

Open Design Methodologies.

Exploring architectural practice for systems design

Hilda Tellioglu & Ina Wagner
Multidisciplinary Design and CSCW
Technische Universität Wien
Argentinerstr. 8, A-1040 Wien, Austria
+43 1 58801 (Ext. 4492, 4439)
htelliog,iwagner@pop.tuwien.ac.at

Rüdiger Lainer
Master School of Architecture
Academy of Fine Arts in Vienna
Office: Reiserstr. 41, A-1030 Wien, Austria
+ 43 1 713 37 06
Ruediger_Lainer@blackbox.at

ABSTRACT

This paper explores the commonalities of architecture and systems design, using the notion of open planning. The practice of *open planning* is explored as a way of preserving the strength and conceptual integrity of a design concept while at the same time keeping it open for evolving and changing requirements, and of interpreting and handling constraints in innovative ways. A small case of cooperative prototyping is used for examining in how far this notion of openness can be made fruitful for the design of computer systems. Four aspects are discussed: the role of inspirational objects, the relevance and difficulties of working along themes, extending the notion of placeholders to systems design, and the need for open and rich forms of communication.

Keywords

Architectural design, systems design, design methodology, open planning.

INTRODUCTION

"Bringing Design to Software" [1] has drawn attention to the commonalities of the design disciplines, uncovering some exciting possibilities of rethinking software design. Among these commonalities are the conceptual and creative aspects of designers' work practice and the relevance of aesthetic judgment in design. In a recent paper on applying the architectural studio method to the education of software designers, Sarah Kuhn [2] builds on the analogy between the two design disciplines.

This paper takes a step further in exploring this analogy, using the notion of *open planning*. We developed this idea in our field work on architectural practice.

We use it as an umbrella term for expressing that architects should be supported to work within, and also present their work in, an open space of possibilities rather than a set of

defined solutions. Openness implies that decisions about possible design trajectories are not made too quickly, and requires that the different actors present their work in a form that is open to the possibility of change. It puts emphasis on the dynamics of opening and expanding, fixing and constraining, re-opening, etc. [3].

Our notion of open planning reflects a particular methodological approach to architectural design also termed *morphological*. It proceeds through concepts, on the level of images, metaphors and analogies, which are gradually made interact with the givens, in a process of "combining and contradictory combining, of discovering and inventing, of creating confrontation and harmony"¹. On the level of process, this approach requires to organize work in an open, informal and fluent way. We use field work² in one particular architectural office (most of it focusing on a recent project, the design of a *Cinema Center*) for describing open planning.

We see a strong connection between openness and (participatory practices of) systems design. PD puts special emphasis on keeping the design-in-development open to evolving and changing notions of use (which are elaborated in close cooperation with the users). Neumann and Star describe a large infrastructure project in the language of openness: "... managing ambiguity, very complex multiple contingencies, in a distributed and open-ended project is at the heart of crafting infrastructure" [4, p. 239]. The small case of systems design³ we describe in this paper uses co-

¹ Expressions in quotation marks are citations from field work material.

² Ethnographic field work in the architectural office combines observations and recordings of design sessions, unstructured interviews, as well as combinations of observations with discussion-interviews.

³ The case refers to our work on computer support for architectural design and planning. One of our approaches builds on the metaphor of *Wunderkammer*. The design of a first *Wunderkammer* prototype was worked out by Johannes Siglär and Martin Kom-

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operative prototyping [5] which we perceive as coming close to what architects do when engaging in open planning.

Our aim here is to examine in how far open planning as an architectural practice can be extended to and made fruitful for practicing systems design and for reflecting on this practice. For this we take a step beyond an ethnographically informed account of current practice, formulating a *design methodology* or method [6]. This methodology is a result of both, working on architectural projects and reflecting on this work. It is grounded in practice, and prescriptive, spelling out some basic principles that have been experienced as useful guidelines for this practice.

THE ANALOGY

What makes open planning a relevant concept for both design disciplines is that it shows how to preserve the strength and conceptual integrity of a design idea while at the same time keeping it open for change.

In an architectural design project this need for change arises from many sources, such as the client's ideas and requirements, technical constraints, new products, regulations and norms (and their interpretative flexibility). As has been widely debated within the PD community, the vision of a system-to-be-developed has to take account of the diversity and fluidity of work practices [7], of the difficulties of knowing future uses of a system in context, as well as of the heterogeneity and multiplicity of possible views on it [4].

Building on this analogy, however, also requires to look at the differences between the two design disciplines. These differences have to do with the participating actors, their competencies, their role in defining the design concept, with the very nature of the artifacts they produce, and with the language they speak.

Clients and/or (often multiple) users play a somewhat different role in both domains. So are architects more than the translators of the client's basic requirements into a design. They possess and assume a unique authority (and skill) in creating a conceptually and aesthetically elaborate design. A substantial part of the engineering work is done by or in collaboration with (external) technical consultants. They represent and articulate constraints and cooperate with architects in developing the more detailed technical solutions. The image of the architect is still that of acting in the hybrid role of (aesthetic) designer and planner (who ideally remains in control of the detailing of a design and its implementation). In this sense the design concept is both, individually authored, and evolving in dense cooperations.

Software designers do not have comparable possibilities of authoring an aesthetically designed product. They simultaneously act as representatives of technical constraints and as

translators of users' requirements into design specifications and develop the technical product. As we will argue, while exhibiting some strong commonalities, this process of translating (specifying and implementing), differs from the practice of detailing an architectural design concept in some quite fundamental aspects.

THE NOTION OF OPEN PLANNING

We can talk about openness in a variety of ways. Here we stress the openness of the process, and not the openness of the designed artifact itself, even though both may be connected in interesting ways (e.g. designing an open system of organizing space [8]).

Open planning as an architectural practice can be characterized as a) conceptual, thinking in images metaphors, and analogies, confronting them with the givens, handling contradictions; b) moving on in a process of encircling specific design problems; and c) systematically enlarging the solution space and holding it open.



Fig. 1 The translucent skin

The notion of open planning may best be approached by looking at how topics are addressed and *encircled* in design sessions, within the designer team as well as in meetings with external consultants. A design problem cannot be solved in a sequential, straightforward way. A central idea in the *Cinema Project* for example is the notion of the building's façade or skin as "translucent and as creating a textile impression, filtering the light in a highly differentiated way" (Fig. 1). The skin as a design problem to be solved appears and re-appears in many sessions. Its conceptualization, using images, metaphors, sketches, has to be successively confronted with the givens: the context of the building and the specific requirements, technical constraints and possibilities, building regulations, etc. These givens themselves are not clear from the beginning, but take shape through interactions with multiple actors.

This is reflected in the dynamics of design sessions. In such a session, many topics - the elements of a building such as ventilation, ceilings, stairs and gangways, etc. - are addressed. While some of these are discussed in detail, others are briefly touched upon to be then left open. The team's conversations unfold through defining a particular topic, trying to clarify the facts, generating and testing preliminary solutions.

This encircling often takes the team through the entire building, since each topic has ramifications for others, and a particular solution influences the relations and dependencies between many parameters: the lighting concept for the

past who generously shared their experiences with us. It will be further developed within Esprit LTR Project 31870 DESARTE.

created by combinations of material and light: "... and the material, light will be used for framing, the (projection) cabins: white light with some colored stripes, this produces the impression of shimmering colors on the walls, which will be from wood, palisander, indirectly, through reflection".

Conceptual design is an ongoing activity and not restricted to the early design phase. A rich space of inspirational resources helps to better grasp a concept (a particular combination of parameters) that is evolving in the designer's head, to externalize images that are difficult to express, and to share them. When we look at the collection of resources used in this process - maps, photographs, prints, plans, texts, images, metaphors, artifacts of different material quality - each has its own way of mobilizing and directing the architect's knowledge and associations.

Defining themes

An approach practiced in the *Cinema Project* for keeping the design concept present in ongoing work is the definition of themes. Themes specify the basic points of view to be taken when working on specific tasks. They are of different quality, with some of them describing the overall aesthetic appearance of an object, others properties of particular elements or features. They serve as guidelines for considering different options, their advantages and disadvantages. As such they simultaneously shape the structure of the object-to-be-built and structure project planning.

When we look at the themes developed for the lighting design, lighting plays a central role in the notion of the building's skin as mediating between inside and outside, as well as in the spatial dramaturgy created in the building's interior. Light is conceived of as flooding and radiating. It should appear as a "calm surface" or "membrane" (onto which e.g. images can be projected).

A *themed* approach to lighting design is crucial in a process of encircling topics. This can be seen in the way the lighting concept is developed. The notion of light as a changeable surface influences how all other parameters should be read and discussed: fittings, light strips (on ceilings), light beams (on the façade), projections (from inside, outside), flooding the volumes with light, etc.

Thinking through them together with a lighting consultant (L) is a process in which a joint but still fuzzy understanding of the lighting concept has to be worked on cooperatively, jumping between design concept (as expressed in terms of themes), givens and some previous knowledge about technical possibilities and constraints, including products. While talking systematically through a series of topics, guided by a checklist of questions, plans are consulted and commented. One of the senior architects produces a schematic drawing (Fig. 4). The annotations in the corner of this sketch express one of the main lighting themes (Traumwelt-Inszenierung).

Themes shape the preliminary solution that is worked out during this conversation:

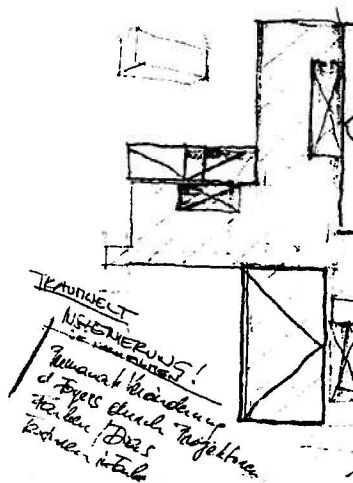


Fig. 4 Themes for the lighting design

A: We thought that here, where the ceiling touches the volume, we should have a pending ceiling to be able to create indirect lighting, so that the volume (of the theater) with its rough surface which contrasts with the smooth material of floor, walls, ceiling, stairs -

L: this means, we can put the lighting here along this pink line -

A: yes, though it should not touch the volume itself, the basic lighting should have a theatrical quality, white light which emphasizes the volume, creating a dramatic effect (sketches), and then there are these four projection cabins which ... on principle should look like huge radiating bodies -

L: this very much looks like needing projection beams -

A: couldn't we use neon light -

L: but you insist on continuous lighting and you don't want .. to show the neon tubes, this could be designed in an imaginative way -

A: rather not, there should be the impression of a surface, a radiating surface -

We can see in this short transcript how the *themed* language shapes the talking through details. The lighting themes are evoked step by step and confronted with a variety of solutions. New metaphors are created, such as "das spannende Licht" for the radiating surface of the projection cabins. Working with themes helps maintain the relation between concepts and technical detail: "When I have to do with details, it is certainly more difficult to see the whole ... I zoom myself in and out again".

Solutions for aesthetically significant details are often triggered off by what at first sight appears as a constraint. In the *Cinema Project* this was initiated by a requirement change. For structural reasons two columns had to be added which the architect saw as interfering with the monolithic and floating character of the building. With one of the movie theatres having to be shifted outward, there suddenly was a new, never thought of place for the support structure. Its wedge-shape reflects and strengthens the design concept in a dramatic way (Fig. 5).

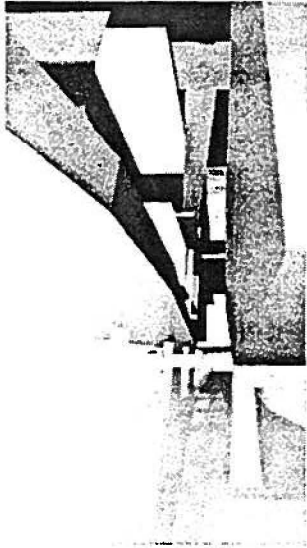


Fig. 5 Dramaturgy of space: the wedge-shaped column

The *themed* approach, how to create a special spatial dramaturgy, allows to re-open a design decision in ways that stimulate innovative solutions.

Meandering - working with placeholders

Open planning uses a much weaker structure for the ongoing project work than a sequential fixing of parameters and detailing of parts. We use the term *meandering* for expressing this difference. Design work no longer progresses along a line, in separable phases, but as an oscillating between preliminary fixing and re-opening.

This requires to maintain things at different stages of in-completion. To know which level of detailedness is necessary at a given moment may be very difficult: "... that at this point I for example need a placeholder for a ceiling, while for knowing exactly how this will work with the ventilation, this I have to separate and get a solution from the construction engineer, and this is this switching between detail and precision, that I draw particular details, and, on the other hand, put a circle around a problem -".

Openness is also made difficult by the fact that architects' work mainly proceeds through plans that necessitate a certain level of detail. This culture of detail and precision is rooted in architects' training and work practices (and drawing with a CAD program encourages detail work). Plans are shaped depending on the stage of the project, the issues that will be addressed by the particular body which will view and discuss the project, the type of input needed from a particular consultant, etc. The open planning mode requires to think of these detailed plans as preliminary and incomplete, in a radical way. We talk of "plans as schemata", stressing the fact that they need to be considered as hypothetical.

A useful notion here is that of a *placeholder*. A placeholder stands for any openness in relation to a set of parameters. The building's skin or façade can be used for explaining the notion of placeholder. Design work for the façade started out with a specification which was preliminary (with most of the parameters open), and at the same time rich, its spatial quality and appearance being fixed. The very first placeholder of the façade which was presented in an official meeting was a piece of glass onto which a transparent textile was glued: "A veil, to stretch something around. The point is that ... this creates a textile impression, filtering the

light in a highly differentiated way. And then came the idea that I apply paper on glass, glue or melt it. ... The essential point now is to find something which has this textile quality. ... Then you talk to producers and you know that it has to be divided into small fields of 3 x 3 m -".

While some of the basic specifications had to be changed (e.g. the notion of gluing), others proved useful and could be further elaborated. The current specification (worked out in cooperation with a consultant) is more detailed and realistic: to apply a textile-like structure to glass; a support structure which is invisible from outside; aluminum profiles (for which a compromise between (non)visibility and stability has still to be found). Working with placeholders requires to regard these specifications as an hypothesis for the façade. This hypothesis needs further explorations and might at some later stage be replaced with still another solution.

Rich and open forms of communicating

2D plans are the central documents through which architectural work progresses. Plans cross boundaries back and forth with the participating actors explicating, negotiating, and modifying. Much of the communication with the principal architect is mediated through the print-outs of these plans which he views and annotates for the others to continue their work.

One of the main problems is that plans are not only difficult to read for people not trained to. They are quite restricted in their capacity to communicate the specific qualities of a design. The language needed here differs from the one required for technical detail. Qualities such as distance ("barely touching"), density and compactness (the interior space as "monolithic and hermetic"), and texture (the skin as a fabric rather than a smooth glass surface) require the construction of rich narratives in order to be grasped by others so that they can fill in their own ideas. Metaphors and visualizations (sketches, models, images) play a large role. Often rather spontaneous forms of communicating are used. To create persuasion in a conversation an architect may arrange a variety of artifacts at hand to create a distinct impression.

Although architects can build on a highly developed visual culture, creating the kind of rich narratives needed to carry conviction requires a lot of additional work and skill. An important step in the *Cinema Project* in this direction was to enrich the repertoire of visualizations and emphasize their use in all kinds of documents and conversations, including to-do-lists into which small images and metaphors are pasted as reminders of themes.

While realistic representations are relatively dense and saturated, more abstract or schematic ones highlight significant features or qualities. Sketches are quite good at capturing this mixture of symbolic richness and abstraction. Also, abstract 3D visualizations of spaces, places and artifacts may be used for conveying a concept, metaphor or shared

cultural symbol. Abstract here does not mean the strive for purity (as in an abstract painting). On the contrary, visualizations like the 3D images produced in the *Cinema Project* are highly theatrical (see Fig. 1, 2 and 5). They use the language of "artistic impurity, hybridity, and heterogeneity" [9] for communicating certain ideas and qualities of an object.

DIE WUNDERKAMMER: DESIGNING A FIRST PROTOTYPE

Our next step is to take these four principles and the descriptions of architectural practice in which they are grounded for analyzing a small case of cooperative prototyping which stretched over more than a year of (intermittent) work.

The *Wunderkammer* is an interactive 3D multimedia environment. It was imagined in talking about open planning and the need for ready access to a wide range of inspirational objects in this process. The *Wunderkammer* is a response to the problem that not all of the material which could inform the creative process of shaping the design concept is at hand. While some of this material is part of the project description, some of it decorates the walls of the architect's studio, some of it (printed images, music and sound, video, film, texts, technical information on standards, product descriptions, etc.) is to be found in books, catalogues, brochures or on a CD, either in the office or at other places which may not be readily accessible. Many inspirational resources are stored in the architect's head and may be only partially remembered. One of the central problems here is how to keep present and eventually represent memory - the mind's landscape "which is often apparently incoherent, and a strange mixture of the sensory and the verbal. It offers us the past in flashes and fragments, and in what seems a hodge-podge of mental 'media'" [10, p. 261].

The basic ideas of use are that the *Wunderkammer* provide a space for a) assembling inspirational objects, contexts, and metaphors, for b) discovering them, and for c) collecting them to be used in a design project in different ways. Interactive here means that each user can insist not only on their own collection of inspirational objects and connections between them, but eventually be supported in building their own 3D spaces (e.g. using a different kind of imagery).

In this early stage the *Wunderkammer* prototype consists of a rather simple symbolic 3D space. Users can navigate in this space and explore it. They can place pictorial objects, and manipulate them (turning, enlarging, re-positioning them). They also can collect pictorial objects and place them in an exhibition space. Technically, the *Wunderkammer* space can be accessed via a conventional 3D viewer with enhanced possibilities for interacting with the pictorial objects which are programmed in Java. The actual state of the contents of the *Wunderkammer* and of its changes are constantly monitored via a set of data files.

Although the existing version is very simple and more elaborate and also alternative versions are currently being designed, it was already used for a series of experiments with users.

The role of inspirational objects in systems design

As we saw, the design concept for an architectural artifact is often formed within a rather short time period, in an associative way, stimulated by a great variety of inspirational objects. Transforming this concept into something that can actually be built is done in an open process of confronting and combining.

Early design - developing the conceptual grounds for a computer system - usually needs longer periods of field work and intense exchange with users. Scenarios of use have to be constructed, they may change and entirely new ones emerge in this process. Similar to architectural planning, inspirational objects of very different quality are needed, and their nature changes with the specific tasks to be accomplished. We have to think of a systems design concept as being expressed in different languages, in terms of sketches, stories, images, and metaphors on the one hand, functions, components, screenshots, diagrams, and flow charts on the other hand.

In the case of the *Wunderkammer* these were stories - the architect's stories about his difficulties of tapping the hidden and invisible resources (images, metaphors) that might inspire him and in communicating them; examples from ongoing or previous projects about the multiplicity of these resources and the transient and ephemeral way in which they pop up and inspire (the train ride); stories about the inflexibility of present forms of archiving, project material being towed away and buried in files and boxes never to be retrieved again, and the need for more intuitive forms of indexing [11].

Another source were the metaphors and images that grew in speaking about actual practice and needs. The *Wunderkammer* (which refers to Rudolf II's collection of precious and exotic objects in Prague) is conceived of as a "mind expanding space" which invites its visitors to practice their own combinatorial aesthetics of collage, to "relate the unrelatable".

Another source of inspiration is the metaphor of travel. Architects often collect images, metaphors, and material objects while traveling, walking through a city, watching a movie, visiting an exhibition. While the furnishers of Rudolf II *Wunderkammer* carried precious objects from far away into one cabinet where they were put into shelves and containers, thereby creating a compressed version of the world of curiosities, their modern counterparts also collect, but their *Wunderkammer* is vast, reaching into far distances, it is a space to be traveled and conquered. The cabinet is turned into an urban space or landscape which invites to reproduce the journey itself (and infinite variations of it), including the activity of collecting [12].

These inspirational resources for the design of a first prototype were collected and shared through descriptions (minutes of meetings), two central visualizations which the architect-user created (Fig. 6 and 7), many informal conversations, preliminary versions of papers, etc., and modified as well as extended in a series of joint prototyping sessions. When talking about the *Wunderkammer*, those more closely involved in the day-to-day practice of systems design frequently referred to these resources.

For translating the requirements into an artifact, systems designers need an additional set of resources of very different quality. In the first prototyping phase the designers used the WWW for looking into many VRML files as well as different Java applications which have been developed for similar purposes. Simple copying and pasting was used as a starting base for own development. This is similar to architectural design and planning which draws upon many different kinds of previously used resources, from design details and specific products to templates, checklists, legal regulations, etc. (only few of which are available through the WWW).

Mobilizing inspirational resources not only describes an important element of the actual practice of systems design. It also indicates the need for access to a much wider array of such resources for shaping and communicating both, user requirements and design specifications. As Neumann and Star observe: "The point is to recognize the necessity of communication and imaginary ... a meta-language, even for imagination, needs to be negotiated" [4, p. 239]. We soon adopted the *Wunderkammer* metaphor to the work of systems designers and their need for archiving and discovering inspirational objects, such as metaphors, images, stories or significant incidents from work practice, reference examples, descriptions of tools, etc.

The difficulties of working along themes

Themes describe and detail the design concept. In architectural work they offer powerful guidelines for the design process. The main themes for the prototype design process were:

- to conceive of the *Wunderkammer* as an urban space, thereby combining the metaphor of travel with the collective cultural experience of cities
- to support the placing and archiving of inspirational objects in this urban space, in a flexible and changeable way (the indexing by placing theme - the idea that objects assume the properties of the places in which they are stored)
- to make this space multi-layered, a space for discoveries, allowing different modes of movement
- to support different modes of exploration (flâneur, sight-seer, archeologist, etc.).

Although these themes proved to be powerful, their status for the practice of systems design is not as clear as it is for

architectural work. Some of the difficulties systems designers experienced with a *themed* approach have to do with the very nature of these themes.

Connected with the urban space theme is a notion of the *Wunderkammer* as consisting of places of different and distinct qualities. This is expressed in one of the first sketches which has been annotated in a follow-up conversation. It consists of places of different qualities, appearance, and attractivity (Fig. 6).

The idea to use this first sketch as an entrance into the *Wunderkammer* turned out to be technically not feasible. The pixelized, scanned image was of no use in a 3D environment, since all you saw when you approached some specific place were the bits. The technical constraints of readily available visualization tools suggested to start with a rather simple first design of the 3D environment. This, however, made it difficult to grasp and concretize the very meaning of spatial qualities, and as a consequence, to maintain the presence of the indexing by placing theme.

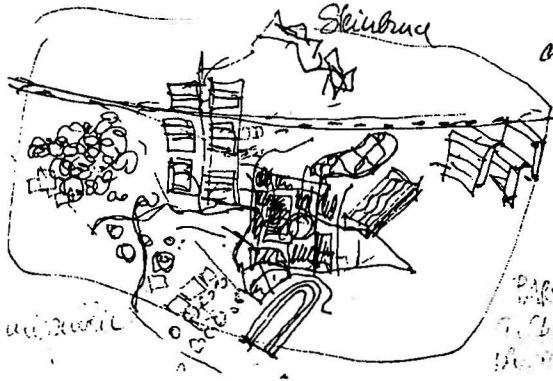


Fig. 6 The *Wunderkammer* sketch: an urban space for placing and discovering inspirational objects

A problem here is that themes like "indexing by placing" build on a variety of assumptions that are extremely difficult to substantiate (and we will need a lot of field work for achieving this). One of the assumptions is that there exists a collective cultural experience of the city. Strangers, although running the danger of getting lost in a maze of streets without a competent guide or a map, may have some chance to orient themselves, following main roads, the tracks of a tramway or a river, heading towards the tower of a church or an agglomeration of sky scrapers. They will have some knowledge of what to find in a natural history museum, department store or park [12]. The indexing by placing theme builds on this idea that inspirational objects will be placed (and as a consequence can also be found again) in such culturally connoted places. Unlike in architectural design such a theme cannot just be translated into (alternative) technical solutions. It needs to be connected to intricate features of human action.

Another, connected observation is that the themes themselves change during the process, with new ones emerging,

some of them contradictory or not easy to reconcile (and some of them too difficult to implement). This is a result of the fact that systems design starts with some notions of use while other possible ones are still out of sight. In the first sessions two different user roles and sets of requirements came to the fore. As a *furnisher* of the *Wunderkammer* I have an interest in retrieving the objects I have placed, as a *traveler* I am looking for surprises and discoveries. The furnisher, it turned out, is interested in building his or her private collection. When archiving is the purpose, stronger forms of indexing are required. For this purpose an image space might be more appropriate, with, as one user suggested, multiple layers, allowing the user to pass through an image (or take an elevator) to a completely different world with its own inspirational objects. The urban space metaphor seems to suit the traveler who is more interested in an open collection for many users, and in spontaneous encounters.

Other users want to be able to immediately manipulate the objects they find within the *Wunderkammer* (to zoom, take out interesting details, change the surface, look at them through water, etc.). This is an intricate feature of cooperative prototyping where "contexts were (are) developed and transformed by the participants in ways that were not part of the demonstrator's planned scenario Often this involves 'holes' or missing parts of the demo which the participants used their imaginations to fill in" [13].

Themes in the practice of systems design, although powerful, have to be seen as changing as the scenarios of use are developing. Unlike in architectural work they are not so much an expression and interpretation of a design concept than of a process of unraveling the system's possible relations with work practices.

Extending the notion of placeholders to systems design

We found the notion of placeholders particularly fruitful for understanding and at the same time exploring the potential of open planning for systems design. It is closely connected to the idea to make first prototypes as simple and as flexible as possible in order to enable explorations of basic features-to-be-developed.

As already mentioned, the first *Wunderkammer* prototype builds upon a highly simplified, symbolic 3D urban design. This placeholder for a more elaborate, aesthetically designed urban space turned out to be sufficiently abstract to avoid early fixations on a specific design, and sufficiently telling to allow early experiments with placing objects and exploring.

One of the advantages of this (enforced) simplicity was that the designers focused first on such mundane aspects as the supporting basic operations like navigating, taking a particular perspective, returning to a specific place, placing objects and moving them, etc. Also, it very quickly became clear that the strength of 3D visualizations lies in their ab-

stract (not in their potentially photo-realistic) qualities.

The designers themselves perceive and treat some of the visible features of this simple user interface as reminders of a functionality which has to be fully developed. These features *stand for* a theme without expressing it adequately.

Equally, the decision to save index data in files instead of using a database can be interpreted as an example of working with placeholders.

The present entrance into the *Wunderkammer* is not only a placeholder for something yet to be concretized and further developed. It also offers some flexibility for doing so. The 3D environment consists of a set of different VRML files. This makes it for instance possible to replace a particular object (e.g. the mountain) by another one (e.g. a quarry).

In general we can say that object-oriented programming enhances openness and flexibility in software development. Object-orientation by means of Java includes handling with classes, subclasses, abstract classes, and objects on the one hand, and with methods like differentiating between class (or static) and instance methods, overriding class methods, etc. on the other hand [14]. A carefully designed implementation of classes and subclasses, including their methods (by considering the possibilities to change the latter) offers flexibility in adapting and enhancing the dialogue box (which is an object) without having to change the data and controls. By parametrizing the methods and using overriding methods which enable modifications of object parameters (such as the coordinates in the 3D space, distance to other objects, or different types of access to these objects depending on user requirements), the designers found easy ways of responding to users' varying first explorations of the prototype.

Communicating qualities

Some of the problems of keeping the design concept and the associated themes present have to do with the difficulties of multi-disciplinary communications. When we look at the sketches, images, stories, and metaphors used to describe the *Cinema Project*, we can see their richness and openness to diverse interpretations, their boundary qualities. They are in a sense incomplete, waiting to be interpreted, detailed, filled in with concrete solutions.

This also holds true for some of the artifacts used for systems design. Although the designer team itself did not produce aesthetically designed visualizations of their design concept in their internal communications, they made use of the incompleteness (and interpretative flexibility) of inscriptions, and this in particularly interesting ways. One example are the task lists they produce. These are simple tables which are filled with catch-words (many of them metaphorical) for features to-be built, tasks, and methods. Some of these fields remain empty. They are the focus of intense conversations and of designers' fantasies around the *Wunderkammer*. Communications around these empty

fields remain partially implicit, but there is a common understanding of what they mean.



Fig. 7 Placing inspirational objects

The architect-users have a variety of possibilities of conveying their design concept of the *Wunderkammer* to the designer team. They mostly talk in stories (which have been condensed to a series of vignettes). Also the two early visualizations of the *Wunderkammer* (Fig. 6 and 7) are frequently referred to when talking about urban space and places.

However, a highly developed visual literacy is needed for reading these images and for converting them into a 3D design. It very early became clear that the urban space of the *Wunderkammer* has to be an aesthetically designed object, and that this design task has to be performed by an artist.

One particular feature of design work is the visibility of the themes in the object itself. For architectural design the problem here is to develop a sense for the qualities of an object before it can actually be entered and experienced. To communicate the notion that the *Cinema Center* should appear as monolithic and hermetic, but also barely touching and floating requires particular effort and skills. Here system designers have the obvious advantage of the prototype which itself is a crucial communication object. In the case of the *Wunderkammer* there is a particular kind of visibility, as its main features are visualized.

In their internal conversations the two designers often treat the prototype interface as an image. They invented the game of using it as a picture puzzle in which to discover a new feature one of them has just developed. This is another example of the mixture of richness and openness which is so important for design work. Part of the value of multidisciplinary communications around the prototype lies in the fact that all participants can actually see and experience systems designers' translation of the design concept, and point to misunderstandings.

At the same time, an early prototype is a rather rudimentary and abstract version of the artifact into which it might develop. It needs to be explained and enriched in order to be properly understood. Here again we can see the need for stronger inscriptions or visualizations of design concept and themes which can serve as boundary objects for users and designers to simultaneously work on the idea of indexing by placing.

EVALUATING THE ANALOGY

When evaluating the analogy we have to consider that our example is special in a variety of ways. Open planning and the morphological approach (to which not all architects would adhere to) are particularly close to participatory systems design. Also, the systems design example we chose is a case of cooperatively developing an early prototype. The designer team is very small (two persons), and relationships with the architect-users are unusually dense.

Still, we consider the notion of openness itself as a valuable conceptual tool for practicing systems design. It is connected to the need for a strong design concept on the one hand, and to a different perception of and approach to constraints on the other hand. The notion of open planning responds to these needs in ways that bear similarities to the openness required in a participatory design project to evolving and changing notions of use.

Within architectural practice the design concept is much easier to identify and represent. It is developed in an intuitive, morphological way (and often individually authored). There is a rich culture of visualizing on which to build. The concept can be expressed in some early, rather informal visualizations such as sketches and a small model. Within systems design the designer's vision does not have the same quality. Many steps are needed for developing it into an "operative image" (in many conversations with different relevant actors), and into design specifications [15].

In both domains of practice we identified the need to and problems with keeping the design concept present in the day-to-day work of designing. The process of detailing the concept, of transforming it into a useable artifact, in many ways also divert from it. In the *Cinema Project* we saw how the pressure to get concrete solutions and the availability of standard solutions for a problem may quickly dominate the day-to-day work around a design, unless the design concept is kept present. Similarly, in cooperative prototyping sessions around the *Wunderkammer* the design concept needs to be evoked again and again to prevent the technicalities (e.g. what is easy to implement) from taking over.

Here we stress the need to express the design concept in terms of themes which simultaneously shape the structure of the artifact-to-be-designed and structure project planning. Themes help to operationalize the design concept in ways that support to "zoom into (a detail) and to zoom again out (and look at the whole)".

Another central element of open planning is a different approach to the notion of constraints. The work of detailing in both design disciplines requires to confront the design concept with the givens, and these givens often change throughout the course of a project, due to the evolving and changing character of requirements, technical limitations, new products, etc. The art of designing consists of handling these constraints, without closing down the solution space opened up by imagination.

An additional important point (which has been made by many others) is the usefulness of visualizations in systems design. Building software is about making linkages between a multiplicity of object worlds, practices, and commitments. One way of bringing these together is through imagery and metaphors [4, 16]. Here we stress the relevance of a highly developed visual culture and of aesthetically designed representations and objects. In the *Wunderkammer* case both, the design concept, and the artifact-to-be-developed have strong visual qualities. So are many aspects of the prototype's underlying technicalities visible and can be directly experienced when moving through the *Wunderkammer*, and when placing and manipulating inspirational objects. We mentioned the use of the user interface itself as an image which is open to interpretations and discoveries.

Another useful concept we took from architectural practice is the notion of working with placeholders. In architectural design many early specifications as visualized in a CAD drawing need to be seen as preliminary. They are placeholders for something which cannot and has not to be fully developed, and which should be held open in order to preserve the space for imagination. In the *Wunderkammer* case designers deliberately made use of placeholders of objects and of first functionalities, for practical reasons on the one hand (and as reminders of things to be developed), for giving space to the evolving character of social use on the other hand.

CONCLUSIONS

Building an analogy between two design disciplines with their own knowledge, language, and tradition is bound to create misunderstandings. We realize that to avoid this our approach needs much more extensive empirical and conceptual grounding. There are in particular three arguments that need to be further developed:

- Open planning as a practice is not only relevant for the early design stages, but for the process of detailing, probing, and concretizing solutions as a whole. Different kinds of inspirational objects are needed for different tasks.
- Although an intricate feature of a participatory approach to systems design (and as such already practiced), openness should be seen as a more generally relevant strategy for bringing multiple "commitments, object worlds, and trajectories" together [4].
- The notion of working with placeholders has to be explored for both design disciplines, using a variety of examples of different complexity.

REFERENCES

1. Winograd, T. et al. (eds.) *Bringing Design to Software*. Reading MA, Addison-Wesley Publishing Company, 1996.
2. Kuhn, S. *The Software Design Studio: Food for Thought for Design Practitioners*. Submitted paper.
3. Lainer, R., and Wagner, I. Offenes Planen. Erweiterung der Lösungsräume für architektonisches Entwerfen. *Architektur & Bau Forum*, forthcoming.
4. Neumann, L. J. and Star, S. L. Making Infrastructure: the Dream of a Common Language. In Blomberg, J., Kensing, F. and Dykstra, E.A. (Eds.), *PDC'96 Proceedings of the Participatory Design Conference*. Cambridge MA, 1996, 231-240.
5. Bødker, S., and Grønbaek, K. Cooperative Prototyping: Users and Designers in Mutual Activity. *International Journal of Man-Machine Studies* 34 (1991), 453-478.
6. Kensing, F., Simonsen, J. and Bødker, K. MUST - A Method for Participatory Design. In Blomberg, J., Kensing, F. and Dykstra, E.A. (Eds.), *PDC'96 Proceedings of the Participatory Design Conference*. Cambridge MA, 1996, 129-140.
7. Trigg, R. Participatory Design Meets the MOP: Accountability in the Design of Tailorable Computer Systems. In Bjerknes, G., Bratteteig, T. and Kautz, K. (Eds.), *Proceedings of the 15th IRIS Conference*. Larkollen, Norway, 1992, 643-656.
8. Lainer, R. and Wagner, I. Connecting Qualities of Social Use with Spatial Qualities. In Streitz, N. et al. (Eds.), *Proceedings of the First International Workshop on Cooperative Buildings*. Heidelberg, Springer, 1998, 191-203.
9. Mitchell, W.J.T. *Picture Theory. Essays on Verbal and Visual representation*. Chicago, The University of Chicago Press, 1994.
10. MacDougall, D. Films of Memory. In Taylor, L. (Ed.), *Visualizing Theory*. New York, Routledge, 1994, 260-270.
11. Lainer, R., and Wagner, I. Die Wunderkammer. Zur computerunterstützten Konzeption von Objekten und Räumen. *Architektur & Bau Forum* 3 (1997), 57-61.
12. Kompast, M., Lainer, R. and Wagner, I. The Architect's Wunderkammer: Aesthetic Pleasure & Engagement in Electronic Spaces. *EASST'98*, Lisbon, October 1-3, 1998.
13. Mogensen, P., and Trigg, R.H. Using Artifacts as Triggers for Participatory Analysis. In *Proceedings of PDC'92*. Cambridge MA, 1992, 55-62.
14. Flanagan, D. *Java in a Nutshell. A Desktop Quick Reference*. Cambridge, O'Reilly, 1997.
15. Bratteteig, T., and Stolterman, E. Design in Groups - and All That Jazz. In *Proceedings Computer in Context: Joining Forces in Design*. Aarhus, 1995, 137-146.
16. Tellioglu, H., and Wagner, I. Software Cultures. Cultural Practices in Managing Heterogeneity within Systems Design. *Communications of the ACM*, forthcoming.