationship between language and the context of the social reality in which it is used, for example, taking into account the relationship between an engineering writer and a client. Figure 1 demonstrates this conceptalisation: at the lowest level, sounds are organised into words and grammatical structures such as sentences. These are then organised into patterns of meaning at the level of a whole text, which enact the social context at the highest level.
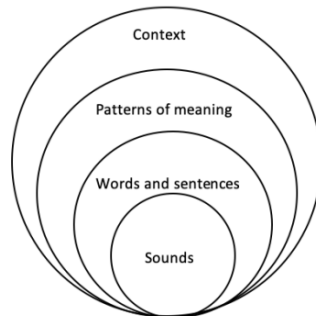
Figure 1: Concurrent meaning making on different levels based on Martin (2016, p. 48)

Additionally, the SFL model of language demonstrates how language makes different types of meanings at the same time, at all levels of realisation. The content, that is, the experiential objects, activities, places and people, of a document can be distinguished from its textual organisation, as well as the interpersonal positioning conveyed. These later two could be interpreted as 'how' the document is written in terms of its style. Figure 2 demonstrates this division of language into different functional domains.
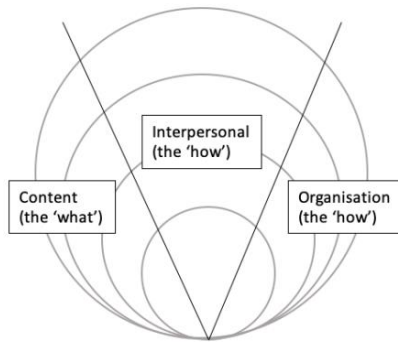
Figure 2: Concurrent meaning making across different functions based on Martin (2016, p. 50)

Separating these functions can be very useful for educational purposes. By explicitly identifying the area of language functionality most challenging for the students, writing instruction can be targeted to the area of most need. For instance, the technical terminology of a particular content area can be addressed separately from the structuring of a document. When it comes to achieving a desired style of writing in response to the needs of a certain audience it is often the interpersonal language choices which are of most concern.

One domain of interpersonal language resource is Engagement (Martin & White, 2005) which is used to create patterns of meaning related to the intersubjective positioning of the writer's voice in relation to other possible voices and perspectives. Choices in this area are concerned with the writer's choices in aspects such as how much they align with their envisaged reader, the extent of tolerance given to other viewpoints and how much authority they command in the relationship. Engagement resources include those of modality, which is the expression of degrees of obligation, likelihood, necessity and certainty through grammatical forms such as modal verbs (for example *should, may, might, need to, have to*), adjectives (for example *necessary, possible*), adverbs (for example *necessarily, probably),* verbs (for example *require)* and nouns (for example *necessity, requirement).*

Results and Discussion

This paper presents one example of the findings to demonstrate how functional grammar may be used to explicitly identify aspects of the appropriate writing style of engineering. As stated above, at the level of context the reports included in my study can all be considered to share a broad social purpose: giving advice to a governing body or client. However, a finer distinction of the context can be made in terms of the relationship between the writer (the engineer) and the intended reader. In some contexts, the engineer is writing on behalf of a company wishing to further a proposed project; the document forms part of the case put forward in support of the argument to grant approval to proceed with the project. Such documents include environmental impact statements, traffic impact statements and some investigation reports. In this context, it can be considered that there is an unequal power relationship between the writer and the intended reader as the reader is in a higher position of power with the ability to grant or deny the desired outcome. I name reports from this context 'seeking approval'.

In other contexts, the engineer takes the role of independent advice giver engaged to provide specialised advice which the decision maker needs in order to inform further action. For example, a report on the findings of an investigation into an electrical failure may advise electricity providers how to avoid repeating such a failure. A report on the structural condition of a building may be used by a council to decide whether to demolish the building or invest in repairs. In this context, the power relationship is the opposite of the 'seeking approval' reports. Putting aside any considerations of flow-on opportunities or reputation building, the engineer is not depending on the decision made as an outcome of the advice. The writer is

engaged as an expert, a voice or authority, who presents findings and gives advice: therefore, reports from this context are named 'giving advice'.

Determining contextual differences in the writer/reader power dynamic is useful to a limited extent. However, such a differentiation on its own does not necessarily lead to an understanding of how to adapt a writing style to these different contexts. Adaption of the writing style requires moving down a level to consider the patterns of meanings used to construct the writer/reader relationship.

The findings demonstrate clear differences in the use of engagement resources which correspond to the differentiated contexts of 'seeking approval' and 'giving advice'. Specifically, there is a clear change in the explicit use of the modality of obligation- words such as *should, must, need* and *require*- being directed at the reader. In the 'seeking approval' reports, explicit expressions of obligation are mostly absent. Those that are present are mostly in relation to the obligations placed on the company proposing the project, as in this example from an environmental impact statement:

> *"[t]o achieve the State interest, Class A and Class B land <u>should</u> be protected from fragmentation, inappropriate development and land degradation" (AECOM 2016, p. xii).*

Please note that modality is underlined in these examples. Occasionally, explicit modality is used in a 'seeking approval' report to emphasise a point in support of the argument, for example:

> *"It <u>should</u> be noted that this assumption of worst-case noise source to receiver wind direction is conservative" (Vipac 2017, p. 10).*

However, the reports identified to have a 'seeking approval' context avoid interpersonal language which may be interpreted as inappropriate for the power dynamic: they do not presume to tell the reader what to do.

Many of the 'giving advice' reports, in contrast, do make use of explicit expressions of obligation directed towards the reader. For example, a report on the findings of an investigation into a large amount of electricity outages is clear about what should be done to prevent repeat occurrences:

> *"DBs [Distribution Businesses] <u>should</u> assess their LV [Low Voltage] networks to identify the appropriateness of and the risks associated with the existing load diversification assumptions" (Energy Safe Victoria 2018).*

Another report investigating a generator failure states that a

> *"monthly testing regime <u>needs</u> to be developed that will allow the generator to be tested at full essential load capacity" (System Solutions Engineering 2016).*

Similarly, explicit expressions of obligation are regularly used in reports on the structural condition of a building or structure:

"Timber decking <u>should</u> be replaced and further inspection of the lower headstock and pile components <u>should</u> be completed to confirm the condition" (GHD 2018, p. 33)

"Analysis of the design showed that the roof slab is structurally inadequate to support the current requirements and that this area <u>should</u> be immediately barricaded off to prevent human entry as this area serves as a potential of serious injury […] [t]he roof slab <u>requires</u> significant strengthening, structural components within the building require large quantities of concrete spalling and sections within the façade <u>need</u> to be rebuilt." (Cardno 2018, pp. 17-18).

As a final example, a report into the geotechnical site preparation requirements of a proposed building repeatedly uses explicit modality of obligation, such as:

"[a]llowance must be made for at least partial removal of the silty/sandy soils' (Douglas Partners 2017, p. 5).

It can be concluded that the power relationship between the writer and intended reader in the context of a 'giving advice' report affords the writer the ability to take an unambiguously authoritative stance.

These findings illustrate a key difference in interpersonal language choices to construct the writer/reader relationship in response to the identified contextual variables, and that this area of grammar is one crucial component of presenting an objective style and persuasive stance. Figure 3 illustrates the difference with reference to the different layers of the realisation of language.
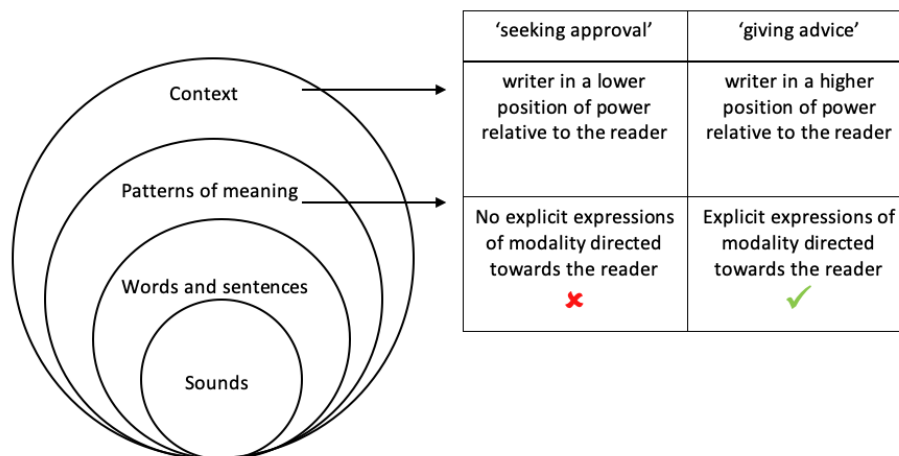
Figure 3: Modality of obligation differences between 'seeking approval' and 'giving advice' contexts

It can be surmised that the use of explicit modality in a 'seeking approval' context would undermine the persuasiveness of the argument, potentially eliciting a negative response from the reader. If the intersubjective positioning is interpreted as inappropriately powerful, the objectivity of the style could also be undermined. It should be emphasised here that the illustration of the use of modality of obligation is just one aspect of the linguistic construction of the style of these reports, chosen to demonstrate the usefulness of functional grammar in an educational setting.

Conclusion and Recommendations

This paper has demonstrated how SFL analysis can make explicit connections between context and language choices, which can be applied in educational materials. The initial identification of the contextual differences between the two groups of reports can help students in terms of the nature of the role of their intended audience, and consider the interpersonal stance they should therefore take as the writer. For some students, this may be sufficient for them to adapt their writing style to the different contexts. However, to do so, such students are likely to have an existing implicit understanding of the appropriate language choices associated with different levels of power, that is, that it would be inappropriate to use explicit expressions of obligation when the reader is in a higher position of power than the writer. Not all students necessarily have this implicit understanding. Identifying the patterns at the next level down on the model of language, and linking them to the context at the higher level, enables students to explicitly understand the choices that are considered appropriate in the different contexts.

There are a variety of ways in which teaching materials using functional grammar can be incorporated into higher education programs to improve students' ability to adopt the

https://doi.org/10.52202/066488-0007

appropriate writing style for a particular context. A common approach is to offer supporting or preparatory writing workshops separate to the main curriculum, and functional grammar can be used successfully in such workshops. However, such workshops are limited by the fact that they are not contextualised (Wingate, 2006). Similarly, online resources (Drury & Mort, 2012) and support from learning advisors or writing consultants (Walker, 1999) can make effective use of functional grammar concepts, but can face the same issues of separation from a realistic context.

Because adapting writing style to contextual variation is crucial, embedding writing instruction across the curriculum in a way that helps students to understand the connections between context and language choices may provide the most effective approach. Embedded instruction of communication skills in engineering modules, with an emphasis on creating realistic contexts, has been shown to be successful in many instances (Beck, 2004; Bodnar & Kadlowec, 2018; Breeze & Guinda, 2017; Yu, 2008). As an example, many engineering programs already use project based learning (Graham & Crawley, 2010) or similar approaches that simulate a professional context. Functional grammar can be used as a learning tool in such a project through the writing tasks involved. The role of a writing task can be the focus of discussion between the educator and students, with consideration at the contextual level in relation to the project milestones, the purpose of the document, the intended audience and their relationship to the writer. This context can then be explicitly linked to appropriate language choices such as modality through the deconstruction and reconstruction of model texts. This embedded approach relies on the language awareness of the engineering educator; therefore, raising the levels awareness of functional language choices among engineering educators is necessary in order for successful integration.

References

AECOM. (2016). *Coopers Gap windfarm environmental impact statement.* Brisbane: AECOM.

Beck, A. (2004). Collaborative teaching, genre analysis, and cognitive apprenticeship: Engineering a linked writing course. *Teaching English in the two-year college, 31*(4), 388.

Bodnar, C., & Kadlowec, J. (2018). Initial validation of a technical writing rubric for engineering design. *International Journal of Engineering Pedagogy, 8*(1), 81-91. https://doi.org/10.3991/ijep.v8i1.7728

Breeze, R., & Guinda, C. S. (2017). Genre-based strategies for integrating critical and creative thinking in engineering and journalism. *ESP Today, 5*(2), 196-221. https://doi.org/10.18485/esptoday.2017.5.2.4

Cardno. (2018). *Structural condition assessment of Sans Souci Bathers Pavilion*. Sydney: Cardno.

Clippinger, D., Jernquist, K., Nozaki, S., & Nitterright, F. (2019, June 16-19, 2019). *Improving undergraduate STEM writing through common language as a tool to teach engineering "dialects'* American Society for Engineering Education 126th Annual Conference & Exposition, Tampa, Florida.

Conrad, S. (2017). The use of passives and impersonal style in civil engineering writing. *Journal of Business and Technical Communication, 32*(1), 38-76. https://doi.org/10.1177/1050651917729864

Curry, M. J., & Hanauer, D. I. (Eds.). (2014). *Language, literacy, and learning in STEM education : research methods and perspectives from applied linguistics*. John Benjamins B.V.

Douglas Partners. (2017). *Report on preliminary geotechnical investigation.* Canberra: Douglas Partners.

Drury, H., & Mort, P. (2012). Developing student writing in science and engineering: the Write Reports in Science and Engineering (WRiSE) project. *Journal of learning development in higher education.* https://doi.org/10.47408/jldhe.v0i0.183

Energy Safe Victoria (ESV). (2018). 2018 Australia Day weekend outages: Technical investigation report. Melbourne: Energy Safe Victoria.

Engineers Australia. (2019) *Stage 1 competency standard for professional engineers.* Australia: Engineers Australia.

Giroux, C. S., & Moje, E. B. (2017). Learning from the professions: Examining how, why, and when engineers read and write. *Theory Into Practice, 56*(4), 300-307. https://doi.org/10.1080/00405841.2017.1350491

Goldsmith, R., Willey, K., & Boud, D. (2019). Investigating invisible writing practices in the engineering curriculum using practice architectures. *European Journal of Engineering Education, 44*(1-2), 71-84. https://doi.org/10.1080/03043797.2017.1405241

Graham, R., & Crawley, E. (2010). Making projects work: a review of transferable best practice approaches to engineering project-based learning in the UK. *Engineering education (Loughborough), 5*(2), 41-49. https://doi.org/10.11120/ened.2010.05020041

Gwiasda, K. E. (1984). Of classrooms and contexts: Teaching engineers to write wrong. *IEEE Transactions on Education, 27*(3), 148-150. https://doi.org/10.1109/TE.1984.4321688

Halliday, M. A. K., & Matthiessen, C. M. I. M. (2014). *Halliday's introduction to functional grammar* (4th ed.). New York, NY: Routledge.

King, R. (2008). *Engineers for the future: Addressing the supply and quality of Australian engineering graduates for the 21st century*. Sydney: Australian Council of Enigneering Deans.

Male, S. A., Bush, M. B., & Chapman, E. S. (2015). Understanding generic engineering competencies. *Australasian Journal of Engineering Education, 17*(3), 147-156. https://doi.org/10.1080/22054952.2011.11464064

Martin, J. R. (2016). Meaning matters: a short history of systemic functional linguistics. *Word, 62*(1), 35-58. https://doi.org/10.1080/00437956.2016.1141939

Martin, J. R., & White, P. R. R. (2005). *The language of evaluation : Appraisal in english*. Basingstoke, New York: Palgrave Macmillan.

McMurtrie Consulting Engineers. (2018). *Traffic impact assessment report: Melbrig cattle feedlot expansion 340 Derra Road, Mundubbera, Queensland.* North Rockhampton: McMurtrie Consulting Engineers.

O'Brien, W. T. (2000). *The acceptability of writing by second language engineering students: acculturating to a profession* Concordia University. Montreal, Quebec, Canada.

Smith, S. (2003). The Role of Technical Expertise in Engineering and Writing Teachers' Evaluations of Students' Writing. *Written Communication, 20*(1), 37-80. https://doi.org/10.1177/0741088303253570

Strauss, P., & Grant, L. (2018). 'We mainly deal with maths': New Zealand engineering lecturers' and students' perceptions of 'engineering writing'. *New Zealand Studies in Applied Linguistics, 24*(2), 1-11.

van Emden, J. (2005). *Writing for engineers* (3rd ed.) Basingstoke, New York: Palgrave Macmillan.

Vipac Engineers & Scientists. (2017). *ABC Birkenhead site: Noise abatement and modelling update*. Adelaide: Vipac Engineers & Scientists Ltd.

Walker, K. (1999). Using genre theory to teach students engineering lab report writing: A collaborative approach. *IEEE Transactions on Professional Communication, 42*(1), 12-19. https://doi.org/10.1109/47.749363

Wingate, U. (2006). Doing away with 'study skills'. *Teaching in Higher Education, 11*(4), 457-469. https://doi.org/10.1080/13562510600874268

Winsor, D. A. (2006). Using writing to structure agency: An examination of engineers' practice. *Technical Communication Quarterly, 15*(4), 411-430. https://doi.org/10.1207/s15427625tcq1504_1

https://doi.org/10.52202/066488-0007

Yong, E., & Ashman, P. J. (2019). Integration of the structured development of communication skills within a chemical engineering curriculum at the University of Adelaide. *Education for Chemical Engineers, 27*, 20-27. https://doi.org/10.1016/j.ece.2018.12.002

Yu, H. (2008). Contextualize technical writing assessment to better prepare students for workplace writing: Student-centered assessment instruments. *Journal of Technical Writing and Communication, 38*(3), 265-284. https://doi.org/10.2190/TW.38.3.e

Acknowledgements

Copyright statement