Strategic Modelling of Web Information Systems and its Impact on Visual Design Patterns*

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Abstract

The development of web information systems (WISs) requires modelling on various layers of abstraction. Based on an abstract abstraction layer model (ALM) the work in this paper approaches the modelling on the highest layer dealing with strategic modelling. Strategic modelling addresses a very general characterisation of WISs in terms of its content, functionality, context, usage and presentation. The paper discusses branding, utilisation space modelling, utilisation portfolio modelling and atmosphere modelling as the major parts of a strategic model. In a second step it is then shown how the strategic model impacts on the formation of a WIS in terms of its layout and playout.

1. Introduction

The development of web information systems (WISs) requires modelling on various layers of abstraction. The co-design approach to WIS modelling in [12] emphasis a strategic layer, a business layer, a conceptual layer, a presentation layer, and an implementation layer. Other methods such as HERA [8], WSDM [5], OO-H [7], OOHDM [14], HDM [6], ARANEUS [1], WebML [2] and UML [9] agree on the use of abstraction layers as such, but differ in the concrete use of layers. In particular, higher layers dealing with strategic modelling and business-oriented modelling are often neglected.

The first goal of this paper is to discuss modelling on the strategic layer of a WIS (see Section 2). Strategic modelling addresses a very general characterisation of the system in terms of its content, functionality, context, usage and presentation. The strategic characterisation of a WIS starts from the very general question what the WIS is about, i.e. the purpose(s) of the system, and what are criteria for the WIS being successful. The general answer to these questions gives rise to an informal *mission statement*, and a characterisation of the *brand* of the WIS. The latter one will follow the general classification scheme for WISs.

Going more into details we first explore the kind of content that is to be presented in the WIS, and the kind of functionality, with which this content can be accessed, customised to the needs of particular WIS users, and updated. This defines the *utilisation space* of the WIS. We then explore the *utilisation portfolio* to gain even more details. This means to model the users (or actors) who will use WIS, their goals, i.e. why they are supposed to use the system, and the tasks that have to be performed to reach these goals.

The fourth and last part of a strategic WIS model are general principles for the formation of the WIS presentation. These address the layout, atmosphere and progression of the system based on knowledge about the cognitive perception of form, colour and other style elements. Taking these parts together we should keep in mind that the role of strategic modelling is to lay out the plan for the whole WIS without drifting into technical details. As a consequence, the techniques applied on this level will be rather informal, whereas formalisation will be achieved on lower levels of abstraction. Methods that are suitable for strategic anaysis such as linguistic analysis, the use of metaphors and communication analysis have been discussed in [11].

The rationale behind our approach is an observation made in theoretical linguistics [3]: whenever a complex construction has to be explained, humans first think in terms of concepts, which are then mapped to a linguistic construct and only finally translated into sentences. Carrying this idea

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over to WIS development means to first lay out the fundamental concepts that are to be captured by the system, then map them onto a conceptual model, before finally approaching an implementation using common available technology.

We will not go into the details of the conceptual modelling of WISs, as [12] contains a detailed account of storyboarding, and content and functionality modelling (see also [13]). We will, however, show how the strategic model impacts on the formation of a WIS in terms of its layout and playout (see Section 3). For this we start from the means that are available for visual communication such as visual ordering, partitioning, colouring and perspective. We then go into more details discussing grid models and colour selection in accordance with the layout, atmosphere and progression patterns identified on the strategic layer.

2. The Strategic Layer of WISs

We start with a brief account of WIS modelling on a strategic layer. For a discussion of the Abstraction Layer Model see [12].

2.1. Mission Statement and Brand

The *brand* of a WIS is based on a rough classification scheme for WISs. This classification scheme has the form $\mathcal{P}^{\mathcal{W}}2\mathcal{U}^{\mathcal{A}}$ and represents in an extremely terse form the following very general information:

- $\mathcal{P}$ stands for "provider", and thus indicates which role the system plays. This specifies very roughly what kind of content can be expected from the system. For instance, if the provider is a bank, the provided services will most likely center around accounts, investments, savings and loans.
- $\mathcal{W}$ stands for "what", and thus adds more detail to the kind of content offered by the WIS. For instance, if the provider is a bank, the provided content may just be accounts, investments, savings, loans, and mortgages.
- $\mathcal{U}$ stands for "user", and thus indicates to whom the services offered by the WIS are directed. For instance, if the provider is a bank, the users are probably just the customers, enterprises or other banks.
- $\mathcal{A}$ stands for "actions", and thus indicates the functionality of the WIS offered to its users. For our example of a bank offering accounts, investments, savings, loans, and mortgages possible actions can be apply_for_loan, apply_for_mortgage, set_up_account, buy_stock, etc.

The brand is usually the result of a brainstorming activity discussing the what, whom and for_whom of the WIS. The aim is to fill these general placeholders $\mathcal{P}$, $\mathcal{W}$, $\mathcal{U}$ and $\mathcal{A}$ with meaningful terms that describe the WIS in very general, terse terms. The brand gives a rough picture of the content and functionality of the WIS and its users using only descriptive keywords. This is, however, a valuable source of information for refinement using linguistic methods.

The *mission statement* complements the brand by an informal, textual description. The importance of having it was emphasised in [4]. Each of the actions in the brand are taken as the major tasks. For each of them the mission statement decribes, which types of users are involved, which activities they are supposed to execute, which content will be provided for them and requested from them, and what will be the results of these activities. However, no attempt is made to decompose the tasks or to refine them, as this is left to storyboarding [12].

Furthermore, the mission statement contains metaphors that turn out to be adequate for describing the activities associated with the WIS. These metaphors refer to the content and functionality keywords used in the brand.

In addition to its descriptive character the mission statement also has an explanatory character in the sense that it contains the reasons for setting up the WIS. That is, the mission statement will describe what the major and minor purpose of the system is, how each task will contribute to these purposes, and what the benefits of the system for the provider and the users will be.

EXAMPLE 2.1 Let us consider the example of a WIS that deals with loan applications. In the case the provider is a bank, and the content will be centered around (personal) loans and mortgages. The only users we think of are customers, and the tasks they execute are applications for loans and mortgages, respectively. This leads to the following brand:

$$\text{bank}^{\text{loan, mortgage}}2\text{customer}^{\text{apply\_for\_loan, apply\_for\_mortgage}}$$

We omit the mission statement, which would be just an informal explanation for the brand.

In general, it is sufficient to formulate the mission statement using free-form text, but it is also possible to use semi-formal structured text. In doing so the brand and mission statement take the following form:

`Content`:	⟨list of content items⟩
`Users`:	⟨list of users⟩
`Tasks`:	⟨list of tasks⟩
`Major Purpose`:	⟨textual description⟩
`Minor Purpose`:	⟨textual description⟩
`Benefits`:	⟨textual description⟩

Furthermore, we obtain the following informal description for each of the tasks:

Task:	⟨task name⟩
Description:	⟨textual description⟩
Participants:	⟨list of users⟩
Required Content:	⟨list of content items⟩
Produced Content:	⟨list of content items⟩
Result:	⟨textual description⟩

EXAMPLE 2.2 Using the tabular semi-formal description, we can rewrite the brand and mission from Example 2.1 in the following way:

Content:	loan, mortgage
Users:	customer
Tasks:	apply_for_loan, apply_for_mortgage
Major Purpose:	open an additional sales channel, for technology-experienced and informed, goal-oriented customers
Minor Purpose:	improve banking efficiency in loan sector
Benefits:	closer binding of customers attraction of new customers improvement of cost efficiency increased availability of bank services

2.2. Utilisation Space

The term "utilisation space" is used as a metaphor to characterise the WIS as a space, through which a human user can navigate. As such it has to cover mainly the content, functionality and context in general terms. The goal is to enable optimal orientation in the utilisation space, such that searching and finding information needed for certain tasks will be facilitated.

The type of content is already characterised by the brand, to be precise by its what-part. This gives a set of nouns describing the content in coarse terms. Similarly, the what_for-part of the brand gives verbs describing the functionality, i.e. what to do with the content.

The utilisation space will now add details to content and functionality, set the nouns and verbs used in the brand into relation, and place both into a utilisation context. This will be done in the following way:

- Refine the content keywords and place them in semantic relationships. These relationships can capture specialisation, part-of relationships, or associations of global context with details. They indicate navigation facilities and order principles among the content. Word fields are a valuable tool for the refinement [11].
- Refine the functionality keywords to discover various facets that can be placed in semantic relationships in the same way as the content. Again, word fields are a valuable tool for the refinement.
- Relate the functionality with the content, i.e. specify in which context a particular content is needed, i.e. which content is needed by which activity, which content is produced by which activity, in which order (if any) the content will be used by an activity. In doing so, we obtain a progression model for the functionality.

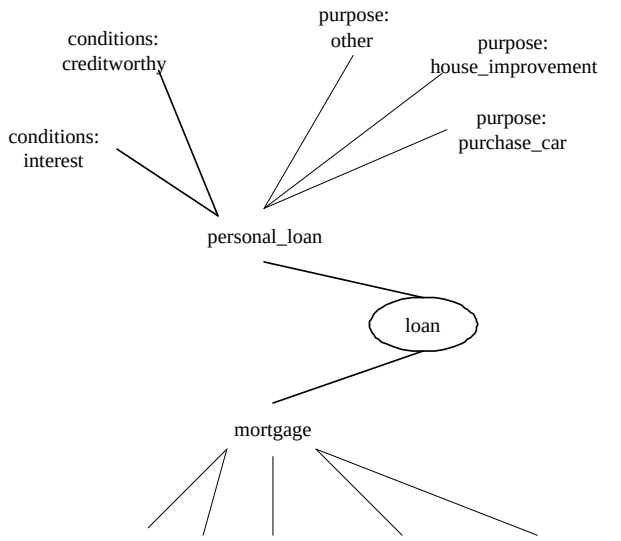

Figure 1. Semantic tree of content items in loan application

Semantic relationships for content – and similarly for functionality – can be represented by rooted trees, where the root is defined by a keyword taken from the brand. Thus, we can obtain the following more detailed description of content items:

Content Item:	⟨name⟩
Derived From:	⟨content item⟩
Relationship:	⟨description⟩
Usage:	⟨list of tasks⟩
Description:	⟨textual description⟩

In the same way we obtain more detailed description of tasks:

Task:	⟨task name⟩
Derived From:	⟨task name⟩
Relationship:	⟨description⟩
Description:	⟨textual description⟩
Participants:	⟨list of users⟩
Required Content:	⟨list of content items⟩
Produced Content:	⟨list of content items⟩
Result:	⟨textual description⟩

EXAMPLE 2.3 Figure 1 represents a tree of content items with root loan, which is specialised by personal_loan and mortgage. Details for mortgages have been omitted, but for personal loans the three decisice facets – conditions for obtaining the loan, i.e. creditworthiness, conditions for loan repayment, i.e. life span, principal and interest, and loan purpose have been indicated.

Similarly, Figure 2 represents a task tree with root apply_for_loan, which again is specialised by apply_for_personal_loan and apply_for_mortgage. For the latter one further details have been omitted. For apply_for_personal_loan the components contributing to selecting terms and conditions, outlining personal finances, declaring the purpose of the loan, and entering customer details are shown in the tree.

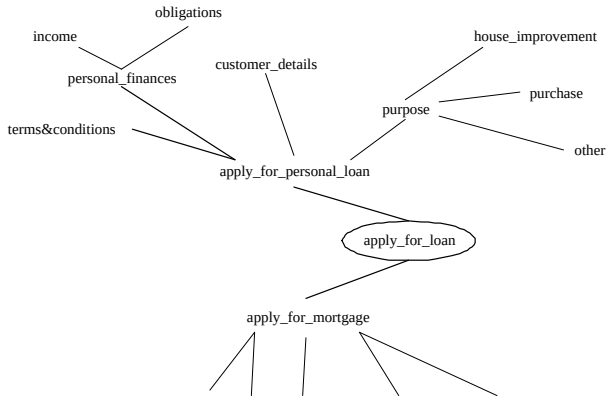

Figure 2. Semantic tree of tasks in loan application

The decisive criterion for orientation in the utilisation space is the preservation of context. This can be achieved, if for each task a mental model can be constructed. This model captures the progression of content perception over a time axis. It represents a system map for the user showing information that has already been used and processed.

For strategic modelling it is important to reflect, whether the stages that represent perception of content are logically connected. It is also important to see that later stages enable the possibility to be redirected to information that was already processed earlier.

If available, metaphors may help to set up this mental model. For instance, the "desktop" metaphor is a well-established tool that has significantly contributed to ease the use of computer technology by technical laypersons. Similarly, the "shop" metaphor is frequently used in commerce applications.

EXAMPLE 2.4 We may regard the task of personal loan application in the loan application system from Example 2.1 as a matching problem. We have to match the needs of a customer with the purposes og the available loans, and the payments arising from loan conditions with the payment latitude of the customer, which is determined by creditworthiness conditions set by the bank and the personal finances, i.e. income and obligations, of the customer.

Thus, a suitable mental model consists of the set of loan options, i.e. loan type, conditions and purpose, and the implications of each option with respect to the payments. This model develops over time in a way that non-suitable options are deleted first, then a selection is made, and finally organisational data are added to turn the selected loan option into a full loan application.

2.3. Utilisation Portfolio

The utilisation portfolio complements the utilisation space emphasising the whom-part of the brand. Thus, it is mainly concerned with the WIS users, for which we will later adopt the term "actor", their goals and the tasks that have to be executed to achieve these goals.

Tasks correspond to the actions in the brand and their refinement in the utilisation space. So we can assume a task hierarchy emphasising specialisation between tasks and decomposition of tasks into subtasks, as long as these can be described in a simple way.

The users used in the brand and mission statement will be roughly classified according to roles they have with respect to the WIS. Each role has particular goals, and each of these goals corresponds to a task that is meant to achieve this goal. This does not mean that the task has to be executed by the user in this role; it may well refer to tasks executed by users in other roles. Tasks are broken down into subtasks to a level that elementary tasks can be associated with a single role. In addition, subtasks should refer to subgoals.

Furthermore, we obtain dependencies between goals, e.g. being a subgoal, a specialisation, or any other kind of dependency. Thus, we complement the informal description of the system by adding goals:

`Goal`:	⟨goal name⟩
`Derived From`:	⟨goal name⟩
`Relationship`:	⟨description⟩
`User`:	⟨role name⟩
`Description`:	⟨textual description⟩

The relationship between tasks, roles and goals can be represented in a graph, which we call a *task-goal graph*. In these graphs we have three different types of vertices for actors, tasks and goals, respectively. Furthermore, we have five different kinds of edges for task-goal relationships, in-

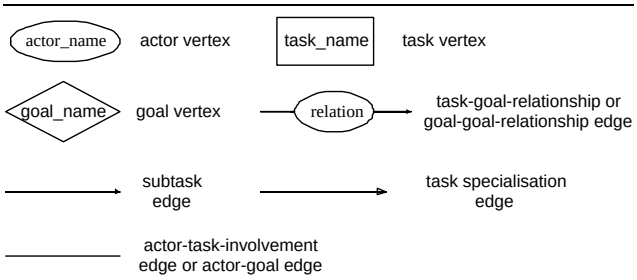

Figure 3. Legend for Task-Goal graphs

volvement of an actor in a task, goal-goal-relationships, as well as for subtasks and task specialisation. Figure 3 shows the legend for such graphs.

EXAMPLE 2.5 The task-goal graph in Figure 4 illustrates goals, tasks and actors in a loan application. In this case the goal buy_new_car depends on obtaining a personal loan, i.e. on the goal personal_loan. Sufficient for achieving this goal is the successful execution of task approve_personal_loan, which has to be done by a bank clerk. However, this task will only be triggered by a task apply_for_personal_loan to be executed by the customer. This task is thus necessary for the goal. Furthermore, the task decomposes into four subtasks select_conditions, enter_customer_details, declare_purpose and set_up_budget.

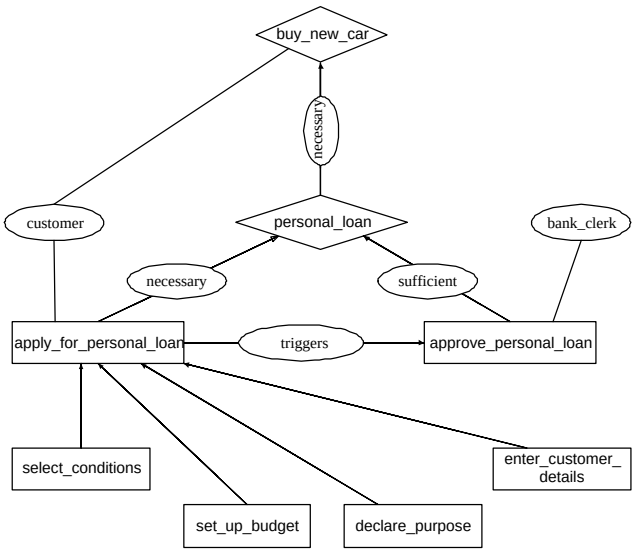

Figure 4. Task-Goal graph for loan application

A valuable tool for setting up the utilisation portfolio is communication analysis, which addresses how a user will communicate with the WIS and why this communication is the best for the provider and the user.

2.4. The Atmosphere of a WIS

While the brand, mission statement, utilisation space and utilisation portfolio aim at the characterisation of content, functionality and usage of the WIS in strategic terms, the atmosphere addresses the gestalt of the WIS, i.e. how the WIS should be configured. At the end the WIS will be implemented by and presented through web pages, which should convey a uniform impression to the WIS users.

Categories characterising the impression of pictures can be used such as energetic, romantic, elegant, refreshing, harmonic, or stimulating. Each of these categories will have implications on the choice of form and colour [10]. On the strategic level the choice of one of these categories corresponds to the question which impression the WIS shall convey. The question is, which atmosphere is best suited for the envisioned content and functionality.

EXAMPLE 2.6 In Example 2.4 we characterised the application for loans as a matching problem. Choosing a harmonic presentation for the WIS would suggest the intention to find an "optimal" solution for the customer and the bank. Choosing a stimulating atmosphere might suggest to encourage the customer in his/her application. An elegant atmosphere of the WIS may be chosen to convey confidence to the customer, i.e. that his/her financial affairs will be dealt with in the best way.

In addition, the atmosphere of a WIS is concerned with the progression patterns for the tasks. These patterns reflect the logical connection of information revealed to the user during the execution of a task. We distinguish between the following *progression patterns*:

- A *circular* progression pattern is centered around a particular content item, the phases of which form the core of the content to be delivered. At each stage details are added.
- A *loop* progression pattern emphasises the iteration of content, each time taking a different perspective. This is similar to a circular pattern, however puts more emphasis to changes.
- An *incremental* progression pattern emphasises the development of several content items over time. At each stage some of the items may be completed.
- An *evolutionary* progression pattern emphasises the stages of the content items, in particular those that are used in the result of tasks. At each stage content item may still be incomplete.

- A *network* progression pattern emphasises the flexible treatment of content items during the development of tasks and the logical connection between various such objects.

EXAMPLE 2.7 If we choose a circular progression pattern for a personal loan application, the presentation of information will be centered around the loan, each time gaining a clearer picture of the result. In Example 2.4 we explained that it would be a good idea to successively discard possible loan options. This is in accordance with circular progression.

An incremental progression pattern would emphasise the various components of a loan application, i.e. the customer data, the conditions, and the budget. Each of these components would be treated as a separate item. While this is common in many WISs that offer form-oriented access, it may not be the best choices, because it does not support well the interaction between a tentative choice of conditions, the calculation of repayment costs and the personal financial situation of the customer.

An evolutionary progression would be very similar to an incremental one. However, each component could be left incomplete. This would help with the problem of changing conditions.

A loop progression would be similar to a circular progression. The difference is that the circular progression emphasises more the narrowing of options, while a loop progression would permit returning to options that have already been discarded.

Finally, a network progression is again similar to an incremental one, but leaves much more flexibility, as to fixed order of the components is presumed.

Progression patterns have a direct impact on the placement of content on web pages, thus on the tiling of pages and the mapping of content to the tiles. Such a mapping of patterns to web page grids is discussed in detail in [10].

3. Visual Design Patterns

We will now discuss how the decisions made on the strategic level impact on the formation of the WIS presentation. We may assume that the result of conceptual WIS modelling is available, i.e. there is a clear specification, which content is to be presented, and how the different content units are logically linked together. This is captured by the *media schema* in [12]. So our focus now in on how the WIS content and functionality is to be presented to its users. We concentrate on the visual design, though audio design could be tackled as well.

3.1. Basic Principles

Visual design patterns are composed of visual and functional building blocks. The visual building blocks correspond to the geometric partitioning of the screen, whereas the functional building blocks realise the access to the presented content. Thus, the functional building blocks correspond directly to the represented content and its organisation along the strategic progression patterns. They order the content, whereas the visual building blocks place the content on the screen using a flexible graphical structure with constant colour coding and repeating elements that reflect the functional order.

Within the limitations of this paper we concentrate on the visual building blocks.In doing so, we have to consider the following three aspects:

- the visual alignment and partitioning of the screen;
- the colouring with respect to funcionality and aesthetics;
- and the perspective perception of the whole screen.

The visual alignment is based on a tiling of the screen as a two-dimensional surface. In general, we can divide the horizontal and vertical axes using grid points $x_{\min} = x_0 < x_1 < \cdots < x_k = x_{\max}$ and $y_{\min} = y_0 < y_1 < \cdots < y_\ell = y_{\max}$. A *tile* is defined by a rectangular region $[x_i, x_j] \times [y_{i'}, y_{j'}]$. Then use a partition of the whole screen into tiles.

EXAMPLE 3.1 A very common tiling is obtained by using just 4 horizontal grid points $x_0 < x_1 < x_2 < x_3$, and only 3 vertical grid points $y_0 < y_1 < y_2$. Then define four tiles

$$\text{up} = [x_0, x_3] \times [y_1, y_2] \qquad \text{left} = [x_0, x_1] \times [y_0, y_1]$$
$$\text{middle} = [x_1, x_2] \times [y_0, y_1] \qquad \text{right} = [x_2, x_3] \times [y_0, y_1]$$

Usually, the "up" tile is used for some menu bar, the "left" tile for navigation links, the "middle" tile for the major content, and the "right" tile for side options.

The colouring scheme will be the major instrument to achieve the desired atmosphere as specified in the strategic model. For the perception of the presentation by a user the interaction of colours is decisive. The basis can be a *colour chord* consisting of n colours ($n \in \{2, 3, 4, 6\}$) that form a regular polygon in the colour circle. These are complemented by adding grey tones enabling to achieve contrast between light and dark colours. A *quality contrast* results from brightening the coulours of a chosen ground chord in the same way.

From the theory of colour harmonics it is known that the choice of colour chord impacts directly on the perception

leading to the sensations such as warm, cool, cold, intensive, hot, light, dark, etc. Conversely, the desired sensation indicates guidelines for the choice of the colour scheme.

The colouring scheme also impacts on achieving a three-dimensional impression (if desired) or not. The technical means for achieving a perspective perception are contrast, colour perspective, depth of sharpness, and the differentiation of motif [10].

3.2. Grid Geometry

Following the general principles the grid geometry addresses the visual alignment. We now leave the simple tiling into several columns and rows aside and concentrate on grids, in which the visual building blocks have sizes following a rhythmic structure that can be expressed by a sequence of positive integers. Such grid models can then be combined with colour schemes in a way that the rhythmic proportions of the colours conform to the desired atmosphere.

We are particularly interested in the Fibonacci sequence, which is defined by the recurrence $f_{n+2} = f_n + f_{n+1}$ with the starting values $f_1 = f_2 = 1$. This gives the well-known sequence $1, 1, 2, 3, 5, 8, 13, \ldots$ Solving the recurrence equation gives

$$f_n = \frac{1}{\sqrt{5}}\left(\frac{1+\sqrt{5}}{2}\right)^n - \frac{1}{\sqrt{5}}\left(\frac{1-\sqrt{5}}{2}\right)^n$$

involving the two roots of the equation $x^2 - x - 1 = 0$. The positive root is known as the *number of the golden section*, which played an important role in art and architecture, and appears naturally in nature.

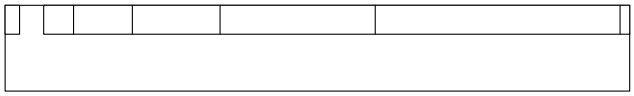

Figure 5. The grid model of visual flags

A simple use of the sequence leads to the model of *visual flags*, which in fact dates back to Leonardo da Vinci. This is illustrated in Figure 5. The flags enable the selection of sections that are ordered according to some functional criteria.

In terms of tiling we simply use the Fibonacci numbers as the horizontal grid points, and do not bother about vertical grid points at all. Multiplying the Fibonacci numbers with a constant can be used to define a partition of the screen width.

Another use of the Fibonacci sequence is to place squares with increasing side length f_i along a spiral as shown in the lower part of Figure 6. It is therefore called the *Fibonacci gid model*. In doing so we obtain

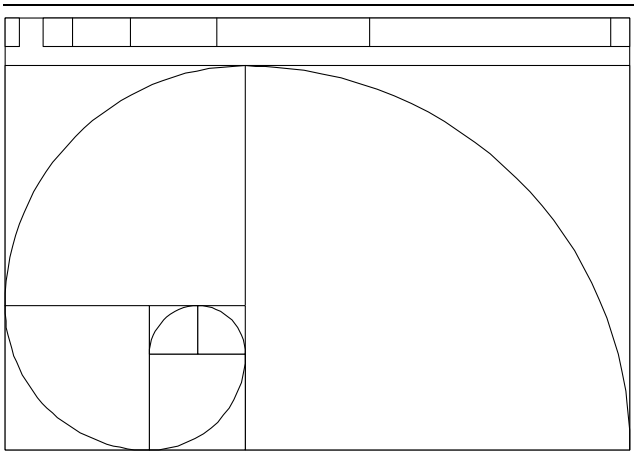

Figure 6. The Fibonacci grid model with flags

a very nice tiling of the screen, in which the proportions of the square tiles are determined by the Fibonacci sequence. If each tile is associated with a colour of a well chosen colour scheme this enables to achieve the desired atmospheric effects as specified in the strategic model. The thesis [10] shows this combination of the Fibonacci grid with various colour schemes in different web application projects[1].

The Fibonacci grid can be combined with visual flags as shown in Figure 6. In doing so we obtain a visual alignment with the following characteristics:

- It can be combined with a harmonic colouring due to the proportions of the tiles that are defined by the Fibonacci sequence. This has been often exploited in art.
- Its visual flags can be exploited for global navigation according to the functional specification.
- The implicitly given Fibonacci spiral can be used as a line along which the content progresses.

3.3. Atmospheric Effect of Colour Schemes

On the strategic level we specified the desired atmosphere of a WIS. For this we used categories such as energetic, romantic, elegant, refreshing, harmonic and stimulating. All these categories refer to a desired sensation that the WIS presentation should convey to the users. The question is, which colour schemes can be identified to support these desired effects.

For each category we first need a ground colour chord, which is extended to a quality contrast. In particular, colours

1 Unfortunately, it is difficult to show the effect of colour schemes in a black and white text.

will be brightened uniformly. Based on these base decisions we develop an ordering of colours. The colour ordering in combination with the association to grid tiles determines the overall effect of the colour scheme. The colour ordering is based on formal and functional criteria:

- Formally, the order is determined by the placement of the colours in the colour circle. It is known that equidistant colours harmonise better.
- Functionally, the order of colours is determined by the subjective sensation and associations of a viewer. This is taken from psychological studies and centuries of experience in art.

An energetic or powerful atmosphere can be achieved using a three-colour chord with bright and high-croma colours such as a blueish purple with green and orange. The blueish purple colour with increasing brightness can be used for the visual flags. Orange with increasing brightness can be applied to the initial squares on the Fibonacci spiral, where green is reserved for the largest tile. However, a tile will always inherit the colour of its corresponding flag.

A romantic atmosphere can be achieved using a three-colour chord with pastell colours such as (light) blue, pink and yellow. Similarly to the energetic atmosphere yellow and blue in increasing brightness would be used for the flags and the initial tiles along the Fibonacci spiral, where pink would be reserved for the largest tile.

An elegant atmosphere can be achieved using a two-colour chord, e.g. red and green, in combination with grey. As before, grey would be reserved for the largest tile in the Fibonacci grid, while the other colours in increasing brightness would be used for the initial tiles and the flags, respectively.

A refreshing atmosphere can be achieved using a three-colour chord with light colours in a "temperature contrast", i.e. the individual colours show opposite effects with respect to associated temperature. For instance, we might choose (light) purple, yellow-orange, and a blueish green such as cyan. The use on the Fibonacci is as before with yellow-orange for the largest tile.

A harmonic or balanced atmosphere can be achieved using a two-colour chord, e.g. dark blue and ochre, in combination with grey with grey being used for the largest tile. Similarly, a stimulating atmosphere can also be achieved using a two-colour chord, e.g. yellow-green with red-purple, in combination with grey.

4. Conclusion

In this paper we discussed the strategic modelling of web information systems on the basis of the abstraction layer model from [12]. The starting point is an informal mission statement and a characterisation of the brand of the WIS, the latter one following a general classification scheme. Both together describe what the WIS is about, i.e. the purpose(s) of the system, and both result from brainstorming.

Going more into details we presented models of utilisation space and utilisation portfolio, which describe in very general terms the content that is to be presented in the WIS, the functionality, with which this content can be accessed, as well as the users of the WIS, their goals, and the tasks that have to be performed to reach these goals. The fourth and last part of a strategic WIS model are general rules for the layout, atmosphere and progression of the system based on knowledge about the cognitive perception of form, colour and other style elements. We then showed how the strategic model impacts on the formation of a WIS in terms of its layout and playout. Based on general principles for visual design patterns we discussed grid models and colour selection in accordance with the layout, atmosphere and progression patterns identified on the strategic layer.

The strategic model complements the conceptual model of WISs that was presented in [12]. Furthermore, it shifts interface design to a higher-level of abstraction in a way that permits intentions, metaphors and context information to be exploited from the very beginning, whereas it is usually left only to the generation of pages using style patterns. This enables a much tighter coupling of the abstraction layers in WIS development.

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