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## Research Paper

# Persuasion in Engineering Reports: Evaluative Resources and Targets in Practice

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## Abstract

This study investigates the use of the attitude system in engineering writing, including how attitude resources are deployed and what they target. The study analyses 10 professional engineering texts. Research suggests that professional engineering writing is largely an object-centred form of written communication, that is, focused on physical objects (Ding, 2001; McKenna, 1997). Engineering writing also has a persuasive purpose and an ‘objective’ style (Winsor, 2006), which can be challenging for novice engineering writers as it requires a command of evaluative language including an understanding of how and to what evaluation can be applied. Appraisal system offers an approach to understanding the use of evaluative language. Findings show that the valuation subtype of appreciation, a subsystem of attitude, is used in significant preference to all others. Physical objects and activities are the most commonly evaluated targets. These findings have implications for teaching writing to engineering students.

**Keywords:** Appraisal Analysis; Systemic Functional Linguistics (SFL); Persuasive Language; Evaluation; Engineering

## 1. Introduction

The development of appropriate writing skills is a challenging task for professional engineers. Professional writing in engineering has been described as uniquely object-focused (Ding, 2001). That is to say, the work of an engineer is concerned with physical objects, their qualities, their function, the processes they are involved in and how they interact with the environment in which they are placed. This concern is reflected in the written discourse of the profession. The central task for the professional engineer writing at work may be described as performing analysis by way of the ‘recontextualization from common-sense events, processes and entities’ (McKenna, 1997). At the same time, writers of engineering documents are required to adopt an objective style (Winsor, 2006) in which emotion and subjectivity are either not present, or only present very subtly. Engineering writing is also widely regarded to be persuasive (Collins, 2010; Winsor, 1998, 2006), in that the writer seeks to influence the reader to take a particular course of action. As described by McKenna (1997, p. 192), engineering writing is ‘an instrumentalist discourse that is epistemologically constructed by the scientific concepts that provide its intellectual foundation (its social construction of reality) and is socially embedded in the relations and shared understandings that exist between engineer and client.’ The combination of the requirement to be objective and persuasive, while focusing on physical objects and actions, is one reason why the acquisition of appropriate professional writing skills can be so difficult for engineers. Along with an understanding of different genres and their language features, a command of evaluative language which includes an understanding of how, and to what, evaluation can be applied in engineering discourse is arguably necessary in order to achieve the desired stance. The appraisal<sup>1</sup> framework (Martin & White, 2005) offers a methodology of investigating this stance, and is the focus of this paper. In particular, this study investigates the use of one domain of appraisal resource, the attitude system, and what ideational content the resources are used to evaluate. This study makes use of the partial results of a larger research project into the persuasive discourse of engineering.



## 2. Dataset and Methodology

### 2.1. Dataset

The dataset consists of 10 publicly available professional engineering texts, which are part of a larger corpus being used for a research project on the persuasive discourse of engineering. The basis for inclusion of these 10 texts in the corpus is that they are:

- partially or fully written by a professional engineer,
- written in the Australian context,
- written for the broadly defined purpose of informing a governing body or client prior to commencing a proposed project, determining the need for engineering work, or giving advice, and
- written as recently as possible. (The earliest publication date of these 10 texts is 2013.)

The texts included in the study share a broad generic purpose and structure and can be considered as examples of a macrogenre (Martin & Rose, 2008, p. 218) with the purpose of inquiry (Derewianka & Jones, 2016). The reports include environmental impact statements, a traffic impact assessment, investigation reports and other reports written for governing bodies or clients. The texts can be classed as examples of the category of ‘analytical report,’ as described by McKenna (1997), in which engineers ‘generally record their design of a construction or process, or their *analysis of an existing construction, process, or event that may be used in legal and quasi-legal situations*’ (McKenna, 1997, p. 192). The second part of McKenna’s description (highlighted in *italics*) particularly applies to the texts included. The reports have the common ‘macrostructure’ of Introduction^Methodology^Results^Discussion (IMRD), which has been identified as being common across engineering reports in student assignments and published journal articles (Gardner & Xu, 2019) and is broadly similar to Martin and Rose’s (2008, p. 200) description of the staging of procedural recounts, including technical notes, experiment reports and research articles:

Introduction^(Optional Methods)^Investigation/Results^Conclusion & Recommendation

Genre stages are realised by configurations of the register variables field, tenor, and mode (Martin & Rose, 2008). From the perspective of field, that is, the topic or focus of activity, these reports are focused on specific concrete things, the processes in which these things are engaged and the places in which they are located. The mode, or textual organisation, of the texts is one common to formal, written documents; comprising sections which preview and summarise the central content, headings to organise sections and cohesive linking between sentences. Tenor is concerned with the social relationships construed by the texts, and is the central focus of this study.

Whereas the reports included are similar in their macropurpose and structure, there are also identifiable differences between them due to their particular communicative purposes as distinct instantiations of the macrogenre. For example, environmental impact statements are concerned with the future: they analyse the impact of proposed activities and outline mitigation measures whereas investigation reports consider the past, for example, analysing the causes of the failure of an electrical component. Finally, some of the reports in this dataset are concerned with a current situation as well as the future, such as the structural condition of a building.

An overview of the texts analysed for the current study is in Table 1:

Table 1. *Engineering Texts Analysed*

Text	Document Type	In-Text citation*	Overview of text
1	Environmental Impact Statement	Spencer Gulf Ports Link 2013	Assessment of the risk posed by potential impacts to the environment as a result of a proposed project, and statement of proposed mitigation measures.
2		AECOM 2016	
3	Traffic Impact Assessment	McMurtrie 2018	Assessment of the impact on traffic of a proposed development.
4	Technical Investigation Report	Energy Safe Victoria (ESV) 2018	Results of an investigation into a technical failure

5		ESV 2018	
6		ESV 2019	
7	Posttrial Report	Adelaide Brighton Cement (ABC) 2015	Results of a trial into the use of alternative fuel as support for a request for permission from the Environmental Protection Agency to use the alternative fuel in regular operations.
8	Civil Engineering Report	Taylor Thompson Whitting (TTW) 2017	Advice and regarding stormwater disposal in support of an application for a proposed development
9	Noise Abatement and Modelling Update	Vipac 2017	Results of investigation into the impact of industrial noise on surrounding residential area.
10	Engineers Assessment Report	Tonkin 2016	Results of an investigation into the structural conditions of a building.

\*Please see Reference list for full citation details.

Where possible, the entire text was analysed. Some of the texts were short enough to allow this, however some were prohibitively long. In these cases, only a portion of the text was analysed, focusing on the results and conclusion stages as these stages engage most with the presentation of evidence- a key element of the persuasive stance.

## 2.2. Using Appraisal to Investigate Persuasive Writing

The appraisal system (Martin & White, 2005) has been extensively used by researchers in systemic functional linguistics (SFL) to investigate the construction of a persuasive stance. Appraisal is a discourse semantic system, concerned with the organisation of lexicogrammatical resources into patterns of meaning. Research into the way texts are construed at the level of discourse semantics can bridge the gap between the study of grammar and the study of context (Martin & Rose, 2013), helping to make explicit the way the grammar constructs the register and in turn, the genre. The interpersonal meanings covered in the appraisal system are used to negotiate social relationships, construing the tenor of the texts, by evaluating entities and positioning the voice of the writer in relation to other perspectives (Martin & Rose 2013, p. 26) and as such, are crucial to persuasive writing (Lam & Crosthwaite, 2018; Lee, 2015). In persuasive academic writing, Hood (2010) demonstrates how expression of an evaluative stance which balances both critical argument and objectivity is reliant on command of these interpersonal resources. Appraisal has been used to investigate persuasion in a diverse range of other contexts, such as customer reviews (Su, 2016), wine appreciation (Hommerberg, 2011; Hommerberg & Don, 2015), property advertising (Beangstrom & Adendorff, 2013; Pounds, 2011), political discourse (Thuube & Ekanjume-Ilongo, 2017) and writing by primary school age children (Thomas et al., 2015), as well as to inform the teaching of persuasive writing (e.g., Humphrey, 2016; Humphrey & Economou, 2015). Appraisal has also been used to describe the construction of objectivity in journalism (Thomson et al., 2008; White, 2012). Of particular interest to this study is research concerned with persuasive strategies used in writing which is generally considered to be only factual and lacking the commonly expected language features of overtly persuasive writing, such as medical research articles (Stosic, 2021) and institutional documents (Tupala, 2019). In some genres, only certain ways of making evaluations are appropriate and ‘the persuasive nature of the text tends to be hidden behind a veneer of ‘objectivity’’ (Hunston et al., 2000, p. 177).

An investigation of the way appraisal resources are combined and layered and how they interact can offer significant understanding of the way a text presents a persuasive or evaluative stance. In SFL, the term ‘prosody’ has been used to describe the ‘dynamic interplay’ of interpersonal resources that combine and extend across phases of discourse, or the ‘spread, sprawl, smear or diffusion of interpersonal meanings that accumulate, reinforce, or resonate with each other to construct an evaluative “key” over an extended segment of text’ (Hood, 2006, p. 38). This discourse semantic conceptualisation is of particular use for this study, as Hood (2006, p. 38) states that:

An appreciation of the functioning of prosodies of interpersonal meaning makes an important contribution to our understanding the ways in which writers do persuasive work, especially in the context of discourse that relies minimally on overt and explicit attitude.

The appraisal system is divided into three dimensions which interact and complement each other: attitude, engagement and graduation. Expressions of values are presented through resources from each system. Engagement resources relate to the way the authorial voice of a text engages with and positions itself in relation to other possible voices and stances on a theme while resources covered by the graduation system are used to up-scale and down-scale other attitudinal or engagement meanings (Martin & White, 2005). The focus of this study is on the attitude resources which deal with the expression and negotiation of emotions, ethics and aesthetics. A gloss of these domains could be expressed as the ways in which people feel, how they judge behaviour in others and how they appreciate ideas and physical things. In the attitude network these three domains are named affect, judgement and appreciation. These three domains are, then, broken down into further, more delicate categories and identified to be either positive or negative in terms of their stance towards the target of evaluation. Due to the nature of the field of the texts with its focus on physical things, the subcategories of appreciation (reaction, complexity and valuation) are of most relevance for this paper.

The following examples taken from the texts illustrate the three domains of the attitude network. In these examples and throughout the paper, attitude items are highlighted in *italised bold* font. An example of negative affect is present in Example 1, conveying a feeling of concern:

[1] ESV was **concerned** about the safety implications for the community arising from the large number of incidents and outages and requested information from each DB regarding the outages (ESV 2018, p. 10).

Positive judgement of a human institution, the *testing company*, can be seen in the following example:

[2] All of the above results were generated using the same **highly regarded** testing company who have published reports on dioxins and furans for the Federal and NSW EPA Websites (ABC 2015, p. 7).

Negative appreciation, in particular valuation, is demonstrated in examples 3 and 4:

[3] [P]arts of the building are **structurally unsafe or unsound** (Tonkin 2016, p. 1).

[4] There is a **risk** that materials or substances brought to the site and stored or used during the construction process could be released into the groundwater environment. (Spencer Gulf Ports Link, 2013, p. 113).

Example 5 contrasts with the above negative appraisal, demonstrating positive valuation:

[5] The purpose of LV fuses on the distribution network is **to protect** LV assets and distribution transformers from overload by operating when the electrical load reaches a certain level based on the fuse rating (ESV 2018b, p. 8).

In this example, the description of the purpose of the LV fuses, that they *protect* other pieces of the system, conveys a positive valuation of the fuses themselves. Similarly, the effect of something may also be read as conveying attitude through causal relations. For example, the fact that a weather event or piece of equipment caused a fire which, then, damaged property may be read as inscribing a negative valuation towards the weather event or piece of equipment; an example of this is seen in Example 6:

[6] [A] high wind event passing through Victoria's South West Region **caused a fault** on the electrical network and a fire in the Terang area that **resulted in significant property damage** (ESV 2018a, p. 5).

The examples of affect, judgement and appreciation presented so far have all been presented explicitly. Martin and White (2005) label explicitly expressed attitude as 'inscribed,' and implicit evaluation expressed through 'tokens' of evaluation as 'invoked.' Invoked attitude relies on potentially very subtle positioning of inscribed attitude, engagement and graduation resources and the ideational content itself. A strategy of invoking attitude 'clearly depends on shared values or, at least, on the addresses perceiving and accepting, however provisionally, the values which are required in order to make [a] statement relevant' (Thompson, 2014, p. 50), Martin and White (2005) and Don (2016) make further distinctions between invocations of attitude based on the method of presentation, along a cline of explicitness. Due to the scope of this paper, the analysis will only make a distinction between inscribed and invoked attitude. Additionally, whereas the methodology of this study draws on the analysis of engagement and graduation resources for the identification of invoked attitude, these are not discussed independently in this paper.

The perception of invoked attitude is more reliant on the reader than inscribed attitude and, as such, it is subtler. Graduation resources can play a significant role in invoking positive and negative attitude. For example, in Text 1, the groundwater resource at the project site is described as **minimal in quantity** (Spencer Gulf Ports Link, 2013). Minimal is

a graduation item which quantifies the groundwater resource. The use of this quantification invokes negative attitude, in particular a negative valuation of the groundwater, which is subtler than a choice of inscribed attitude would be in this case. The writer could have written that the groundwater resource is inadequate, but instead chose a construction that is more reliant on the reader understanding that having minimal groundwater resources is a negative situation. Another example of invoked appreciation is the following:

[7] Drainage design for the permanent works *will be aimed at minimising the disruption to natural drainage patterns* (Spencer Gulf Ports Link, 2013, p. 115).

In this example, the positive valuation is invoked through the statement of intent regarding the proposed drainage design. Because the design will attempt to reduce a negative consequence (*disruption of natural drainage pattern*), a positive perception of the proposed design is connoted. The reader is assumed to share the understanding that disruption to natural drainage patterns is in fact a bad thing. A further example demonstrates how engagement resources add to graduation resources to invoke a negative appreciation:

[8] [I]t is conceded that the proposed cattle feedlot expansion *will have an impact on the Derra Road pavement* (McMurtrie 2018, p. 24).

In Example 8, no explicitly negative lexis is used, however infused graduation in the term *impact* invokes a negative appreciation. Again, this relies on the shared understanding that minimising impacts on surrounding environments is a good thing whereas actual impacts are likely to be a bad thing. Additionally, the engagement resource *it is conceded that* demonstrates that the writer acknowledges a potential negative outcome from the feedlot expansion. The use of the modal verb *will* rather than *may* or *could* also connotes this negative appreciation by up-scaling the likelihood that an impact will occur. A different example highlights how invoked attitude can be presented through a statement of compliance with external policies or requirements, as in:

[9] The operation of the majority of the LV fuses over the Australia Day weekend *is in line with the businesses protection philosophies* (ESV 2018b, p. 10).

In order to read this as a positive attitudinal statement, the reader must have some level of understanding that to comply with the business protection philosophies is a positive thing.

According to Martin and White (2005), technical language that is derived from attitudinal resources but have become institutionalised ‘as rules and regulations or as criteria’ can be regarded as ideational content and does not inscribe attitude but invoke it. For instance, Szenes (2017) gives the example of the legal technical term *sentencing* as invoking judgement of someone who is given a sentence in the legal context. This kind of terminology is referred to as axiologically charged, or ‘axi-tech’ (Martin & Zappavigna, 2018, p. 110). In the texts included in this study, a useful example of axi-tech is the term *mitigation*. To understand the condensation of values in this term, reference is made to three dictionaries of engineering terms (in particular, environmental engineering) and a book about environmental impact assessment. *Mitigation* can be simply defined as the following: ‘measures taken to reduce the adverse impacts on the environment’ (Pankratz & Pankratz, 2001, p. 156).

A more detailed definition with additional context is given as the following:

In environmental management, it is the measures undertaken to avoid (preferably) or reduce or offset the adverse environmental effects of a specific activity. Mitigation may include changes to policy, management plans and technical matters. In some countries (not the UK) the term ‘mitigation’ also implies compensation being paid by the polluter for the environmental damage. (Smith & Scott, 2005)

A more recent dictionary with an additional focus on wastewater treatment adds the particular lens of climate change to the term, defining the term as:

A human intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks. Act of fixing a system that has malfunctioned, preceded by an evaluation of all the components (source, collection and storage, pretreatment, final treatment and dispersal) to determine the reason for the malfunction; certain jurisdictions may require a permit before mitigation occurs. (Bahadori, 2016)

In the specific context of environmental impact assessment, the purpose of mitigation is described as ‘to identify measures that safeguard the environment and the community affected by the proposed project’ (Mareddy et al., 2017, p. 383)

Mitigation can arguably be read as an ideational, technical term which could be analysed as invoking attitude in this context. However, the presence of attitudinal (e.g., *adverse, preferably, polluter, damage, enhancing, fixing, malfunctioned, and safeguard*) and infused graduation of force (e.g., *reduce and impact*) resources in these definitions reveals the evaluative meanings condensed within the term. Mitigation measures fix or, at least, reduce, problems: undertaking mitigation removes or reduces a bad outcome and can, therefore, be read as giving a positive meaning. Additionally, in the discourse patterns of texts such as the environmental impact statements, mitigation plays a key evaluative role, positioned as a positive evaluation against the explicit negative of risk. Therefore, in order to investigate the persuasive stance being taken in these texts, instances of axi-tech such as mitigation are treated as inscribed attitude, following Szenes (2017).

In order to investigate the presentation of a persuasive stance through an objective style, this study engages with the following questions:

1. What attitude resources are used to create this stance?
2. What prosodies of attitude are present in the stance?
3. What are the various patterns of inscribed and invoked attitude in this stance?
4. What targets are evaluated using the identified attitude resources?

### 3. Use of Attitudinal Resources

The results of the analysis show that there is an overwhelming reliance on appreciation as an attitude choice across all texts. As a group, the breakdown of attitude resources identified in the texts shows that 96% can be categorised as appreciation, 3% as judgement and 1% as affect. Of the appreciation resources used, there is also a very significant representation of valuation as a subcategory, with 94% of the appreciation resources used signifying valuation. The remainder of the appreciation resources are represented by 5% composition and 1% reaction.

These results demonstrate that across the ten texts, the language of feelings and judgements of people are almost entirely absent. It can be concluded that engineering discourse avoids affect and judgment as a way of construing the tenor of the writing as objective. Using emotion based language or regularly evaluating people may be perceived by the reader as too subjective, and inappropriate for the objective style. Therefore, these resources, which may be utilised for persuasive purposes in other discourse domains, are largely avoided by the writers of engineering texts.

The significant use of valuation as an evaluative resource is perhaps unsurprising given the field of the texts is centred on the ‘complex process of renaming and classifying (reconstruing) real world entities, processes and events’ to ‘the engineer’s task as an applied scientist’ (McKenna, 1997, p. 198). The subcategory of valuation provides the linguistic resources for evaluating these real-world entities, processes and events. Valuation, in terms of its grammatical relationships, can be considered ‘related to cognition (our considered opinions)’ and also to ideational worth (Martin & White, 2005, p. 57). In comparison with the other dimensions of appreciation, valuation is ‘especially tied up with field’ (Martin, 2000, p. 160) because what counts as evaluation is ‘institutionally specific.’ It can be argued that engineering discourse relies so significantly on one domain of evaluative resource both because valuation is the most relevant to the field of the text, being the task of analysis that is tied to the physical world, and because the other options available in English are considered too subjective for the discourse. Thus, by giving preference to valuation as the dominant linguistic means of evaluating entities in their texts, engineering writers are able to employ persuasive strategies but also maintain the veneer of the objective style that is valued.

### 4. Positive and Negative Prosodies

The analysis results highlight a key difference in the use of positive and negative attitude resources across the 10 texts. Each of the texts displays a meaningful bias towards either positive or negative attitudinal resources. This difference can be linked to the purpose and topic of the reports. The following figure shows the percentages of each text in terms of the use of positive and negative attitude. A very small number of attitude resources were analysed as ambiguous in term or positivity or negativity and have been omitted from these results.

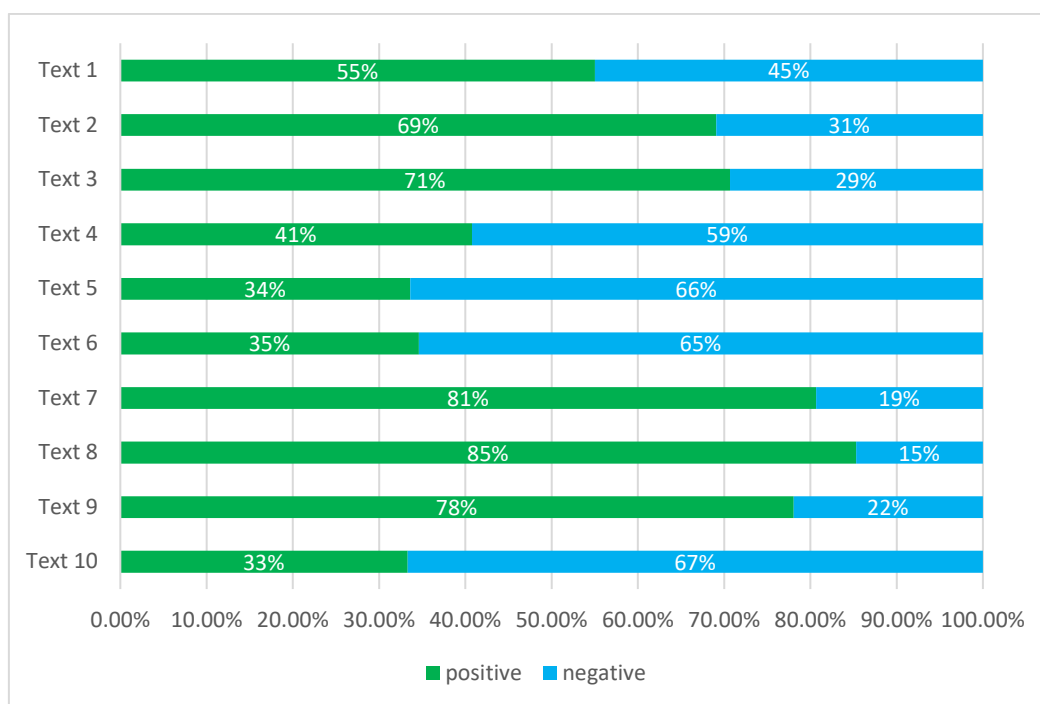


Figure 1. Percentages of Positive and Negative Attitude

Texts 4, 5, 6, and 10 are concerned with the investigation of a technical failure or the poor condition of a building. As can be seen in Figure 1, these texts use proportionally more negative attitude, ranging from 59 to 67% negative. This result can be explained by the fact that these texts are about what went wrong and what can be fixed in order to make decisions about what should happen in the future. By repeated use of negative attitude in relation to objects and activities, these texts build a negative prosody in relation to the failures the analysis identifies, supporting the justification of their interpretation of the evidence. For example, Text 10 provides a report on the structural conditions of a building. Negative evaluations are repeated in relation to the whole building and individual components in Example 10. Each instance of negative evaluation in this example is followed by its coding as invoked or inscribed in square brackets:

[10] The Roundhouse is *fenced off and signed to prohibit entry [invoked]*; however, it is obvious that even with the fencing and signage in place that the building has been and is probably still being entered into by children and young adults. *With open pits, and building debris/timber boards with nails protruding lying about [invoked]*, the Roundhouse is *definitely not a safe place to walk around in [invoked]*. During our inspection we noticed *burnt [inscribed]* timber boards and galvanized iron sheets *swaying in the breeze and hanging precariously [invoked]* from the *weakened [inscribed]* roof framing. (Tonkin 2016, p. 2)

Whereas the initial statement that the building has been *fenced off and signed to prohibit entry* could be interpreted as a positive action to protect the public, it also invokes a negative impression of the state of the building, which reinforces the evaluation which has been presented in the prior text. The repetition of inscribed and invoked negative valuations in Example 10 build a persuasive stance that positions the reader to accept the final finding that the building is unsafe for use and should be demolished, leaving little room for the reader to disagree with this position.

Texts 1, 2, 3, 7, 8, and 9 report on the results of investigations in order to give advice in the context of seeking approval from a governing body such as an Environmental Protection Agency (EPA) or a local council to progress a project, change an industrial process or continue an existing practice. These texts use significantly more positive attitude: 79% or higher in each of these texts. It can be argued that these texts pattern repeated positive attitude towards certain targets in order to build a positive prosody in support of the persuasive stance. The reader is, then, positioned to agree with the positive stance taken towards the project or request concerned. As an example, Text 1, a chapter from an EIS, repeatedly inscribes and invokes positive appreciation of the Environmental Management Plan (EMP) proposed. The EMP details the measures that will be taken to mitigate adverse environmental impacts that could be caused by the proposed project. One instance of this is shown in the following extract:

[11] The EMP includes *appropriate [inscribed] procedures for recovery of spills and leaks from sumps and containment areas, so that secondary escapes cannot occur [inscribed]* and it *will detail how wash down and other wastewaters, metal particle, paint and solvent emissions and wastes will be contained, collected and managed so as not to contaminate the environment [inscribed]*. (Spencer Gulf Ports Link, 2013, p. 115)

In addition to the inscribed appreciation of the *procedures* as *appropriate*, this extract uses causal relations (*so that*) to link the EMP to a positive outcome (*preventing secondary escapes*). This extract also uses engagement resources (shown in double underlining) to invoke support for the positive attitude, increasing the likelihood that the EMP will be effective in reducing negative impacts by using denial in relation to the undesirable impacts, and upscaling the certainty of success through the modal verbs *will*. Repetition throughout the text of these patterns of positive inscription and invocation of appreciation targeted at the EMP builds a persuasive stance towards the proposition that the EMP will be able to effectively reduce the risks posed to the environment by the project, which supports the proposal that the project should be given approval.

### 5. Patterns of Inscription and Invocation

Unlike the distinct differences in use of positive and negative attitude, the analysis shows that there is a tendency towards inscribed over invoked attitude in 8 out of the 10 texts. Figure 2 shows the distribution of attitude resources between inscribed and invoked instantiation:

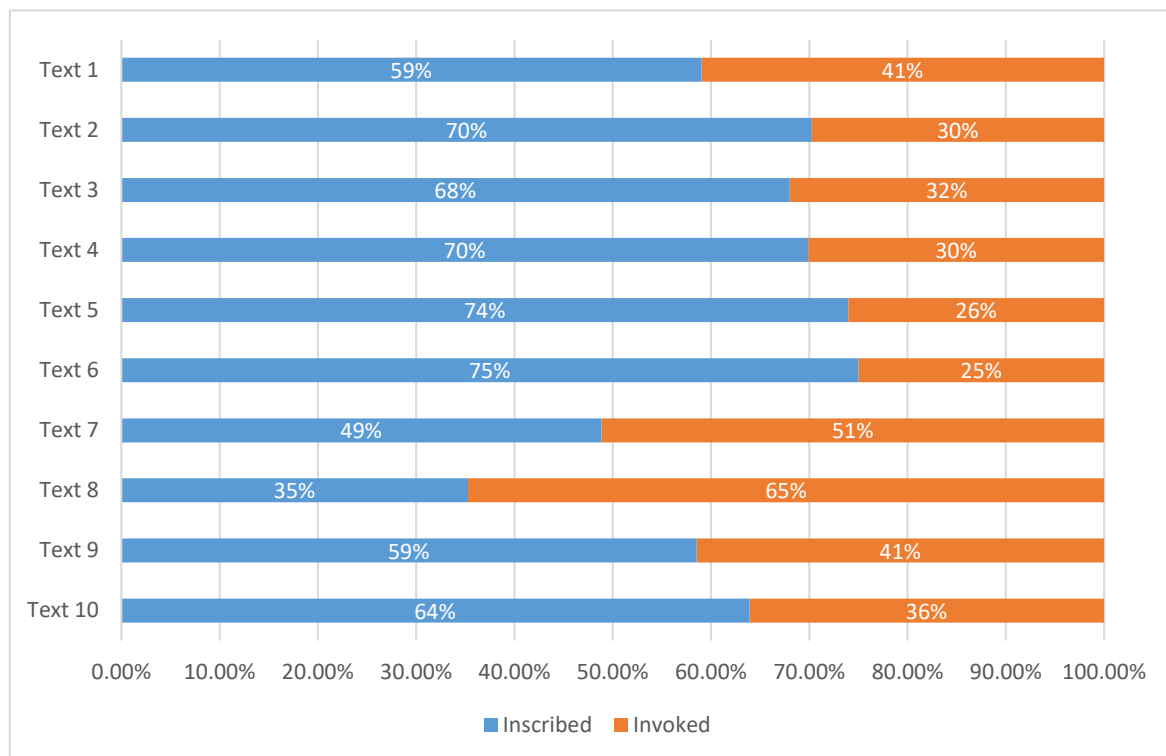


Figure 2. Explicitness of Attitude in Each Text

From these findings, it may be concluded that engineering discourse in general tends towards inscription rather than invocation of attitudinal resources. As stated above, axi-tech has been considered as inscribed attitude in this study in order to stress its role in presenting a persuasive stance. This methodological decision has meant that inscribed attitude is represented in greater proportions in the results. However, because terms such as mitigation are technical and particular to the discipline, they may be read as appropriate because they do not rely on overly emotionally based values. Therefore, the use of axi-tech alongside other inscribed valuation enhances the objectivity of the style.

Having determined that there is a tendency towards inscribed attitude which enhances objectivity, it is important to draw out where invocation is used. In some texts, invocation is often used when negative attitudes are conveyed, perhaps in order to downplay or reduce the impact of these negative evaluations in order to avoid undermining the



persuasive stance. For example, in Example 8 it *is conceded that the proposed cattle feedlot expansion will have an impact on the Derra Road pavement* (McMurtrie 2018, p. 24), but it is not explicitly stated that this impact will be negative. Additionally, the few judgement resources which are present in the texts are almost entirely presented through invocation. For instance, the following example invokes positive judgement of a company:

[12] [T]he suppliers of this alternative fuel have recently *undergone an equipment upgrade*. (ABC, 2015, p. 3)

The fact that the suppliers have taken the step of upgrading their equipment may be read as a positive judgement of their capacity as producers of the fuel because in the engineering context this is widely agreed upon as a good thing to have done. Similarly, a simple statement of the role of the engineers in creating the document or undertaking a job at the request of another company can invoke a positive judgement of their capacity because it shows that their services are valued sufficiently by others to be engaged, for example:

[13] Vipac Engineers & Scientists (Vipac) *were engaged by Adelaide Brighton Cement (ABC)* to conduct a noise impact model assessment for the ABC Birkenhead Plant operations on the existing residential receivers located within the surrounding suburbs. (Vipac, 2017, p. 4)

The almost total use of invocation to convey judgment reinforces the conclusion that engineering discourse prefers to avoid judgement of people in order to maintain the objectivity of the style. Where judgement resources are employed, there is a marked preference to present them implicitly so that their perception is somewhat dependent on the reader's choice and the engineering context.

## 6. Targets of Attitude

Identifying the target of evaluative language is as important as identifying the resources used to convey the evaluation (Martin & White, 2005, p. 59). Analysing the target of evaluation requires some exploration of the ideational content of the texts, that is, the 'subject matter' being evaluated. As part of the analysis, the target of each instance of attitude was coded. Following coding, the identified targets were grouped together and categorised for the purposes of identifying what commonalities there are in terms of the couplings between ideational content and evaluative language. In order to categorise the targets, it is necessary to shift focus from the interpersonal resources covered by appraisal and into the experiential system of ideation. Though a full exploration of ideation is not within the scope of this paper, a brief introduction is required. Whereas appraisal can be described as 'negotiating attitudes,' the function of the system of ideation is glossed as 'representing experience' (Martin & Rose, 2013). Ideation covers the 'sequences of activities, the people and things involved in them, and their associated places and qualities, and on how these elements are built up and related to each other as a text unfolds' (Martin & Rose, 2013, p. 73). Ideation comprises a range of resources that are useful for the purpose at hand of categorising targets in these texts. The resources most relevant for this purpose include entity, dimensionality, figure and grammatical metaphor (Hao, 2020). Firstly, a discourse semantic entity realises 'people, places and things' (Martin, 1992, p. 29) and the system of entity classifies entities into six main categories: source (including people), thing, activity, semiotic, place and time (Hao, 2020). During analysis of the targets found in this study, an entity was found in Text 4 which does not belong to any existing entity category: a clearance. In Example 13, the target of the negative valuation is the *clearance*, or the distance, between two thing entities (the conductors).

[14] the clearances between the upper and lower P3 22kV conductors *were insufficient to prevent clashing and arcing during the high wind event*. (ESV 2018a, p. 25)

The clearances between a range of thing entities are important targets in the context of the discourse of this text. Because a clearance requires two entities in order to exist and refers to the space between them, it cannot be considered an aspect or dimension of a single thing entity. The clearances also cannot be considered only as a grammatical metaphor, as they are technical terms and can be taxonomised and arrayed (Hao, 2020). Therefore, it is proposed that this represents a new category of entity not previously covered in the ENTITY system: a space entity.

Entities can be augmented through use of resources from the system of dimensionality, which refers to how entities are categorised, structured, measured, or perceived (Hao, 2020, p. 90). For example, the activity entity *works* can be dimensioned according to what type of *works* are undertaken: actions that fix a problem are *repair works*. In terms of relationship to attitude resources, it may be that the dimension of an entity is the primary focus of evaluation. For example, in Example 14, *sections of roof framing*, rather than the whole of the roof, are negatively evaluated.

[15] DPTI has removed some sections of the roof framing that were *structurally compromised and in danger of collapse*. (Tonkin 2016, p. 2)

Another example is the following:

[16] it is anticipated that there will be *adequate* “capacity” in the relevant sections of the state-controlled road network to cater for the additional trips generated by all proposed stages of the Melbrig cattle feedlot expansion. (McMurtrie 2018, p. 18)

In this example, the salient meanings from an attitude perspective are that the road network will be big enough to accommodate the extra traffic that will occur because of the proposed project: the *adequate* “capacity,” which is a dimension of the thing entity *road network*. In addition to being dimensioned, entities are also configured with other discourse semantic elements into structures called figures, which can also be targets of evaluative language. Consider this example:

[17] The circuit breaker operated four times with settings applied **in accordance with the current approved Powercor Bushfire Mitigation Plan**. (ESV 2018b, p. 25)

The *circuit breaker* is a thing entity, and in combination with the occurrence *operated four times*, construes a figure. This figure is, then, evaluated through invoked valuation by indicating that the occurrence was compliant with the approved plan. Finally, grammatical metaphors may also be targets. Meanings may be represented ‘metaphorically,’ that is, the meaning can be transferred from one grammatical form to another. For example, *the kiln process was stable* can be expressed metaphorically through nominalisation of the quality *stable* to the noun *stability* that can, then, be evaluated as *excellent*, as in Example 17:

[18] the stability of the kiln process was *excellent*. (ABC 2015, p. 4)

For the purposes of grouping the targets identified through the attitude analysis, six main categories are outlined to bring together ideation resources under a broader focus. These categories are named object, activity, semiotic, people, place, and time. Table 2 describes these categories by stating the ideational elements comprising each category and giving examples from the texts. For the purposes of categorising the targets of evaluation, the proposed space entities have been grouped together with thing entities under the category of Object due to their close relationship with physical objects:

Table 2. *Categories of Targets*

Category	Ideational Elements Functioning as Targets	Examples
Object	Thing Entities and Proposed Space Entities	the building, roof sheets, old heavy timbers, RCD wood waste, plastic, fuel, heavy metals, wind turbines, wind farms, antenna, fuses, low voltage system, clearances between the upper and lower P3 22kV conductors
	Dimensions of Thing Entities	carbon monoxide levels, parts of the roof, section of the roof framing
Activity	Activity Entities	earth moving activity, welding, metal grinding, high wind event, engineering design checks, inspection processes, biannual stack testing
	Dimensions of activity Entities	repair works
	Figures	weather conditions, circuit breaker operated four times, these instances were reported and actioned, installing so much capacity on LV networks

	Grammatical Metaphors Involving Activities	stability of the kiln process, combination of high temperature and high humidity
Semiotic	Semiotic Entities	documents, standards, guidelines, legislation, agricultural water quality criteria, Environment Protection Policies, emergency management plans, result, opinion, advice
People	Source Entities—Institutions	suppliers of this alternative fuel, ABCL, testing company, Vipac, ESV, the developer, COS, local governments, and public sector entities, AGL
Place	Place Entities	Water Protection Areas, the site, Position R16, land,
Time	Time Entities	the period of the incident, the time of the incident Total Fire Ban days

The categorisation of target types here is useful in order to take a broad view of what is commonly targeted for evaluation in engineering writing. Figure 3 illustrates the percentages of each category of target type across the texts:

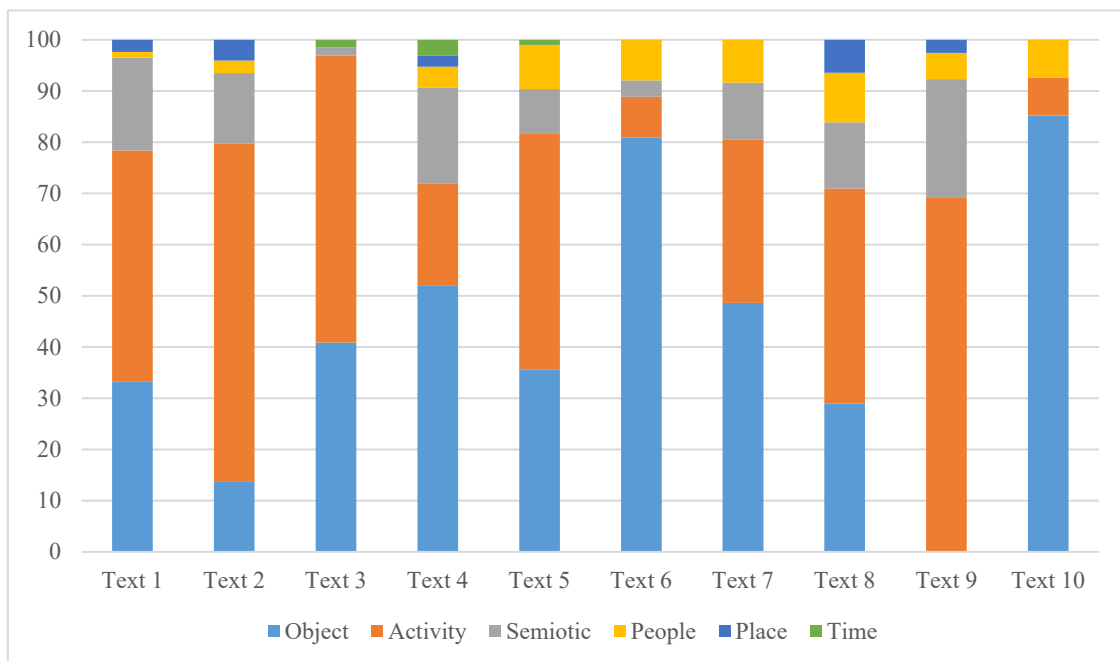


Figure 3. Target Type Percentages in Each Text

Whereas the percentages in each text vary, it can be seen that the most common category of target when the texts are considered as a whole group is activity, closely followed by object, as shown in Figure 4:

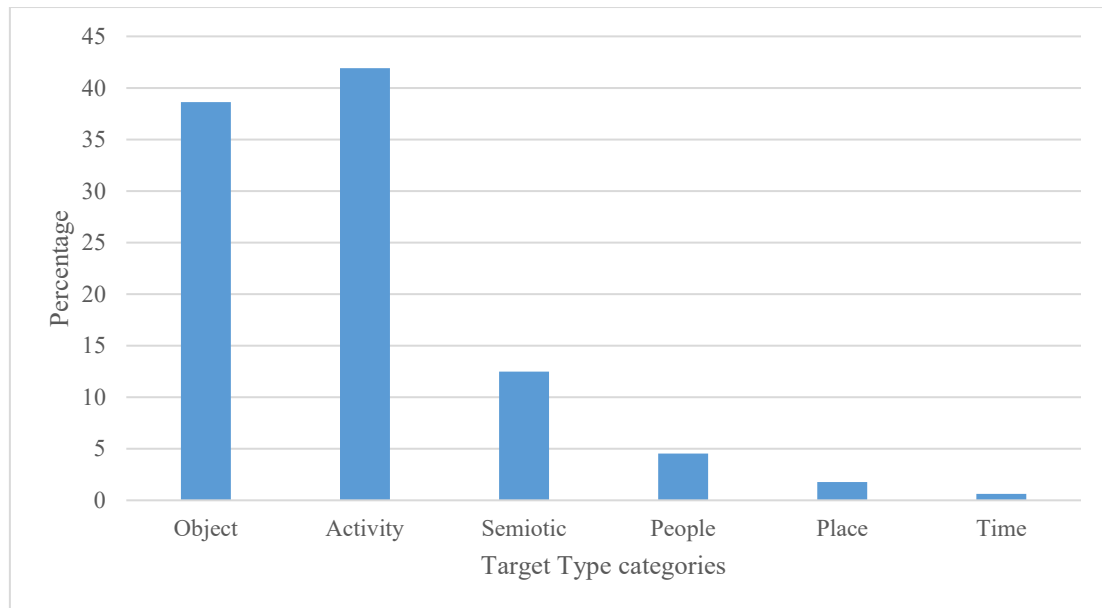


Figure 4. Target Types Across the Corpus

This result supports the findings of previous research like McKenna (1997) and Ding (2001) that engineering discourse is primarily concerned with real-world events, processes, and objects. This focused concern, realised in the linguistic choices made in the texts, may be considered as an important aspect of maintaining the objectivity of the style of writing. Having considered both the appreciation resources used, and the categories of target evaluated, this characterisation of the style of engineering discourse is given additional weight.

## 7. Proposal for Engineering Specific Subcategories of Valuation

The significant domination of valuation as the primary appraisal resource suggests that it could be possible to refine this category specifically for the engineering discourse domain. Adaptations to the attitude subcategories have been proposed by several researchers (e.g., Bednarek & Caple, 2010; Hommerberg, 2011; Macken-Horarik & Issac, 2014; Ngo & Unsworth, 2015; Su, 2016). Distinguishing specific subcategories of valuation would provide a more delicate investigation of the way that attitude resources are used to position the persuasive stance of the texts. Based on the 10 texts, a tentative proposal of three subcategories can be made: Functionality, Benefit/Harm and Compliance. The examples of both inscribed and invoked valuation resources can be used to draw out these potential categories.

### 7.1. Functionality

At the core of engineering work is the creation of functional, effective solutions for problems. Hence, the functionality, effectiveness or usefulness of a thing or activity is an important evaluative consideration. For example, Example 14 states that *the clearances between the upper and lower P3 22kV conductors were insufficient to prevent clashing and arcing during the high wind event* (ESV 2018a, p. 25). The clearances, therefore, did not perform their intended function, the prevention of clashing and arching, and this failure is the basis of the negative evaluation. As an additional example, the positive evaluation of the *stability of the kiln as excellent* (ABC 2015, p. 4) rests in the fact that stability of the kiln is beneficial for its functioning. This proposed subcategory could also be considered to include the importance of something as it relates to functionality. Example 5, which states that *[t]he purpose of LV fuses on the distribution network is to protect LV assets* (ESV 2018b, p. 8), can be considered a good example of functionality as an evaluative resource. The function of the fuses in *protecting* the other pieces of equipment is the basis for the positive valuation.

### 7.2. Harm/Benefit

The potential for an object or a process to result in harm to something or someone, or to provide benefit, is another core consideration for engineering. Engineers must consider all possible impacts of their projects and adjust

designs and practice accordingly. Harm and benefit are central elements of documents such as the environmental and traffic impact statements, and are crucial components of the other texts, as well. The fact that *parts of the building are structurally unsafe or unsound* (Tonkin 2016, p. 1) is based in the negative implication that an unsafe structure may result in injury. *Contaminating substances including diesel, petrol, oils, greases, cement, construction chemicals and herbicides* (Spencer Gulf Ports Link, 2013, p. 114) may lead to harm to the environment. The positive valuation in example 7 of the *drainage design* which will be *aimed at minimising the disruption to natural drainage patterns* (Spencer Gulf Ports Link, 2013, p. 115) rests in the meaning that there will be a positive outcome (a benefit) from the drainage design in terms of reducing potential harm and allowing the natural patterns of water flow to continue.

### 7.3. Compliance

Engineering projects are proposed, undertaken, completed and monitored through the lens of the requirements of various levels of government. A range of standards, policies, guidelines and legislation determine how projects must be designed and against which they are approved or rejected. Any engineering failures will be investigated in terms of whether the work completed met the relevant standards that should have been applied. Therefore, whether something complies with the relevant legislation is another important evaluative subcategory in terms of the worthiness of something. Compliance is the basis for the invoked valuation in Example 9, as *[t]he operation of the majority of the LV fuses [...] is in line with the businesses protection philosophies* (ESV 2018b, p. 10). Similarly, the positive evaluation of the fact that *the circuit breaker operated [...] in accordance with the current approved Powercor Bushfire Mitigation Plan* (ESV, 2018b, p. 25) demonstrates compliance.

These proposed categories can be investigated further in the full project from which the partial findings presented in this study are taken. This investigation can more fully consider whether these categories are reflected across the complete corpus, how they are used, and whether additional categories should be added.

## 8. Conclusion

In conclusion, this study has argued that in terms of the use of attitude resources, the persuasive stance presented in these engineering texts relies on the subcategory of appreciation: valuation almost exclusively, which shows that what is important in terms of presenting a persuasive stance in engineering writing is a question of what is considered worthwhile. The question of worthiness in the engineering report writing context is proposed to be based on three distinct categories: functionality, harm/benefit and compliance. In future research, these categories require substantiation across a larger body of texts. The objective tenor is maintained by the reliance on valuation, as this subtype of appreciation is closely tied to the field of the text and is the least impacted by emotion or explicit subjectivity. Adding to these findings, the grouping of targets into distinct categories has shown that from the perspective of evaluation, engineering discourse is focused primarily on objects and activities, and this finding complements previous research. This focus on objects and activities is driven by the field of the texts, but can also be seen as helping to maintain the appearance of objectivity in the tenor of the writing and avoid perceptions of reliance on emotion or subjective judgements. It should be emphasised here that the use of valuation and the focus on objects and activities is just one aspect of the tenor of the texts. While outside of the scope of this paper, further discussion is needed in future in relation to the role of other appraisal resources in presenting the persuasive stance, as well as comparison to similar genres such as bureaucratic discourse.

For the purposes of persuading the reader to align with the stance taken, the attitudinal resources used in the texts are patterned and reinforced to establish a semantic prosody that builds a particular positive or negative interpretation of certain elements of the content in a way that supports a particular proposition. Invoked attitude is used selectively to reduce the explicitness of negative evaluations, avoid undermining the persuasive stance and also to limit the visibility of judgements of people, allowing the reader more freedom as to whether to interpret them as presenting judgement.

This study has demonstrated the usefulness of the appraisal framework, particularly the attitude subsystem, in investigating how meaningful texts are formed: it shows how a persuasive stance is enacted through a particularly constrained objective tenor. In relation to curriculum development, these findings are useful in terms of informing teaching materials on writing for engineers. Students can be advised to select attitude resources from a constricted selection mostly limited to valuation, and to primarily target objects and activities. Teaching materials can also show students what choices to avoid, and to explicitly explain why they are not appropriate in an engineering report.

In summary, this study has implications for the use of the attitude system in researching the linguistic nature of engineering writing, and provides insights into professional writing style which will be beneficial for the engineering industry's understanding of its practice, and in designing education programmes for the development of future engineers.

## Notes

<sup>1</sup>Following the conventions of systemic functional linguistics (SFL), system names are formatted in small block letters (e.g., Halliday & Matthiessen, 2014).

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## Conflict of Interest

The authors declare that there is no conflict of interest.

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