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Pattern libraries, originating in architecture, are a common way to share design solutions in interaction design and software engineering. Our aim in this paper is to consider patterns as a way of describing commonly-occurring document design solutions to particular problems, from two points of view. First, we are interested in their use as exemplars for designers to follow, and second, we suggest them as a means of understanding linguistic and graphical data for their organization into corpora that will facilitate descriptive work. We discuss the use of patterns across a range of disciplines before suggesting the need to place patterns in the context of genres, with each potentially belonging to a "home genre" in which it originates and to which it makes an implicit intertextual reference intended to produce a particular reader response in the form of a reading strategy or interpretative stance. We consider some conceptual and technical issues involved in the descriptive study of patterns in naturally-occurring documents, including the challenges involved in building a document corpus.

Keywords: information design, layout, typography, pattern, genre, multimodal, corpus annotation

1. Background and context

1 Information design is a relatively young discipline, which struggles with the lack of a usable descriptive framework. By usable, we mean one that not only can be used to describe to a reasonable degree of formality the layout and typographical characteristics of a given communicative artefact, but one that can be used to teach or define effective design strategies that at present tend only to be known tacitly by experts. Examples of practical uses for a descriptive framework are when government regulators prescribe formats for consumer information, when publishers specify formats for textbooks, or when insurance companies set up standard styles for customer communications. So by a *usable* descriptive framework we mean, in effect, one that is to a degree prescriptive as well as descriptive.

2 Without anything analogous to "grammaticality" to use as a yardstick, information design tends to rely instead on success measures that are harder to test, such as usability. In practice, rigorous testing with users is often impractical —and so practitioners rely more on "knowing what works" from experience. Communicating this expertise, however, is not straightforward when no established descriptive framework is in place to distinguish between good and bad practice. Prescription, then, might allow us a means of judging —or at least some rules of thumb— through which we can be of use as trainers and designers in the practical world. And, in addition, the much newer field of corpus-based research on multimodal documents also lacks metrics for choosing what we should include, and what we should exclude, from corpora.

3 A number of descriptive frameworks have been proposed from within the study of typographic or information design (e.g. Twyman, 1979), classifying objects of analysis according to theoretical schemata. While these frameworks may help us to organize phenomena that we find, and understand the influences that underlie them, they are not intended to be the basis of the kind of practical guidance that we have argued is needed. However, there is a role for a descriptive approach: one that allows a detailed picture to be built of the patterns that are in use and their purposes. It is only then, we suggest, that we can select from among the available patterns to propose "ideal" solutions.

4 The programme described in this paper builds on genre-based approaches (e.g. Bateman, 2008; Delin, Bateman & Allen, 2002; Waller, 1987 and 1991), using the concept of pattern languages and pattern libraries —an approach which originates in architecture, but which has been fruitful in information design's close neighbour, interaction design. However, while genre theorists have tended to focus on explaining discourse types that already have names, the compilation of a pattern library is to a large extent a naming exercise. As Scott (2006: last paragraph) put it:

> [Naming] is one of the real powers of [...] patterns. They not only expose a solution but they give it a name. They create a classification system. They form a vocabulary, a language. They provide a way for people to talk about the concept and a way to recognize the solution when a similar problem context arises in the future.

2. The origin of the pattern language approach

5 In this context, *pattern* refers not to repeating decorative effects (for example, on wallpaper), but to configurations found consistently within recurring design solutions to common problems. They may be patterns of words, visual configurations, or a combination of both.

6 The term *language* needs qualifying also —it is used loosely here and does not refer just to verbal language or discourse, but to any systematic relationship between elements of almost any kind. We use it by way of reference to its originator, the architect Christopher Alexander, and in some practical applications the more realistic term *pattern library* has become more common.

7 Alexander (Alexander, Ishikawa & Silverstein, 1977; Alexander, 1979) developed his pattern language to describe consistently observed solutions to common problems that he and his team found in a wide range of human settlements —it is a way of describing forms found in vernacular architecture that have evolved naturally in response to human needs, rather than out of theoretical models (and in particular modernist approaches).

8 The idea of patterns is fundamental to human thought, and is not, of course, original to Alexander. In communication theory, the definition of rhetorical patterns goes back to classical Greece, and the term is frequently used by linguists working at various different levels of analysis —particularly at the discourse level (e.g. Hoey, 1983; Hunston & Francis, 2000). For information designers, Alexander's pattern language approach is attractive because it lends itself to a prototypical rather than taxonomic approach, which corresponds closely to how design is traditionally taught and practised (but not necessarily articulated). Experienced practitioners of any art, trade or craft are often able to recognize problems they have met before, and to call on a repertoire of possible solutions. Pattern libraries are an attempt to make explicit these traditionally tacit repertoires, and require the involvement of "reflective practitioners" (Schön, 1983) as well as descriptive analysts and this is reflected in our project team.

9 A typical example of an Alexander pattern is COURTYARDS WHICH LIVE (pattern 115). A courtyard allows us to resolve our desire to be outdoors and our need for protection —what Alexander calls a "living courtyard" includes paths that cross, an opening to a wider space and a sheltered porch. Without these things, the courtyard becomes claustrophobic, rarely visited, and neglected —a "dead courtyard". Good spaces, created in this way, aim to achieve a quality which, having rejected as inadequate such terms as "alive", "whole", "comfortable", "free", "exact", "egoless", and "eternal", Alexander calls "the quality which has no name". Linguists would similarly reject terms such as "grammatical" as being barely adequate to capture the conversational, rhetorical and pragmatic qualities of a discourse segment that is correctly formed, relevant, cohesive and so on —and which might therefore count as a "good" discourse contribution.

10 In order to help us to build in this way, Alexander captures the characteristics of what he observes to be successful environments through a series of 253 patterns (Alexander, Ishikawa & Silverstein, 1977). The patterns are presented systematically, and it is this approach that has been taken up in fields outside architecture —in particular, by software engineers (Gamma et al., 1995). In fact, while the idea of pattern language is little more than a footnote in its original context of architecture, it is now a mainstream approach in software engineering. Software engineers were attracted to the approach because they needed a way to organize a range, or library, of configurations for software objects, to make them accessible for engineers in need of a solution to a problem that another engineer might have previously encountered.

11 Interaction designers (e.g. Tidwell, 1999 and 2005) have also adopted this approach. In contrast to paper document users who are expected to spend long

enough with each document to become used to its unique conventions, web users move quickly between different information environments and need them to behave consistently. So interaction design as a field has had to quickly evolve a consistent set of rules that developers can use, and that users can intuitively grasp, to ensure that user effort is focused on accessing content rather than figuring out functionality. Pattern libraries have proved to be a useful way for interaction designers to share best practice.

12 So for Alexander, and for followers in other disciplines, a pattern is a format for capturing insight into common problems and their solutions, and for understanding the relationships between them. In this paper we consider whether it is also a useful format for capturing similar insight about documents.

3. How problems relate to solutions in pattern languages

13 In his book *A Pattern Language*, Alexander describes patterns thus:

> The elements of this language are entities called patterns. Each pattern describes a problem that occurs over and over again in our environment, and then describes the core of a solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice.
> (Alexander, Ishikawa & Silverstein, 1977: x)

14 We will take as examples two of Alexander's patterns: the ENTRANCE ROOM (pattern 130; Alexander, Ishikawa & Silverstein, 1977: 622) and the WAIST-HIGH SHELF (pattern 201; Alexander, Ishikawa & Silverstein, 1977: 922).

15 The patterns take the form of the statement of a problem or need, followed by a solution. In the case of WAIST-HIGH SHELF (Figure 1), the problem statement is as follows:

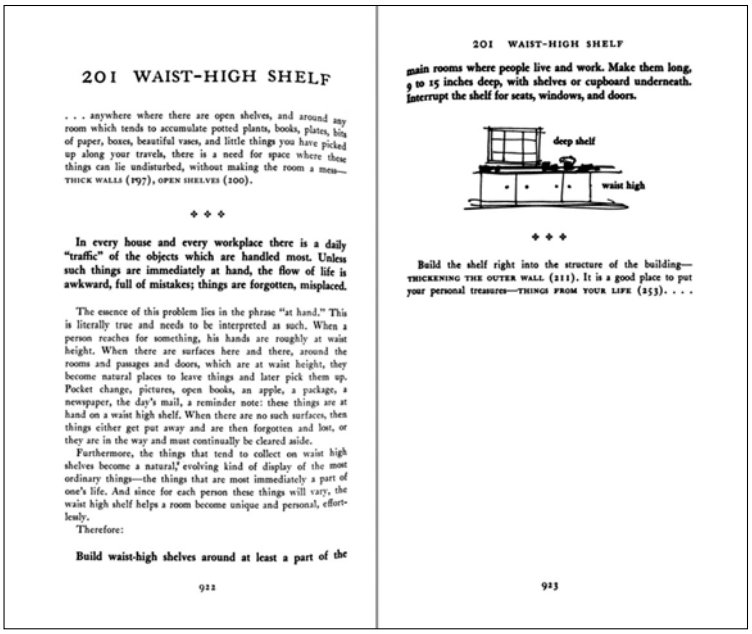
> In every house and every workplace there is a daily "traffic" of objects which are handled most. Unless such things are immediately at hand, the flow of life is awkward, full of mistakes; things are forgotten, misplaced.

16 There is then a discussion of how the problem might be solved, followed by a summary (in bold) of the solution:

> Build waist-high shelves around at last part of the main rooms where people live and work. Make them long, 9 to 15 inches deep, with shelves or cupboard underneath. Interrupt the shelf for seats, windows, and doors.

17 It is interesting to note that the pattern name in this case is the name of the solution —build a waist-high shelf. However, in the case of ENTRANCE ROOM, the solution is a particular design of entrance room, and the pattern name is more a general topic. Other pattern names are different again: SLEEPING IN PUBLIC, for example, recommends building outdoor environments that contain sheltered benches, away from traffic, where people can read the paper and doze off. In this

case, the pattern is named after a habit or desirable activity. The one thing Alexander does not do is name the pattern after the problem: we do not see INHUMAN SCALE BUILDING, for example, or EVERYDAY OBJECTS OUT OF REACH. This might be a clue to which part of the several pages that make up the pattern "definition" is the actual "pattern": an alternative description of pattern might be, it seems, "loosely-specified design solution that solves a particular problem". In the description given at the beginning, too, Alexander, Ishikawa and Silverstein do suggest that patterns are both the problem *and* the solution, together.



201 WAIST-HIGH SHELF

. . . anywhere where there are open shelves, and around any room which tends to accumulate potted plants, books, plates, bits of paper, boxes, beautiful vases, and little things you have picked up along your travels, there is a need for space where these things can lie undisturbed, without making the room a mess— THICK WALLS (197), OPEN SHELVES (200).

In every house and every workplace there is a daily "traffic" of the objects which are handled most. Unless such things are immediately at hand, the flow of life is awkward, full of mistakes; things are forgotten, misplaced.

The essence of this problem lies in the phrase "at hand." This is literally true and needs to be interpreted as such. When a person reaches for something, his hands are roughly at waist height. When there are surfaces here and there, around the rooms and passages and doors, which are at waist height, they become natural places to leave things and later pick them up. Pocket change, pictures, open books, an apple, a package, a newspaper, the day's mail, a reminder note: these things are at hand on a waist high shelf. When there are no such surfaces, then things either get put away and are then forgotten and lost, or they are in the way and must continually be cleared aside.

Furthermore, the things that tend to collect on waist high shelves become a natural, evolving kind of display of the most ordinary things—the things that are most immediately a part of one's life. And since for each person these things will vary, the waist high shelf helps a room become unique and personal, effortlessly.

Therefore:

Build waist-high shelves around at least a part of the

922

201 WAIST-HIGH SHELF

main rooms where people live and work. Make them long, 9 to 15 inches deep, with shelves or cupboard underneath. Interrupt the shelf for seats, windows, and doors.

Build the shelf right into the structure of the building— THICKENING THE OUTER WALL (211). It is a good place to put **your personal treasures—**THINGS FROM YOUR LIFE (253). . . .

923

Figure 1. A typical spread from *A Pattern Language* shows the key components: a title, an introduction that links to higher order patterns, a problem statement in bold, and an illustrated explanation

18 Alexander made a deliberate choice of the term "language" to reflect some language-like characteristics of his system: patterns occur at different levels (from a city to a shelf), and may be associated with particular sets of higher-level patterns (which establish their usual context) and particular sets of lower-order patterns (which serve to operationalize them). Additionally, there are various kinds of non-nested relationships between patterns: some are commonly associated with one another, or compete with each other, or require each other. In other words, it could be argued that, while not constituting a language in a way that would satisfy a linguist, there are some equivalences to syntagmatic and paradigmatic relationships between elements. This is the kind of ordering that Lemke (1995 and 1999) has referred to in his own descriptions of the kinds of "text-formational semantic patterning" that hold texts together. As Lemke (1999) argues:

> Not just texts, but any text-formational semantic patterning we construe within a text that preserves ordering or sequentiality, such as the patterns by which we define genre, will also be semantically heterogeneous... There are many, many semantic features that characterize any scale in a text or genre pattern (group, clause, clause-complex, rhetorical or dialogical structure, genre element, segment, section, etc.). Some (but, to preserve cohesion, usually not all) of these will change from each unit to the next on each scale.

19 This, then, allows for text patterning to include patterns within patterns. Applying this to Alexander's patterns, the pattern ENTRANCE ROOM contains a recommendation that there should be a waist-high shelf within the room. As point 4 of a 6-point series of recommendations, Alexander, Ishikawa and Silverstein (1977: 624) suggest that there should be a "shelf near the entrance" which is "at about waist height", and provides further onward references to these and other patterns that are relevant to the satisfactory construction of the entrance room. This tells us that patterns, in his view, are recursive: it is quite normal for a pattern to contain "calls" to several other patterns that are required to fulfil it. Whether this is full recursion or not we are not sure, but it does at least mean that patterns can be embedded within one another, in that the solution to one problem can invoke another pattern.

20 This makes sense, if we remember that, from Fikes and Nilsson (1971) onwards, the traditional approach to computer planning is to break down a problem into sub-problems, or goals into sub-goals. So, the problem "make coffee" creates a sub-goal "find coffee jar" which itself creates other sub-goals involving opening cupboards, and so on.

21 There are some differences in the way that different disciplines have treated the relationships between patterns. Software engineers have replaced the hierarchical relationship with a simple categorization of "creational", "structural" and "behavioural" patterns (Gamma et al., 1995). Van Welie and Van der Veer (2003) have argued that while hierarchy of scale is a valid model for architectural patterns, in interaction design there is a more abstract hierarchy of problems. What users see on a screen stays the same size, so hierarchical relationships are about stages in a process rather than a matter of physical scale, or enclosure —a conceptual, not a physical relationship that is cognitively understood, not viscerally experienced.

22 Going back to the summary of patterns as "loosely-specified", it is clear from Alexander, Ishikawa and Silverstein's book that they must be so: if we "can use this solution a million times over, without ever doing it the same way twice", there must be enough leeway in the solution to implement it in many different ways.

23 There will be a big gap, then, between the notion of a pattern as intended by Alexander, Ishikawa and Silverstein, and a notion of pattern that is implementable and computationally tractable. In fact, as Erickson (2000: 4.2.1: 361) puts it,

> Perhaps the most common misconception about pattern languages is that they are sets of templates that are rigidly applied to situations. This is *not* the case.

> Understanding how pattern languages are intended to be applied is *absolutely crucial* to their use. Alexander's pattern language is actually a meta-language.

24 In other words it is not a vocabulary so much as (speaking loosely, again) a grammar —a way of relating problems to solutions. In fact, Alexander describes a process for building a project-specific pattern language, which included modifying patterns and creating new ones (Alexander, Ishikawa & Silverstein, 1977: xxxviii).

4. Patterns in information design

25 To see whether patterns are a notion that is relevant to information design, we can look at an example of a relatively common problem in forms design: that of getting people to supply their phone number.

26 In Figure 2 we can see from the data collected by Crofts (2009) that there are a variety of ways of doing this even in a limited sample of four application forms. What is interesting about them is that they are more or less strongly constrained in terms of the format of the information the user can put into them.

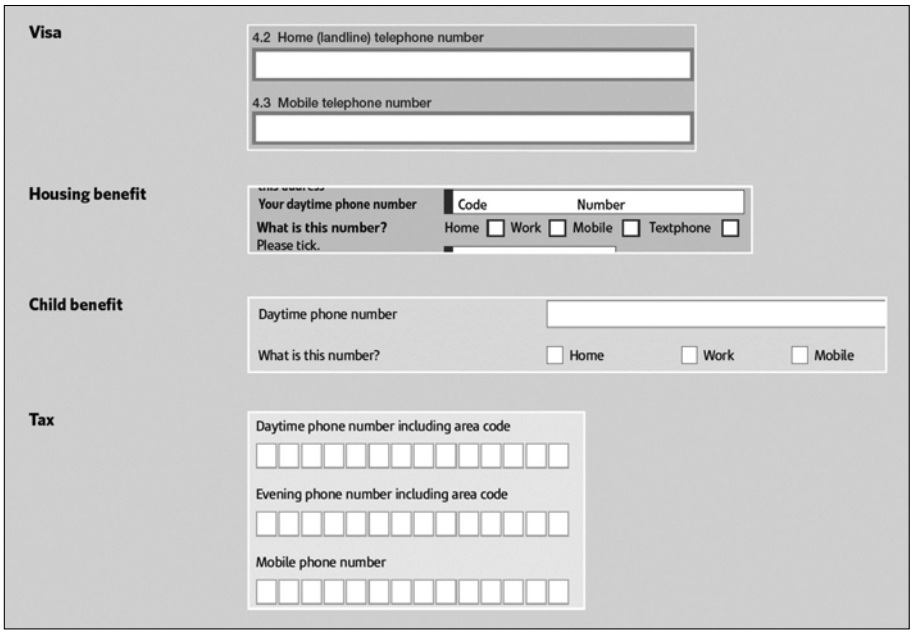


Figure 2. Data from Crofts (2009)

27 The tax form is the most constrained, in that it requires a separation of the digits into individual boxes and assumes a maximum of 14 digits. Housing benefit is the next most constrained, in that it divides the box into "Code" and "Number". The Visa and Child Benefit boxes are hardly constrained at all, in that they do not suggest a format for the number or a maximum number of digits although

they do employ different strategies for capturing what kind of phone number has been supplied.

28 We can see from this brief survey of solutions that a variety of functional solutions exist to solve the same problem. Some of the differences may not matter —they may be arbitrary side-effects of choices made at a different stage in the design process (for example, the choice of typeface or colour, and the thickness of lines around boxes). But some may matter in particular circumstances. For example, separate character boxes are often a sign that Optical Character Recognition (OCR) is being used to read the user's data. Captioned sections ("code" + "number") may be intended to prevent people missing out one part of the information requested. So a pattern definition needs to distinguish between its essential, or constituent features, as distinct from those that can remain accidental or contingent on other design imperatives (which might include features essential to a higher order pattern).

29 A question for the analyst is: looking at these samples, should we identify one loosely specified pattern, to be called PHONE NUMBER (after all, these are all reasonable ways of getting a phone number), with a range of potential realizations as graphic elements, or should we identify three patterns (OPEN BOX, STRUCTURED BOX and OCR BOX), each of which has been applied to the topic of phone number, as distinct from, say, name, date or national insurance number?

5. How do patterns relate to genres?

30 Multimodal studies of discourse have used genre as a key concept. As Biber (1989: 5-6) suggests, genres are "text categorizations readily distinguished by mature speakers of a language; for example [...] novels, newspaper articles, editorials, academic articles, public speeches, radio broadcasts, and everyday conversations [...] categories defined primarily on the basis of external format". Many other definitions are, of course, available, but in each case a genre tends to be something that has already been given a name by its community of users: for example, leaflet, form, textbook, workshop manual, romantic novel, or crime novel. Following Bateman, Delin and Henschel (2004), we assume that these different text types also reflect distinctions in the author's *purpose*: as they put it, "the texts look different, and contain different language forms, because they are intended to do different things". And according to Halliday (1978) and Martin (1992), texts also look different because they need to function in different social contexts. Finally, following Waller (1987) and Delin, Bateman and Allen (2002), we also take into account the practical contexts of production and consumption of genre: they are defined by how they are constructed, encountered, used, and re-used, and by the sets of assumptions with which readers and users approach them. One of us has previously suggested that genre names evolve naturally, the arrival of a name signifying the achievement of communicative force by a new genre (Waller, 1987: 285).

31 As we have already remarked, the identification of patterns is in one key respect the opposite of this —it is a deliberate naming exercise that recognizes the existence of structures in documents that recur and are judged to be effective, but which have not acquired names naturally, except perhaps within a restricted community of practice (for example, within a particular studio, designers might refer to a layout where all items on a spread hang down from a common position, as a "washing line", but this term is not shared by their readers). Pattern libraries articulate common solutions that designers use, so they can be shared and discussed.

32 Patterns are also distinct from genres because they are assumed to occur at various different levels of analysis, and many occur across multiple genres (that is, in documents which have very different purposes, content, format, context, etc.). This was an explicit goal of Jenifer Tidwell, one of those responsible for introducing the pattern language concept to interaction design. Indeed, she saw pattern libraries as harnessing techniques not only from multiple genres but from multiple channels:

> [A pattern language] would enable us to more methodically draw on expertise in related fields, such as book design, consumer electronics, the design of control panels (for cars, airplanes, power plants), video games, the Web and hypertext, and speech-driven interfaces.
> (Tidwell, 1999)

33 A further distinction is that while the power of genres lies mostly in their adherence to convention, patterns may work not because they represent visual conventions that readers have learned, but because they represent other sources of communicative power. For example, they may work because they represent insight into the strategies and behaviours of typical readers. Or they may represent good "gestalt" —layouts that communicate connections, structures and separations by harnessing the natural tendencies of our perceptual systems to seek sense in visual form. In such cases, it should be noted, we need to acknowledge a potential confusion of terminology: Alexander-type patterns are not the same as visual patterns that are used for rhythmic effect —although the two usages may occasionally coincide.

6. Prototypes and peripheries

34 If there are some patterns that are most used, most familiar, or more constrained, or that are otherwise considered "best" for a particular genre, we might think of those patterns as the prototypical elements of a genre. And similarly, those typographic and graphic solutions to the display of a pattern that normally work best can be thought of as prototypical solutions to a pattern.

35 The notion of prototype is inspired by Wittgenstein's concept of family resemblances (Wittgenstein, 1953) and developed by Rosch (1973; see also Taylor, 2003). It accounts for the fact that humans tend to group things into classes for the purposes of convenient identification and understanding, and that some members of those

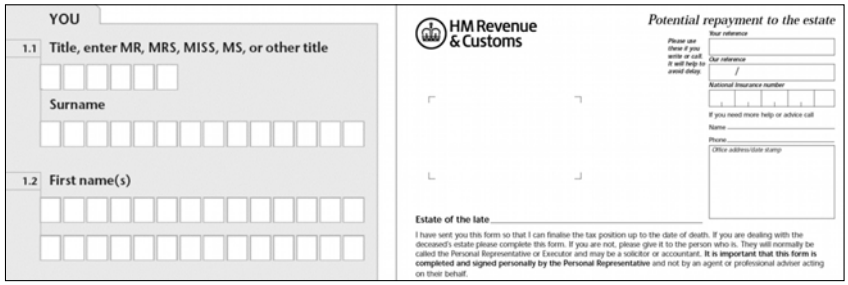
classes may appear to be more "central" members than others. For example, a penguin makes a worse prototypical bird than a robin or a blackbird, because it can't fly and is an odd shape. The purpose of a prototype and the human ability to group things around it is basically because things in the real world differ from one another, but that some things (birds, chairs, cars, democracies) share enough common features for us to be able to identify them as instances of the "same thing":

> The world consists of a virtually infinite number of discriminably different stimuli. One of the most basic functions of all organisms is the cutting up of the environment into classifications by which non-identical stimuli can be treated as equivalent. (Rosch et al., 1976: 383)

36 So peripheral members of a group are open to classification as part of more than one such group (for example a table lamp is a peripheral member both of the category "furniture" and also of the category "electrical household appliance"). In terms of document genres, then, we might think that there are forms that are "formier" than others, and newspapers that are more newspapery. By extension, there are elements of such documents —pattern solutions— that make more or less prototypical solutions to their problems.

37 For example, Figure 3a shows quite a good solution to the problem of eliciting a name on a form and is typical of the forms genre in its current state in the UK. Users of the form in Figure 3b, however, often fail to supply the name correctly, because the sentence-completion solution used to elicit the name is now largely obsolete. The same solution seems quite at home, however, in the children's party invitation (Figure 4), which is a more peripheral member of the forms genre.

38 While patterns can occur within different genres, it may well be the case that many of them have a "home genre" in which they are an essential feature. For example, the pattern LIST OF INGREDIENTS is an essential feature in its home genre "recipe book", but it also occurs in the genre "form" (where users might be given lists of key information to gather before starting).



Figures 3a (left) and b (right). Two ways to elicit someone's name.
The left-hand example, using the CHARACTER BOXES solution is prototypical of the current state of the forms genre. The right-hand example uses the solution SENTENCE COMPLETION which was prototypical before the twentieth century, but which is now peripheral



Figure 4. The SENTENCE COMPLETION solution seems quite at home in this prototypical party invitation (making it also a peripheral member of the forms genre)



Figure 5. The NEWS HEADLINES pattern in its home genre (left) and in a gas bill (right)

39 Figure 5 shows how the pattern NEWS HEADLINES has been transported from its home genre, "newspaper" to the genre "gas bill": indeed, the newspaper was the acknowledged inspiration for the bill design (personal communication with the bill designers). The resulting bill thus departs from its genre, but it nevertheless

works because the headlines enable an effective reading strategy. The headlines in the bill work in a similar way to the headlines in a newspaper —in addition to their typographic similarity, they also anticipate the key information which their readers need in order to get a quick picture of what is happening in the world (or in the world of their gas account) today. Indeed, the use of newspaper-style headlines is an implicit intertextual reference to the newspaper genre, suggesting to readers that the reading strategy they use there (that is, a quick preview possibly, but not necessarily, followed by a detailed read of stories that interest them) is also appropriate for reading a bill. In time, if successful enough to imitate, the energy bill genre may shift.

40 While we are looking for a way to identify possible members of a set of solutions in a given pattern, therefore, we should note the following:

- available solutions may be constrained by genre, but are also judged on their functionality in context, and the quality of their execution;
- within the set created by the genre constraint, members will be more or less prototypical.

41 A hypothesis might be that solutions that are less prototypical might (a) be harder for users to identify visually as belonging to the pattern or the genre, and might therefore cause slower response rates and/or higher error rates, and (b) might, if they are less constrained, be more likely to turn up as possible solutions to other patterns. In this case, the more prototypical a solution is to pattern B, the more likely it is to cause confusion when used as a solution to pattern A —even if it appears within A's set of reasonable possible solutions.

42 Cohen and Snowden (2008) have indeed demonstrated a correlation between the familiarity of document elements to readers and their performance in literacy tests. They use the term "document mental model" to describe the kind of genre-specific knowledge required by competent readers that should be anticipated by competent document designers.

> Readers are likely to have a different mental model for each specific document type with which they are familiar. When confronted with a document, readers may recall and use these mental models, which, if accurate, should aid them in locating the vital information. For example, menus often contain the price of a dish to the right of the listing for that dish. For those with an accurate "menu" mental model, a request to locate price should be facilitated when the information is near the predicted location and inhibited when it is not.
> (Cohen & Snowden, 2008: 19)

43 This looks like a useful basis for a genre assumption, that audiences might employ as one of the heuristics that help them navigate and understand the world, and cut down on cognitive effort in doing so. So, for research purposes, we would be interested to be able to look at how often that heuristic is justified: are the prices of dishes positioned to the right? How often? To be able to answer these questions, we would need not a single recommended pattern, but a representative

set of examples of solutions to the problem of how to show a price on a menu. This would represent not what we judge as designers *ought* to happen, but what *does* happen —moving us from a prescriptive position to an empirical, descriptive one.

44 A cursory look at current menus from restaurants quickly reveals that this might be a worthwhile endeavour. Taken at random from a list of the top 10 recommended restaurants from a London website, the three menus in Figures 6-8 adopt different approaches to showing prices.

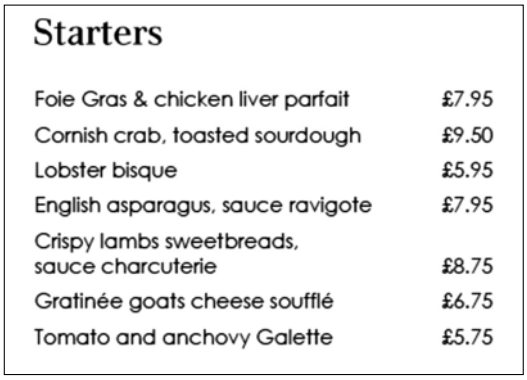


Figure 6. Starter menu from the Bistro du Vin

45 Figure 6 shows the menu arranged as Cohen and Snowden expect, with prices to the right of each menu item. Additionally, the menu uses a table format so that the prices are equally spaced apart from the descriptions of the dishes. Figure 7 adopts a slightly different approach, with prices still to the right of menu items, but picked out in bold rather than spaced away.



Figure 7. Starter menu from The Ledbury

46 Heston Blumenthal's restaurant Dinner adopts a different approach (Figure 8). His menu demotes prices to below the dish descriptions, and perhaps confounds

expectations by displaying not a price, but a date, to the right of each item. This uses typography and position to foreground the historical derivation of his dishes (and perhaps, additionally, conveys the information that people who are interested in knowing the prices may be better advised to choose a different restaurant).



Figure 8. Starter menu from Dinner

47 In each case we might say that menu design has a functional requirement for the price to be clearly related to the dish but separate enough to work as the target of a scan for, say, dishes under £10. The examples we show indicate that this relationship might be achieved by: aligning dish and price in a table; running the lines together but with a font variation for the price; a new line for the price, with a constant position (centred). A wider survey might reveal further executions of this same functional requirement.

48 The point of reviewing even these few examples is to show that, whatever our assumptions, we do not necessarily have a secure grasp of what "normal" might look like for any given design solution. If we are to interrogate the relationship between design problems and the typographic and layout resources that are used to solve them, we need to look at corpora of examples that represent the practice at large.

49 Appropriate description of examples such as these would not just encompass patterns that show prices next to restaurant dishes in the context of the menu, but allow us to interrogate which other problems similar solutions are being used to solve. This, then, is the beginning of a systematic approach correlating design patterns to genres, and how we might map the shifting of genres over time and culture. If we adopt a more fine-grained approach to pattern description, we can capture the specific devices and relationships that constitute patterns, and see how those devices and relationships recur elsewhere. And there would need to be numerous examples: our descriptive approach would not be able to discriminate

between good, bad, and mediocre design, being quantitative rather than prescriptive in focus. The framework would need to map "central" or "prototypical" examples of the application of patterns in genres, and "peripheral" patterns which may also be taking part in relationships within other genres.

50 A question remains about how we might treat the different menu executions in a pattern language. Are they examples of patterns at a different level of analysis, or simply alternative executions of a menu pattern: much as Alexander's waist-high shelf might equally be supported by wood or metal brackets, suspended from the ceiling, or achieved by placing an antique sideboard next to the wall.

51 One response to that question would be to ask whether the execution affects the reader and their reading. If the shelf brackets are out of sight, and equally strong then they do not affect the user of the shelf. But the antique sideboard or suspended shelf would alter the perception of the whole room —they would be part of a traditional or modernist solution respectively, and therefore would contribute to a wider perception of the environment.

52 In the case of our menus, we can see that the tabular menu (Figure 6) shares its layout with numerous other tabular layouts, including for example a parts catalogue. Figures 7 and 8 are both centred, quite a rare form of layout in this century, and mostly reserved as a sign of formality and prestige: wine labels, book title pages, and invitations, for example. They therefore make cultural reference to those genres, while fulfilling the core functional specification of the menu: to relate dish to price.

53 So we can look at the design of any menu from different perspectives:

- a genre perspective: a menu typically exists in a limited range of sizes, is typically between 1 and 20 pages, is typically hierarchical, split into sections based on courses of a meal, and further subsectioned based on types of food;
- a functional perspective: the centred layouts we looked at only work for a short menu with limited options. A long menu typical of take-away restaurants (in the UK at least) would need a more easily searchable format;
- a stylistic perspective: it is easy to call to mind menus that look modernist, formal, farmhouse, fast food, Mexican, etc. The function here is to fit in with the restaurant as a whole, considered as a brand, which in turn will signal the kind of experience you might expect.

54 These levels to some degree mirror a distinction common in the design of websites: between site architecture, wireframes and skins (although there are various different terms used for these levels).

55 *Site architecture* refers to the overall structure of a website: its division into sections and subsections, which may not be hierarchically related, and the broad way in which they relate. It may also include flow diagrams that illustrate how typical users might move through the site. *Wireframes* are outline diagrams, of the structure and functionality of individual pages. *Skins* are graphic themes applied to

the wireframe (a more consistent metaphor for wireframe would be "skeleton"). The same wireframe might be realized using different fonts, backgrounds, or colours.

56 Patterns may be applied at all of these levels, and sometimes include specific guidance about where they might be situated (architecturally) and how they are best executed (at the surface, or skin level).

7. Pattern libraries

57 We have noted earlier that the concept of patterns has been adopted by interface designers, who generally refer to pattern "libraries", a less theoretically demanding term than "languages".

58 Libraries of previously-used solutions, many of them held as free-to-access online resources, not only save effort, but they prevent a confusing proliferation of alternatives. Re-use of patterns takes advantage of users' increasing familiarity with ubiquitous types of interaction —for example, the horizontal scrolling technique you might find on Flickr.com for looking through libraries of photos, or typing into a blank box to use a search engine such as Google. So pattern libraries serve to reinforce genre norms, as well as exploit them.

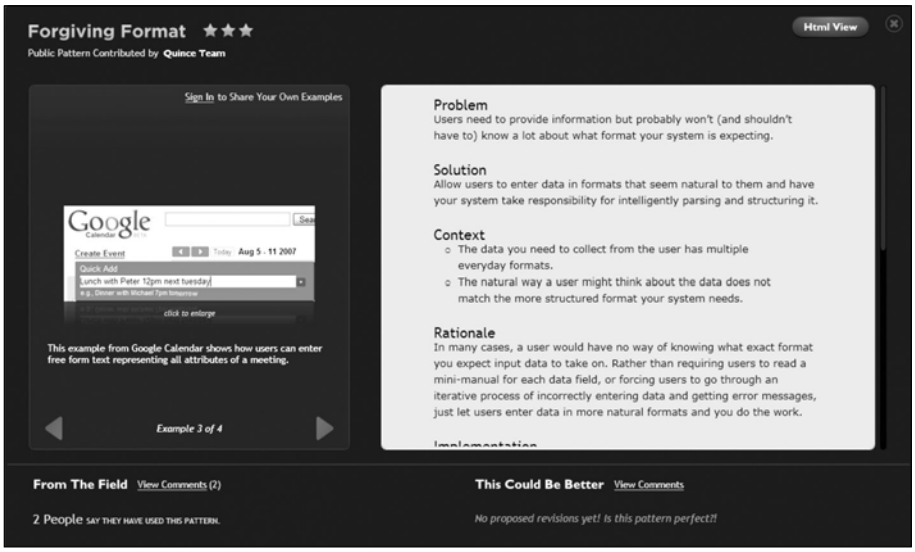


Figure 9. The "Forgiving Format" pattern from the Quince pattern library, showing the problem, the proposed solution, and a rationale justifying the solution

59 Most pattern libraries contain a rationale for using a particular solution to the problem the pattern describes. For example, Figure 9 shows the "Forgiving format" pattern, which allows the user to enter free text unconstrained by the data structure of the system being searched (as in the Google search example it contains). However,

beyond the labeling of some patterns as "best practice", pattern libraries do not always cite research on usability to support their solution.

60 This combination of problem, solution and rationale broadly follows Alexander's original concept (although he did not use these explicit headings). As Table 1 shows, libraries have slightly different emphases, and they do not all share Alexander's hierarchical concept. While architecture problems can be easily organized into a hierarchy of scale (hence the presence of upward and downward links within most Alexander patterns), the software engineers refer to patterns that participate in or collaborate with other patterns, which better corresponds to the way software objects relate.

61 Interaction design pattern libraries, on the other hand, do not typically break suggested patterns down into contributing structures, so that patterns may have shared sub-elements which are not linked together or referenced within the library. They are usually organized along some other principles, such as kinds of interaction (for example, navigation) or by the area of the screen where the pattern is usually used. This makes it easy for the designer to choose from alternative patterns, or to see clusters of problems to be solved together.

Alexander	**Gamma et al.**	**Tidwell**	**Yahoo**
Architecture	Software engineering	Interface design	Interface design
Number & name Photograph Upward links Problem statement Explanation Sketch/diagram Solution summary Downward links	Term Pattern Name Intent Applicability Structure Participants Collaborations Consequences	Name Illustration What Use when Why How Examples	Name What problem does this solve? When to use this pattern What's the solution? Why use this pattern? Special cases Accessibility Open questions *(The last three only appear on some patterns.)*

Table 1. Pattern definitions typically evolve to suit the special requirements of each field of application

62 In the Information Design community, Farkas, Larson and Naranjo (2011) have begun collecting a library of patterns for designing consumer labels for products and equipment (http://www.labelpatterns.org). In a similar move, Behrens (2008)

has created a pattern library focused on information visualization (http://www.infodesignpatterns.com). Both these resources include a rationale for each entry, so that the applicability of patterns to particular design issues can be interrogated by their potential users.

63 A *categorical* comparative label (Figure 2) divides all the competing products (such as a class of refrigerators) into distinct categories based on their performance on one or more measures. Here the measures are Materials, Production, Impact in use, and Recycle/disposal (plus an Overall score). A rating symbol, in this case stars, is used to show which category the product belongs to on the basis of its performance. How does one choose between the two kinds of comparative labels?



Figure 1. A continuous categorical label.



Figure 2. A categorical comparative label using four different measures (plus overall rating).

Figure 10. Farkas's pattern for using categorical vs. continuous scales

64 As Behrens (2008) argues, part of the point of pattern libraries in information visualization is to allow less experienced designers access to good design solutions —solutions that will allow audiences easy, intuitive and unbiased access to complex data in visual form. Behrens organizes his patterns hierarchically, allowing search on function (such as "Navigation" or "Filtering"). Farkas's library is richly tagged, allowing for search on components of the pattern (patterns that include some kind of rating element or scale, for example) as well as by domain (e.g. food, health, medical) and other tags.

65 We mention this tagging because we believe it is a stepping-stone to a function that pattern libraries as they stand are unable to fulfil. While they are a valuable prescriptive resource —in that they suggest solutions that could or should be adopted— pattern libraries do not function as a research resource that will allow us to interrogate how patterns, and elements within them, congregate around particular generic and functional uses. As design and language researchers, the second, descriptive part of our task is to observe how people choose language and design resources to serve particular functions in particular contexts of use, how audiences respond to those choices, and how genres are constituted by the

composition of those visual and verbal resources —and how they change as different choices are repeatedly made and the resulting solutions used.

66 Referring back to Figure 10, it is notable (and not unusual) that there are design elements occurring within this pattern that are capable of independent description and independent application elsewhere. Firstly, the pattern is composed of two possible solutions (continuous and categorical scale labels) that are alternatives —and which themselves are possibly applicable elsewhere in their entirety (for example, beyond the world of labels). Second, each element contains further elements, such as captions, explanations, titles, and indicators of position on a scale (stars, a slider) that could themselves recur elsewhere in other patterns.

67 Although the information design pattern libraries are somewhat more detailed than their interaction design counterparts, they still lack some vital characteristics that would enable them to act as a resource for information designers and linguists to use as a basis for exploring patterns in use. In the next section, we will set out some desiderata for a patterns resource that might help us answer some interesting questions —such as how design elements within patterns can recur and recombine within more than one pattern. We could also ask how often particular design elements are used as a response to a particular information challenge. We will also look at an element that has been missing so far: the linguistic contribution to patterns.

8. Towards a corpus of patterns

68 Taking a cue from the online pattern libraries which use multiple tags as a means of access to the library content, we have the beginning of a multidimensional description that could usefully be applied to the empirical study of patterns. Rather than having to decide whether a pattern is more properly labeled at the functional level (the "phone number" pattern, for example) or at the realization level ("open box"), we can tag patterns multiply and richly. Multiple tagging will eventually allow a collection of naturally-occurring patterns to be interrogated for interesting correspondences: we can look at design elements such as stars, sliders, labels, and captions as constituents that take part in more complex structures, and which can be more or less promiscuous in terms of how many or how few of those structures they are involved in. Design elements that collocate freely may be either prototypical or peripheral to many different patterns. The free text box in the context of gathering an address or phone number is promiscuous in this way, and can appear in many genres. However, the "dotted gap" that appears in the middle of a sentence, as in:

> Caitlin _____ the butter on the sandwiches.

appears (nowadays) in fewer genres —such as school text books, language exercises, and legal forms such as leases and wills. It may therefore carry with it connotations that the open box does not: a slightly dictatorial feeling, perhaps, since the position

of the gap in the middle of a phrase or sentence constrains the syntactic choice of the reader as well as the vertical and horizontal space in which she is expected to write.

69 What is missing from the discussion so far is any reference to the linguistic component of patterns —or, indeed, that the extremely well-developed fields of discourse research could contribute to an enquiry into design patterns in terms of methodological approach. There are many information design problems whose solution is linguistic as well as graphical, and constraints that may apply on linguistic as well as visual content. For example, a pattern we might call "caption" describes the relationship of the design element to something else (an image or diagram) —and we might expect this to fit within expectations about positioning and proximity. There are also expectations about what captions might be like linguistically: they are required to describe, specify, or elaborate upon the image or diagram content, and therefore bear a particular rhetorical relationship to it.

70 The idea that language and graphical display interact in important ways has long been acknowledged from the perspectives of typographers and information designers (e.g. Hartley & Burnhill, 1977; Waller, 1987), linguists engaged in discourse analysis (e.g. Bernhardt, 1985; Lemke, 1998) and those working on natural language generation (e.g. Bouayad-Agha, Scott & Power, 2001). However, there is a gap between this acknowledgement and the development of corpus-based research that could fully investigate the relationship between graphical and linguistic expression. This is not to say that the need for such work has gone unnoticed. Bateman, Delin and Henschel (2004) point out that, in the case of multimodal meaning-making, we lack convenient cut-off criteria such as "grammaticality" that can be interrogated. Empirical work is critical for building the conceptual scaffolding for multimodal analysis: as with language, corpus data can help distinguish between those graphic phenomena that are at all frequent and those which constitute anomalies. While, in some contexts, such anomalies may be of interest in themselves, there is a risk that according them undue significance, as may happen when interpreting hand-picked examples, skews the overall picture. In terms of prescription, while the very lack of a grammar might mean we lack criteria for establishing whether a given instance is well-formed and, as such, run the risk of learning from bad examples, it would nonetheless seem useful to be able to identify the different options selected by document designers to solve a particular design problem.

71 A relatively early formal attempt to explore how graphical and linguistic information work together was the development of the Dart_bio system (Bateman et al., 2001). This was a computer system that generated text, diagram and layout through observing the content and rhetorical relationships between the content elements —the rhetorical relationships being captured through the application of Mann and Thompson's (1986 and 1987) Rhetorical Structure Theory (RST). The system represented logical relationships between system-represented "facts", and rhetorical relationships between them: for example, that fact B might elaborate on fact A, or contrast with it, or that both A and B would be the first two elements of

a list of three equivalent points. Additionally, it was able to suggest plausible and implausible layouts, positioning and graphical realizations such as bold type and bullets based upon the nature of the rhetorical and logical relationships between the elements. Successive research (e.g. Delin, Bateman & Allen, 2002; Bateman, Delin & Henschel, 2004 and 2006; Bateman, 2008) has elaborated on this work and the genre description of Waller (1987) to develop a sophisticated descriptive framework for annotating each element of a visually-complex document —typography, layout, rhetorical structure, and linguistic form. This work, further extended and developed for the purposes of comparing print artefacts across languages and cultures by Thomas (2009), provides sufficient detail and formality to allow the precise description of any element of a design, and thus provides us with a good starting point for the annotation of a corpus of patterns for analysis.

72 A corpus-based approach to the analysis of how graphics and text are used to provide particular design solutions is, of course, a demanding task. To make populating a corpus tractable, Thomas (2009; Thomas, Delin & Waller, 2010) has developed software to automate as much of the annotation process as possible. The first step is to subject the documents to be analyzed to OCR, which outputs OpenDocument format. This is post-processed semi-automatically to generate stand-off XML annotations following the GeM model (Henschel, 2003). These generated layers describe the content and layout of the document. This information is augmented with functionally-orientated descriptions and RST analyses. In parallel with designing the corpus, we have been developing a web-based interface to support querying the data and to present results. While describing this in detail falls beyond the scope of the present paper (see Thomas, Delin & Waller, 2010, for a fuller description of the work so far), the approach to corpus annotation in summary is to capture metadata about the document (what it is, where it came from, its date, and so on), transcribed and annotated document content, and a facsimile of the document itself. The corpus annotation is sufficiently detailed to facilitate the kind of detailed investigation into correlations between information problems and visual and verbal solutions that we are advocating here. It is based on the GeM scheme described comprehensively by Henschel (2003), which implements stand-off annotation in XML layers.

73 (1) Base layer: a transcription of the verbal content of the document —or, in the case of non-verbal graphics, a verbal description of the element is provided. This layer also segments the document into base units, each with a unique identifier.

74 (2) Layout layer: a segmentation of the document into layout units, each composed of one or more base units; realization information about the graphical and typographical properties of each layout unit (colour, typeface, size, line height, justification, case, and so on) and its positioning with regard to the layout as a whole.

75 (3) Rhetorical structure: manual annotation of the document with information about the semantic and rhetorical relationships in which the segments are participating —including relations such as contrast, elaboration, purpose, means, result, and sequence.

76 The corpus is currently too small to support general claims about graphic signaling of discourse structure and, having put the processes and tools in place, the most pressing future work involves its population. This said, the pilot annotations performed so far have drawn attention to certain features and inconsistencies within individual documents. For example, the idea of "sequence" between elements is variously realized graphically in our pilot corpus of documents from financial services companies. In one case, separate steps are enumerated and each step is boxed in table format, while in another, a combination of ticks and crosses, and bullets of different shapes and colours are used to differentiate the sequenced items. The use of these resources seems to lack consistency, a point made earlier in our previous discussion of menus. But this is precisely the function of such corpus-building: to review and compare the verbal and graphical resources used to accomplish similar tasks. It seems likely that the application of this approach to a broader set of questions and much larger collections of comparable documents will yield significant new insights.

9. Conclusion

77 We have introduced patterns as a way to describe the graphic structure of discourse, not just in terms of its content or language, but in relation to a much wider set of functional tasks that discourse is used for. It is obvious that there are a range of theoretical, practical and technical issues to be debated before we have a workable definition of pattern language for documents. But we believe that the close annotation and analytical possibilities of the corpus approach outlined here offers the opportunity to approach patterns as clusters of graphical and linguistic features that occur and recur as regular solutions to particular design problems in particular contexts. Close description in this way allows us to spot which clusters are central (frequent, and very similar) solutions, and which are peripheral, being unstable and/or rare. We can see how very similar or identical patterns occur across more than one genre of document. And, given a diachronic corpus construction and sufficiently detailed analysis, we can also research how patterns have shifted or are currently shifting, allowing the mapping of how genres merge and diverge —for example, examining whether the design patterns at large in technological media are genuinely new, whether they are adapted from elsewhere, and whether they are "colonizing" traditional genres to cause them to shift as well. In addition, the resulting analysis and pattern description will have to satisfy a range of critical success factors:

- it will be both descriptive and prescriptive, using the concept of prototypical and peripheral examples to manage the potential conflict between the two;
- it will be clear about essential and accidental features at the execution level;
- it will cross boundaries between online and paper documents;
- it will allow patterns to relate or combine both hierarchically and functionally;

– it will allow for domain specific patterns libraries to be developed (for example, within an organization or industry, as well as more generically).

78 An approach such as that recommended here is a sizeable analytical task, but we suggest a worthwhile one.

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