The building: the problem-solving product of the construction discipline

Concepción Orna-Montesinos · Universidad de Zaragoza (Spain)

ABSTRACT

The Problem-Solution pattern has been widely considered a key discourse-organizing resource in technical discourse (Hoey, 1983, 2001). This paper aims at exploring the role of the pattern in a corpus of construction engineering textbooks. The paper contends that use of the pattern facilitates the introduction of specialized knowledge, scaffolded by means of lexical resources which allow the reader to recognize and interpret the staging of the pattern. The analysis centers on the building, as it is the main product and the process of the construction profession, and more particularly on how disciplinary discourse is constructed around the problems that affect the building. Findings show that the textual use of the Problem-Solution pattern is closely connected to the pragmatic problem-solving nature of the engineering discipline. The social dimension of this discipline is textualized in their concern to analyze the cause and the effect of the building problems for which adequate solutions should be provided. Drawing on the perspective of applied discourse analysis (Bhatia, 2004), the paper finally discusses the textual use of the lexico-grammatical, semantic and rhetorical resources of the pattern in the light of the specific professional culture and disciplinary community practices in which the text is produced.

Keywords: Problem-Solution pattern, building, disciplinary discourse.

1. Introduction

Typically considered one of the so-called hard applied sciences, technology is characterized by its purposive and pragmatic character and by its aim to transfer research knowledge into products and techniques (Becher & Trowler, 2001). Different studies into the discourse features of engineering texts (e.g., Archer, 2008; Artemeva, Logie & St-Martin, 1999; Dlaska, 1999; Koutsantoni, 2006; McKenna, 1997; Pérez-Llantada, 2003) have convincingly claimed that the engineering community constructs a specific type of discourse which links the abstract to the specific and translates the systematized theories formulated by the specialists into everyday commonsense. Science and engineering are thus interrelated and rely on each other to shape society, with engineering doing the task of recontextualizing hypothesized and objectivized science into a real-world entity, that is, the devices and tools a layperson will use. Archer (2008) argues that the discoursal practices of the professional engineering community can be compared to the design process, central to engineering problem-solving industry-based practices:

> Engineering comprises scaffolding of deductive and inductive reasoning, formulating hypotheses, making generalizations, identifying exceptions, connecting evidence, classifying and organizing, it is this notion of design which moves engineering discursive practices away from the realm of abstraction and links argument to the material world in a way that scientific discourse does not always do (p. 25).

If we narrow down the scope of the engineering field and specifically focus on the subfield of architectural design practice, we could easily regard the latter as a socio-cultural cognitive system, in which implications from such fields as genetics, cognitive neuroscience or ethics underlie the cognitive mechanisms of "how designers think" (Lawson, 2006). Design researchers (Dong, 2007), architects (Forty, 2000; Markus & Cameron, 2002) and linguists (Medway, 1994) alike question the role of language in creating a complex non-verbal three-dimensional structure, the building, in which surfaces and volumes in space do not readily lend themselves to verbal expression. Starting from the premise that design tools and methods are inseparable from their social context, it would be interesting for both linguistic and pedagogical purposes to draw particular attention to the conceptual link between language and design, to the connection between what is said and written about building design. The context-driven approach to the problem-solving nature of the engineering discipline, very much in tune with Bhatia's (2004, 2008) applied linguistic approach to specialized discourses, represents an insightful complementary view to the linguistic analysis conducted in this paper. In line with this author, I would argue here that professional genres and professional practices are co-constructed in the reality of professional contexts. Drawing on Bhatia's influential work in applied discourse analysis, in this paper I will interpret the textual realization of the Problem-Solution pattern in the light of the text external influence of professional culture and practices. Below, I briefly depict in broad terms the socio-constructionist perspective of disciplinary writing and the way this perspective foregrounds the interconnectedness between specialized discourses and the professional contexts in which these discourses are produced and received.

Writing has a social goal, since it is situated in a social context. In other words, texts can only be successfully interpreted in the social and cultural disciplinary context in which they are created and used. The socio-constructionist perspective of disciplinary writing (Bazerman & Paradis, 1991; Bhatia, 2004; Hyland, 2000), on which this paper finds its theoretical foundations, rightly views writing as a process embedded into a social context of approved professional practices whose epistemology and social conventions determine the way their texts are produced and received. Disciplinary discourses establish a complex web of professional and social interconnections, shaped by sets of culturally-influenced discoursal conventions concerning their intended audience and communicative purpose. As

has been widely referred in the literature (Berkenkotter & Huckin, 1995; Bhatia, 2004, 2008; Hyland, 2000, 2003; Swales, 1990), the members of a particular discourse community create their own discourse, with specific lexico-grammatical and discoursal conventions for the transmission of specialized knowledge.

Language is "embedded in (and constitutive of) social realities" (Hyland, 2003, p. 21) through which discourse communities are established and developed. A given piece of writing can be better understood if the extra-textual information of motives and social relationships between objects and actors is made clear, as stated above, by locating the texts within the discourse community which establishes these discoursal practices for reasons of functionality and communication. This paper draws inspiration from the fact that a number of social connections are interwoven in the creation of a text. As a result, textual interpretation cannot be isolated from the influence exerted on it not only by the discourse community in which it was conceived but also by the professional culture in which it is used and interpreted. The recent work of Bhatia (2004, 2008), for instance, has advocated for a complementation of professional writing and professional practices, being "co-constructed" (Bhatia, 2008, p. 161) in professional contexts.

For the present study I align with the view that a given text is grounded in the multiple prior texts and voices that have configured disciplinary culture, thus taking a professional approach to discourse analysis which attempts to go beyond the discursive features of text and look into the situational and socio-cognitive factors which have scaffolded the construction, interpretation and exploitation of the genre. Therefore I propose to follow those studies which have sensibly claimed for a multiperspective process of contextualization (Askehave & Swales, 2001; Bhatia, 2004, 2008; Candlin & Hyland, 1999), which requires, as Bhatia also notes, the analysis of discourse as the complex product of a web of text-internal factors (lexico-grammar, discourse development and organization) and text-external factors (professional, academic or institutional conventions, disciplinary practices, disciplinary cultures). A text-internal feature of text is the organization of discourse in macro-structures or patterns, the Problem-Solution pattern in the particular purpose of this paper.

Departing from the work on clause relations of Winter (1982), Hoey (1983, 2001) understands discourse as organized on a hierarchical basis in which sentences are semantically connected. The analysis of macro-patterns in a text is justified by Crombie (1985):

> Since texts are divisible into discourse elements in terms of the way in which their parts function to convey various types or categories of information. Each discourse element is classified in terms of the communicative function which it performs in relation to the discourse as a whole. (p. 58)

Hoey (1983) identifies the Matching Pattern, combined with two types of General-Particular relations (the Generalization-Example relation and the Preview-Detail relation) and the Situation-Problem-Response-Result-Evaluation pattern, of which a number of variants are possible, as the most important discourse-organizing patterns in English. The Problem-Solution pattern has been recognized as a key discourse-organizing pattern in engineering disciplines given their problem-solving nature (Crombie, 1985; Flowerdew, 2003; Jordan, 1980). Linking the linguistic analysis of the pattern to the engineering design methodology, which solves problems with the practical application of scientific principles, Jordan (1980) stresses, "the close relationship between information structures in the text and the real-life thought/action process it describes... how paragraphs, sentences and signals within the sentences enable the writer to communicate the information in a conceptual array" (p. 221). As also claimed in this paper, the recognition and interpretation of the stages of the pattern is essential, Jordan also argues, to understand the staging of information in texts. For Flowerdew (2003) the stages of the Problem-Solution pattern could be identified with the moves of genre analysis but, as she further notes, "genre analysis may consist of rather broad strokes for the more delicate lexico-grammatical positioning of moves within the Problem-Solution pattern" (2003, p. 492).

Jordan (1980, p. 224) rightly remarks that the understanding of the pattern relies on the real-life knowledge of the Problem-Solution process. In the case of specialized discourse this background content and schemata knowledge, shared by the members of a discourse community, would be even more necessary. Yet, different signaling devices, such as conjuncts, subordinators, repetition or paraphrase, are used to stress the rhetorical importance of a relation and to signal the patterns of a text. Lexical signals on the one hand and subordinators and conjuncts on the other are used to explicitly signal the intended organization of the text and must be successfully decoded by the reader to identify the pattern. Whether in the form of a sentence, clause or phrase, lexical signaling

can also function as "organizing words" (Hoey, 1983) which link sentences and at the same time evaluate its content. As an example the phrase "serious ill-effect" (p. 63), "effect" is an organizing word to link sentences, while "ill" and "serious" are negative evaluative words.

Drawing on previous work by Hoey (1983), Crombie (1985) and Winter (1982), Flowerdew (2003, p. 494) applies a systemic-functional approach to the analysis of the lexico-grammatical patternings of the clause relation of causativity which identify the Problem-Solution pattern. Departing from Crombie's (1985), this author identifies the following General-Causative relations: reason-result (i.e., the causative member is a reason for a particular result), means-result (i.e., the means by which a result is achieved), grounds-conclusion (i.e., the basis by which a particular conclusion is reached), means-purpose (i.e., the purpose for which a means is applied) and condition-consequence (i.e., a condition which results in a consequence). In line with Hoey (1983) and Martin and White (2005), her findings indicate that the lexico-grammatical choices which identify the Problem-Solution pattern fall into two main groups: inscribed and evoking signals. Inscribed words, such as *problems* and *recommendation* are superordinates which have an encoded explicitly evaluative meaning, whereas hyponyms such as *noise*, *pollution* or *contamination*, are evoking lexis which connotes intrinsically less evaluative meaning. The interpretation of the meaning of evoked lexis is left to the reader to decode based on shared cultural values, and in the case of disciplinary texts, by disciplinary values.

2. Methodology

The specific aim of this paper is to enquire into the way the lexical choice of the CTC writers, being linked to the social discipline-specific implications of the concept 'building', is also reflected in the organization of discourse by means of the Problem-Solution pattern. My initial hypothesis, as contended earlier, is that disciplinary value is discoursally constructed in specialized writing about buildings. This combined approach of disciplinary and linguistic knowledge analysis seeks to understand the close relationship between text and context in the exploration of the concept 'building' in the architecture and construction engineering field.

In seeking this understanding, I carried a discourse semantics analysis of the noun *building* to discover how implicitly or explicitly the concept 'building' is constructed at a textual level using the Construction Textbooks Corpus (CTC), a sampling of textbooks for architecture, construction and civil engineering (176 samples, with a total of approximately 1 million words). On the assumption that the communicative practices of professional and workplace communities are reflected on and shape the genres they use, this paper focuses on the specialized textbook genre, viewed as a primary source for the creation and expansion of scientific and technical truths, and therefore for the transmission of the image of technology and science from experts to the general public (cf. Myers, 1992; Parkinson & Adendorff, 2004). The genre of specialized textbooks is specifically written to suit the needs of a disciplinary community in their academic and professional practice. Specialized textbooks address both students, novice to the discipline, on the one hand, and practitioners on the other, including architects, engineers, contractors, urban planners or academics.

The initial assumption of this paper is that the text and its organization and development are related to the context in which it is created and by this means on the professional practices and culture which make a text possible. Accordingly, I analyzed the discourse semantics of the term 'building' as a text internal feature related to the Problem-Solution pattern. The analysis will further help to interpret the pattern in the light of the influence of text-external factors imposed by the disciplinary culture of the construction engineering profession, namely, discourse roles and discourse privileges, and the construction of the professional community. Although acknowledging that the Problem-Solution pattern can only be fully explained when applied to textual analysis, and therefore when applied to the relations extended across phrases, clauses, sentences and paragraphs, the main components of the pattern as defined by Hoey (1983) (Situation-Problem-Response-Result-Evaluation) were identified in the corpus in connection with the lexico-grammatical modifiers of the noun *building*.

Both text-internal and text-external types of features more narrowly configure, as described below, the professional identity and the shared values underpinning the professional community, hence moving the focus beyond the text to "what makes a text possible" (Bhatia, 2002, p. 21).

3. Results

The discourse semantics analysis of *building* showed how the organization of the CTC discourse frequently follows the Problem-Solution pattern. More specifically, the corpus showed a clear tendency to refer to the building in terms of the problems which affect it and the solutions proposed by the professionals. This is thus closely related to the problem-solving nature of the construction and architecture disciplines. Of note, the corpus contains more occurrences of *problem(s)* (989) or *defects* (112 occurrences of *defect(s)* and 33 of *defective*) than of *solution(s)* (326) and *solve* (105) and hence points to the problem-solving nature of the discipline:

> *All construction projects begin with the recognition of an opportunity or of a problem.* To turn this recognition into a finished **building** or some other construction requires a multitude of decisions. These decisions concern amongst other things the location, size, quality, complexity, social and economic influence, time scale, organization and cost of the project. They are made by a multitude of people... It is a matter requiring much skill and knowledge to guide a construction project through this complex decision-making process. (Smith & Jaggar, 2007)[1]

These preferred lexico-grammatical choices can best be explained in the light of the analysis of text external factors such as the understanding of the construction engineering professional practices that inevitably shape disciplinary discourse. According to Lawson (2006), the profession is considered, a "repair job", a "fix of some kind", whose goal is "to correct something which has gone wrong", whether a redevelopment, an extension or a restoration project (p. 58); the mastery of the profession defined "not so much by the kinds of problems they tackle as by the kinds of solutions they produce" (p. 53). This problem-solving orientation of the professional chain, linking the designer to both the client and the builder, is illustrated in the following extract from the corpus:

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[1]   Complete references from the corpus are listed in the Appendix section.

> If the *designer has devised* a precise *solution* to the **building** *problem* set him by his client, then the information to be conveyed to the builder must be of sufficient detail to enable the unique nature of that solution to be appreciated and converted into physical building terms by a variety of people, most of whom will be unfamiliar with the original problem and unaware of the chain of thought processes which has given rise to its solution. (Styles & Bichard, 2004)

The design and construction of the building tend to represent a challenge and the same can be noted about another important area of practice of the profession, the conservation or restoration of buildings (Bierig, 2009, June; Ivy, 2009, March; Pearson, 2009, June): buildings are *unsatisfactory*, *sick*, *inflexible*, *leaking, dangerous* or *inaccessible* and become *redundant*, *obsolete* or *decrepit*. Once the problem has been stated the task of the construction professional is to struggle to provide a solution to the problem by creating *flexible, comfortable, responsive, accessible* or *intelligent* buildings.

A dichotomy between old and new buildings, then sub-classified according to the uses and characteristics of those buildings, is clearly perceived in the CTC. This division closely matches two main areas of professional practice: design and construction of new buildings on the one hand, and conservation of old or existing buildings on the other. Both areas of practice represent two different ways of offering solutions to construction problems: whereas old buildings are seen as 'the problem' to which a solution must be provided, new buildings are frequently considered 'the solution' to a problem or need, as succinctly illustrated in the following extract from the corpus:

> They *complain* about performance aspects of **old buildings** (like *dampness*) *but* about *environmental aspects* of **new** ones (like anonymity). (Day, 2004)

"*Buildings are mortal*" (Feilden, 1994), states the corpus. Despite all maintenance efforts the decline of old buildings seems to be, for the CTC writers, unavoidable–the references in the corpus to *problems*, *defects, damage* or *threats* to the building are numerous (e.g., *fire*, *dampness*, *vandalism*, *flooding* + in **buildings**, *obsolete*, *derelict*, *dilapidated*, *decrepit*, *obsolescent*, *ruinous*, *dilapidated*, *disused*, *abandoned*, *damaged*, *deteriorating* or *dismantled* + **buildings**).

In the corpus old historic buildings generally have a very positive image. Yet, it seems that the CTC writers inevitably assume that these constructions have *problems* or *defects*. They are usually very basic constructions in which structural problems arise. The problem can be lexically signaled by the use of the noun *problem*, or of other synonymous or near synonymous nouns (e.g., *defect*, *deficiency*, *need* or *lack*) or adjectives (e.g., *defective, problematic*):

> Whatever the objectives of its conservation, each **historic building** *presents unique problems.* (Feilden, 1994)
>
> The extended life of an **adapted building** is still only about half of that for a new facility. There is *no guarantee that* the adaptation works will *overcome* all the *deficiencies* in performance. Indeed, all existing buildings contain some latent defects that may prove *difficult and expensive to resolve.* (Douglas, 2006)

Also very common are occurrences of hyponyms of *problem* (e.g., *fire, noise, vandalism, flooding, humidity, damp, leaking*), thus choosing, as Flowerdew (2003) explains, the evoking evaluative meaning of the hyponym, *soot and grime* in the following example, rather than the inscribed, more overtly evaluative meaning, of *problem:*

> The *accumulation of soot and grime* on the facade of **old buildings** is an *extreme* example of this influence. (Douglas, 2006)

Another frequent textual resource employed by the CTC writers is the metaphorical use of language. Indicative of the pedagogical character of the specialized textbook genre, metaphorical language is thus an easification device (as also contended by Caballero-Rodríguez, 2003; Roldán-Riejos & Úbeda-Mansilla, 2006; Úbeda-Mansilla, 2003). The discourse semantics of *building* indicates that a defective building is said to be a *sick building*, and its problems are referred to as the *building pathology.* As exemplified below, the evocative meaning of the metaphor allows the CTC writers to refer to what otherwise might require a long technical list of explanations and reasoning:

'*Sick'* **buildings**, where *chronic performance problems* affecting the perceived health of building occupants, are often the result of technical complexity in the building systems outrunning the capabilities of occupiers to afford to manage them effectively. (Worthington, 2006)

The CTC writers also tend to signal the Problem-Solution relation by means of evaluative lexis, as, for instance, the use of the adjective *low* and the participial adjective *limited*, further reinforced by the adverb *severely*. At other times, the use of the comparative adjective *better* denotes an implicit statement of 'bad building':

The daylight penetration from side windows will depend upon the ceiling height, and in **early buildings** where the *ceiling heights were low, the penetration of daylight into the building was severely limited.* (Phillips, 2004)

The ground may serve as the floor in **primitive buildings**. *In better buildings, however*, the floor may be a structural deck laid on the ground or supported above ground on structural members, such as the joist and walls in Fig. 1.1. (Merritt & Ricketts, 2000)

An interesting feature suggested by the discourse semantics of *building* is that of causativity. Causativity is often associated with the Problem-Solution pattern relation (Crombie, 1985, Flowerdew, 2003). The most common causal patterns (reason-result, means-result, grounds-conclusion, means-purpose and condition-consequence) associated with the statement of problems also occur in the corpus, whether signaled by means of lexical resources such as nouns (e.g., *cause, effect*), verbs (e.g., *reflected in, lead to, result in, produce*), conjunctions (e.g., *because, if, however*) or relying on the semantic power of words to identify the pattern. Cause-effect relations are used to identify the problem (e.g., *many of the **building** problems identified *after occupancy* have been found to be...; is indicative of *a **building** oversupply* problem); to assess the problem (e.g., *each historic **building*** presents unique problems*; these* problems become much more severe *in large open-plan **building** structures*); to find the cause of the problem (e.g., problems associated with *oil or gas installations or other structures such as highway bridges;* problems often arise because *the utilization of the historic **building**...*); or to refer to the effect of the problem (e.g., *product quality* problems *are* reflected in ***leaking building**; the movement of population*

from large urban areas and decline of the existing manufacturing base can accelerate redundancy *of both* **commercial and residential buildings**).

Through these textual realizations, the CTC authors appear to create a disciplinary image of the building. Old buildings are compared to new ones: the higher risk and maintenance costs and the lower energetic efficiency of old buildings are usually referred to by the writers as negative factors. This comparison is further corroborated by the fact that the CTC writers think that old buildings do not usually meet modern standards and cannot be adapted to the use of modern facilities:

> Of the *causes of decay* in an **historic building**, the most uniform and universal is gravity, followed by the actions of man and then by diverse climatic and environmental *effects*–botanical, biological, chemical and entomological. Human *causes* nowadays probably *produce the greatest damage*. (Feilden, 1994)
>
> [**Effect** = decay → **Cause** = gravity, actions of man, climatic and environmental effects]

The CTC discourse about buildings, though negatively loaded, never seems to be too overtly negative. Problems are assigned to use, to accessibility or to ownership, thus causing a conflict between *cultural and economic values*. Historic buildings are positively valued within the community as part of their cultural and historical heritage. Consequently, the CTC writers do not only provide an account of problems but, with the aim of reaching a solution, seek to find the causes of these problems.

> Whereas for movable objects the problem of values is generally more straightforward, in architectural conservation *problems often arise because the utilization* of the **historic building**, which is economically and functionally necessary, must also respect cultural values. Thus, *conflicts can arise between cultural and economic values* and even within each group, for example between archaeological and architectural values. (Feilden, 1994)

Though new and modern, many problems that writers pose in the CTC are usually associated with new buildings: the shorter life of their design life, maintenance costs, inadequate construction techniques or deterioration among

others. For instance, modern design, despite being so highly valued, is perceived as a challenge in architectural practice, not always successfully met; a solution that the CTC writers do not positively evaluate. By way of illustration, in the following corpus extract, the negative evaluation is clearly stated with *one would have hoped... yet*:

> One *would have hoped* that at the beginning of the twenty-first century no building would be lit by day or by night in such a manner that glare is permitted, *yet* **important buildings** still *suffer from the bad effects of glare*–glare from natural light where the windows have been *ill-conceived* allowing *too great a contrast* between the view of the sky outside and the interior surfaces of the building; and glare from the artificial sources within. (Phillips, 2000)

The perception of new buildings is not always a positive one. Their status is certainly confronted by negative evaluative lexis (*spend vast amounts of*) and rhetorical resources, such as the repetition of *too much ... too much ... too often*:

> Alex Lifschutz, founding partner of Lifschutz Davidson, believes there is '*too much architecture'* being produced in the UK–not only is there *too much pressure* to produce **'iconic' buildings**, but even smaller projects are often designed as one-offs. The *result* is that many practices *spend vast amounts of time, energy and money* designing things that needn't be designed at all. And *too often* this work does not see the light of day as a completed scheme. (Littlefield, 2004)

In the CTC very negative lexis (e.g., *wasted, vandalism, squatters, blight and economic recession, poverty*) tends to be associated with *abandoned*, *empty, redundant, vacant* or *derelict* buildings. These buildings are evaluated as a consequence of a negative situation but also as the cause of further deterioration, in a chain of causes and effects:

> The *lack of heating and cleaning* allows *increases in the levels of humidity and dust* inside an **empty building**, both of which can *lead to accelerated deterioration* of its fabric and structure. (Douglas, 2006)

> [**Situation** = empty building → **Problem** = no heating or cleaning → **Effect / Cause** = humidity and dust → **Effect** = deterioration]

Yet, the writers are committed to providing a solution for the problem. The modal *must*, the semi-modal *have to*, or semantically related words (e.g., *require, need, necessary*) are consistently used to lexically signal the search for a solution (e.g. problems *which* need to *be* addressed*; it was also required to solve a specific technical* problem*;* problems *will arise and* have to *be* resolved *rapidly*). Very often the purpose is to provide a method or means of solving the problem or to provide advice on how the problem should be solved:

> Fine soils that don't drain well also tend to shift and move, which can *cause problems* in areas close to **buildings** and under paved areas. In areas where clay is present *you would normally specify* a deeper layer of gravel and sand under slabs and foundations. (Alread & Leslie, 2007)
>
> [**Problem** = drainage in fine soils → **Effect** = shift and move → **Solution** = deeper layer of gravel and sand]
>
> Nonetheless, *care must be taken to avoid errors* made during execution that *may cause problems* later on in using the **building**. (van der Voordt & van Wegen, 2005)
>
> [**Problem** = drainage in fine soils → **Effect** = shift and move → **Solution** = deeper layer of gravel and sand]

Noticeably, one of the most frequently mentioned solutions for historic building problems is preservation. The high frequency of such adjectives as *adapted* (11), *preserved* (3), *refurbished* (2) or *renovated* (1) suggests that *ancient*, *historic* or *old* buildings, being so positively valued, must be respected and preserved. The CTC writers refer to a newer process of '*awareness-building*' about the need to preserve old buildings, for which they seem to feel responsible (*the inescapable responsibility for making history or destroying it* (Feilden, 1994) as referred to in the corpus). The writers also report on the creation of official preservation programs, societies or institutions to preserve, protect or guard old monuments by creating lists or inventories and by providing legislation or funding. New conservation and restoration practices now conjugate the preservation of the past with newer more technological techniques:

> With **historic buildings**, when the *strength of structural elements has been so reduced* that it is no longer sufficient to meet *future hazards*, consolidation of the existing material *may have to be carried out*. (Feilden, 1994)

[**Cause** = reduced structural strength → **Effect** = hazards → **Solution** = consolidation of material]

New buildings are seen as the solution to a problem: the need for space, adaptive use, spatial restriction or obsolete buildings redevelopment. Different resources are used to more or less implicitly state the problem, such as the expression *satisfy the need* in the first example or the mention of *challenge*, a hyponym of *problem* which connotes the search of a solution in the second. In the final example, the evaluation of the solution indicates an implicit problem:

> These **tall buildings** *satisfied* the *need for office space and efficiency* in rapidly expanding cities. (Smith, 2005)
>
> [**Solution** = tall buildings + **Evaluation** = *satisfied* + **Problem** = the need for office space and efficiency]
>
> The elitism of generations of architects has been eroded by changes in business practice and the *sheer complexity* of many **modern buildings**, *demanding a true 'teamwork'* approach to their creation. All buildings can be regarded as either good or bad architecture reflecting the way in which de signers and builders have responded to the *challenge of creating them*. (Tunstall, 2006)
>
> [**Problem** = modern building creation → **Solution** = teamwork]

The solution must finally be evaluated. Adaptation, refurbishment or redevelopment of existing buildings, whether historical or not, also seem to be highly valued by the CTC writers. As the solution to different problems (preservation of historic and aesthetic values, longer useful life or more potential of use), adaptation is positively evaluated–hence presupposing that it is more economical and more environmentally friendly. However, adaptation is not always without problems. To counteract expectations about the benefits of adaptation, negative forms (*not all, may not be much better*, *may also not be compatible*) provide a negative evaluation of the solution in the following corpus extracts:
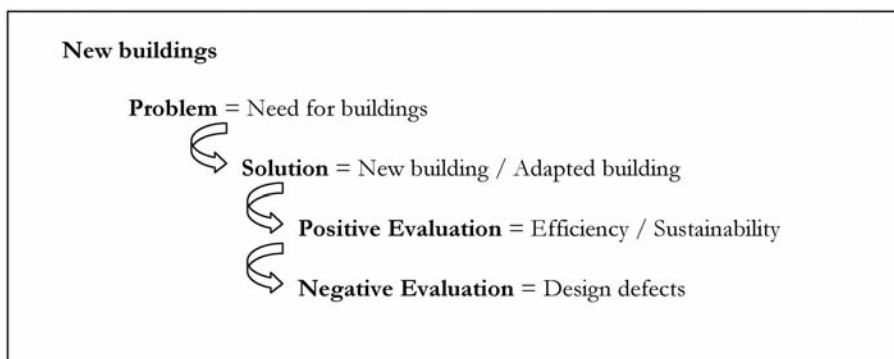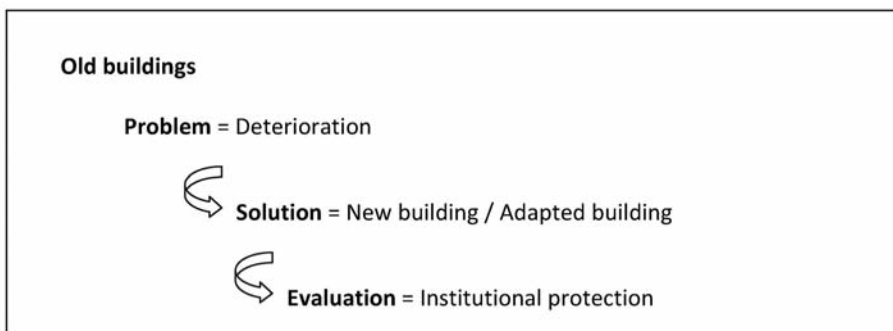
> The **adapted building** should be able to offer *new efficiencies* in terms of *performance and technologies*. These should be manifested in a *more comfortable, attractive and accessible building*. (Douglas, 2006)
>
> [**Solution** = adapted building → **Positive Evaluation** = longer useful life]

> *Not all* **adapted buildings** result in an *improved* internal or external environment. The appearance or energy efficiency of the **refurbished building** *may not be much better*. The use *may also not be compatible* with surrounding properties in terms of density or nature. (Douglas, 2006)
>
> [**Solution** = adaptation / refurbishment → **Negative Evaluation** = not better appearance or efficiency]

In summary, the treatment of both old and new buildings in the CTC covers the whole sequence of the Problem-Solution pattern (Problem-Response-Result-Evaluation), which can be illustrated in the following diagrams:

Old buildings

    Problem = Deterioration

        Solution = New building / Adapted building

        Evaluation = Institutional protection

New buildings

    Problem = Need for buildings

        Solution = New building / Adapted building

        Positive Evaluation = Efficiency / Sustainability

        Negative Evaluation = Design defects

The previous discourse semantics analysis can be further illustrated with the analysis of the Problem-Solution pattern in longer passages, such as its interesting use in the architectural review of a building, a very common area of disciplinary writing, devoted to the evaluation of architectural design solutions:

> [**Problem**] *If there is a problem* with this **building**, it is the comparatively *cool blandness* of the external appearance and the Bruce Mclean art works that adorn the surface like well-designed *but nevertheless gratuitous* advertising bill-boards. [**Solution**] In fairness, the central piazza space awaits (in early 2006) some public furniture. [**Problem**] *But* the space *cries out for* trees and it is *sad that* the budget did not extend to structurally accommodating these above the labs. [**Positive Evaluation**] As for that underground space, it is *surprisingly pleasant*. And, above, the hundreds of galleried PhD students also *appear to be content* with the facilities provided. [**Negative Evaluation**] *However*, all *experimental ventures* always *have problems*- this one includes such things as the neoprene skin to one of the pods that acts as a perfect sound transmitter. (Allinson, 2006)

In this passage a negative evaluation of the building entails the signal of a problem, what Hoey (1983, p. 105) calls a "multilayering" phenomenon. The unsuccessful design of the building, its art works or the lack of trees are stated as a problem, textually reinforced by the use of negative evaluative lexis (e.g., *cool blandness, gratuitous, cries out for, sad that, experimental ventures*). The different stages of the pattern are signaled by means of lexical markers, whether explicitly or implicitly. *If there is a problem* introduces the negative evaluation, therefore signaling the problem. To this, the solution of public furniture is foreseen. After the negative evaluation, the semantic load of *in fairness* is used to introduce the contrast of the solution, though immediately contradicted by another problem introduced by *but* in the following stage. The same contrastive pattern (*However ... have problems*) is used to counteract a first positive evaluation with a negative critique. The use of the adverb *surprisingly* and the verbal form *appear to be*, modulating the positive semantic load of *pleasant* and *content*, contributes to convey an overall negative evaluation of the building.

To sum up, the analysis of the discourse semantics of the noun *building* allows readers of textbooks in specialized design to show the social dimension of the lexical choice of the CTC writers, which as discussed, is extended to the organization of their discourse, frequently resorting to the Problem-Response-Result-Evaluation

pattern in its multiple variations (Hoey, 1983; Crombie, 1985; Jordan, 1980; Flowerdew, 2003).

4. Final thoughts

The understanding of the Problem-Solution pattern as a rhetorical feature of the discourse of the professional community of engineering design seems to consistently rely on expert knowledge of the content to be interpreted, but also, as discussed above, on a number of lexico-grammatical, semantic and rhetorical resources which work as lexical markers to signal the different stages of the pattern. Evaluative and metaphorical lexis have shown to be particularly frequent resources to convey the Problem-Solution pattern.

Reflecting the applied-knowledge, problem-solving nature of the engineering field, I have tried to bring to the fore how the CTC writers tend to project themselves onto their texts as responsible for providing solutions for building problems. We have seen above that the pattern is closely associated to causality relations. Finding the cause of the problems which affect, or might affect, future buildings is certainly a key issue in a discipline which seeks to solve them. Both old and new buildings have been shown to represent a challenge for the profession, though a different one: whereas old buildings pose obvious problems of decay and deterioration, whose causes have to be analyzed and to which adequate preservation and restoration strategies are proposed, new buildings have been described as the solution to many existing problems, particularly with more people-oriented urban design and sustainability concerns. Showing signs of disciplinary dynamism the construction engineering profession appears to foster newer architectural concepts, related to the socio-cultural values of architectural heritage or sustainability. In this we can conclude that the purpose of the specialized textbook is not only to instruct readers but also to create and transmit disciplinary knowledge about the building to its readers, but ultimately to influence the public's image of the building.

The bottom-up approach taken in the present study allows to move from the analysis of text as a final written product with well defined lexico-grammatical, semantic and rhetorical features to the analysis of text as linked to its social context of production and interpretation. The aim has been the contextualization of the

problems and solutions in buildings, in the light of the text-external circumstances which influence the creation of discourse, thus moving from the text to the discourse community and to their socio-cultural implications. In this respect, I hope to have lent credence of the importance of the intricate network woven between textual features and the specific discourse practices and disciplinary values of the construction engineering community. This approach sheds light on the way the process of writing about problems in buildings is affected by the community-specific circumstances in which the texts are produced. Looking at the texts themselves may thus help to envisage the beliefs, values and ideologies underlying the community and, more specifically, how these beliefs, values and ideologies are reflected in their internal features. In line with previous studies, which have emphasized the disciplinary variation of academic and professional discourse (among them Bhatia, 2004; Swales, 1990, Hyland, 2000), we could then conclude that lexical choice in specialized discourses and genres is conditioned by the epistemology of the discipline. This means that the understanding of text requires not only the understanding of the lexico-grammatical, semantic and rhetorical features of the text; another kind of knowledge, perhaps more implicit and subtle, is embedded in the noun *building*: the knowledge of the socio-cultural epistemology of the profession.

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