

# *The design of information systems: parti, formats and sketching*

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**Abstract.** *In this article it is argued that an information system must be treated as an artefact with a format. We need to see information systems design as based on architectonic and not tectonic thinking. Design based on architectonic thinking emphasizes (1) the task of giving form to a design proposal, and (2) the task of creating an overall structure for the information system. These two activities are closely related because they both deal with the issue of seeing the idea or whole of systems, and the problem of how to give form to that whole. The paper begins with an exploration of the concept formative faculties in relation to 'given' and 'non-given' objects. The concepts of parti and format are then presented as a way to grasp the 'whole' of an information system. How formats can be used in information systems design is discussed as well as how this leads to the act of sketching as an important but neglected activity in information systems design. Sketching is promoted by introducing diathenic graphologue as the art of 'giving form to the unknown'. The paper ends by suggesting how formats and diathenic graphologue can be practised and included as important aspects of information systems design education and training.*

**Keywords:** Information systems, design, *parti*, formats, sketching

## INTRODUCTION

When Arnheim writes that the goal in design is to create 'a symmetrical, coherent, and well-balanced whole', he points to an important aspect of design that is not dealt with sufficiently in information systems design, that is the understanding of the system as a whole. Most methods, tools and techniques today focus on one aspect (or a few related aspects) of an information system. 'The details of the aspect they select are shown in utmost clarity, but other details may be obscured or forgotten' (Sowa & Zachman, 1992). Sowa and Zachman continue to state that 'each technique loses sight of the overall information system and how it relates to the enterprise and its surrounding environment'.

This situation is not recognized only by researchers. Practitioners also express concern about the lack of good techniques for describing systems, especially descriptions that can capture the whole in a condensed way, i.e. the structure, functionality and form simultaneously (Stolterman, 1992). As information systems become a complex whole of data structures and information flows — as well as multimedia interfaces, high level interactivity, virtual arenas and network communications — the need for practical approaches for whole systems design increases.

As information systems designers face this new complexity, managers, clients and users need and want to discuss new systems without being pushed into the language of information technology. Information systems designers need new skills and tools to handle and communicate systems from this overall perspective. The process of giving form to new systems — in a way that reflects the system as both a technological artefact and a system embedded in a social and organizational reality — demands formative skill based on judgement. This article is about that skill.

To reach an understanding of that skill, I will argue that an information system must be treated as an artefact with a *format*. We also need to see information systems design as based on *architectonic* and not *tectonic* thinking. Design based on architectonic thinking emphasizes (1) the task of *giving form* to a design proposal, and (2) the task of creating an overall *image* or *gestalt* of the information system. These activities are closely related, for they deal with the process of seeing the system as a *whole* and the problem of *how to give form to that whole*.

The article begins with an exploration of the concept of *formative faculties* in relation to 'given' and 'non-given' objects. The concepts of *parti* and *format* are then presented as a means for grasping the 'whole' of an information system. How formats can be used in information systems design is discussed further, and *sketching* is presented as an important but neglected activity in information systems design. Sketching is promoted by introducing *diathenic graphologue* as the art of 'giving form to the unknown'. The article ends by suggesting how formats and diathenic graphologue can be practised and included as important aspects of information systems design education and training.

## DESIGN AND THE FORMATION OF THE UNKNOWN

Design means simply and directly to create and to give form — and through this process to bring *meaning* and *order* to the world we live in (Schön, 1987; Grudin, 1990; Arnheim, 1995). Architecture, urban planning, information systems design, industrial design, and social systems design, all require the designer to be creative and to conceptualize ideas, and to give form to these ideas in a way that makes them communicable and comprehensible to all people involved in the design process. For the designer, this creates many questions and problems, such as *what* he/she wants to communicate and *how* to 'materialize' that content. (In this paper 'the designer' is a generic label denoting all those involved in the design process. I am not distinguishing between professional designers, managers, users involved or any other stakeholder.)

The ability to form the 'what' and the 'how' can be described, with a concept borrowed from

Kant, as the *formative faculty* of the designer (Makkreel, 1990). Kant's thinking on formative faculties was strongly influenced by contemporary colleagues, but he broadened the scope of the concept to the whole range of imaginative skills (Makkreel, 1990). Kant shows the importance of recognizing formative skills focused on two different categories of objects: *given* objects and *non-given* objects.

In the design of information systems, there is always a need for formative skills in both of these categories, but they are unfortunately not always regarded as equally important. The formative skill for given objects is far more emphasized, i.e. the skill to make a good representation of something that already exists. This might lead to a situation in which designers are insufficiently skilled in making non-given objects (i.e. new designs) visible, communicable and understandable. The formative faculty for non-given objects must be recognized as an important skill in all design fields.

### Formative actions

The nature of formative powers has always been part of the philosophical debate, even if it has seldom been acknowledged as a major question for philosophers. The concepts of imagining and inventing have not always been emphasized in traditional disciplines. (A good overview of this discussion can be found in Schön, 1987.) Because the major purpose of science is to create new knowledge about reality, there has not been the same kind of interest in changing reality by imagining and inventing new realities. Formative action is about the invention of new things — of a new world; it is about things existing only in the mind and the imagination of a designer.

Kant writes that the formative faculty is active in perceptual as well as imaginative processes, as he puts it, 'either in relation to given or non-given objects' (Makkreel, 1990, p. 13). Kant writes, 'Imaginative formation (*Einbildung*) can be distinguished from the power to give form to an intuition (*Bildungskraft*) in that it makes images without the presence of an object (admittedly from the materials of sense), either by invention (*fingendo*) or by abstraction (*abstrahendo*)' (Makkreel, 1990, p. 13). Kant also mentions other modes of formative faculties that span from direct sense-based formations to completely imaginative ones — each reflecting their relative degree of dependence on the material world. For Kant, imaginative formation 'does not have its cause in real representation but arises from an activity of the soul' (Makkreel, 1990, p. 15).

Kant also makes another distinction between formative powers, a distinction based on a temporal relation. He talks about direct image formation (about the present), reproductive image formation (about the past) and anticipatory image formation (about the future) (Makkreel, 1990, p. 16). Design is an act of anticipatory image formation. It is an act where we have to imagine the future, the not-yet-existing.

To Kant it was also obvious that all three modes of formation are dependent on *imagination*. Imagination is needed not only to imagine the future, but also to make a description of the present situation. The situation cannot be described as it appears. Every description is based on a choice of which aspects of the situation are important enough to emphasize. This kind of

decision can only be made on the basis of good imaginative skill, when the outcome of the decision is imagined and valued relative to some purpose. On this basis, we might conclude that no matter what kind of formative actions we are engaged in, imagination is always at the core of that activity, and also that there is no such thing as straightforward 'depiction' or 'direct image formation' without involving imagination and judgement.

Imagination slowly emerges as the foundation of many kinds of formation activities. A designer always relies on his/her formative skill — on the skill to form ideas and visions into something that can be shared with other people — to transform non-given objects into given objects.

### **Given and non-given objects**

By 'given objects', Kant meant objects that approach us through the senses. They result from our perception of the world. 'Non-given objects' are in a way senseless, i.e. they are not a result of our meeting with and our perception of the world, at least they are not part of that world. This dichotomy is of course difficult and delicate to maintain, especially if we identify the given with matter and the non-given with mind or soul. The purpose of this distinction is to have a way of labelling objects that most people agree exist in the world vs. objects that exist only in the mind of a designer. Given objects are in the world as it is perceived, non-given objects are non-existent and may continue to be so. Some of the non-given might come into existence at some point in time, but some may not. The purpose of a design process is to transform non-given objects into given objects, i.e. to make a designer's idea become real in the real world.

Even if non-given and given objects are different in many ways, they present similar problems for the designer. As a designer, one wants to be able to describe and communicate one's interpretation and understanding of them both. When it comes to given objects, we have many methods and techniques developed for that purpose. Science has given us methods, tools and techniques to describe given objects in formal and informal ways. These methods work well with the purpose they are designed for. But these traditional scientific methods and tools also create problems. For instance, they seldom include guidelines for determining when one's description is detailed enough. The methods and tools can be used to create more and more information, more and more descriptions, at ever more detailed levels. For a scientist, this is what makes science into an everlasting and fascinating enterprise. It will never be completed: it will always be possible to continue, to make even more detailed descriptions of reality.

To a designer, this situation is rather a problem, often a practical one, because a design process must end, must result in a design. The designer has to manage large amounts of information, but has still to make a choice and come to a final judgement. A designer needs other approaches than the scientific to accomplish this.

It is of course important for the designer to have information about the present situation, about the given objects where his/her new design (the non-given) must fit. But for a designer, the descriptions of that situation must be achievable in a short time: they must cover the wholeness of a situation, its totality. This motivates a search for different modes of inquiry in design.

## INFORMATION SYSTEMS AND FORMATS

A design process begins with a designer's forming the first idea of a design — the *parti*. *Parti* can be understood as the early, strong, organizing principle guiding the designer in the following design process. (*Parti* is a concept used by French architects from the premodern era through the 19th century. These architects composed books of organizing patterns — *partis* — for buildings of different kinds. A designer could find in these books overall organizing patterns for a good library, a good city hall, etc.) *Parti* helps the designer to draw together — to compose — the design into an integral whole. It is this overall idea of the systems whole that the designer attempts to form during the process and to implement in the final design.

In the process of designing an information system, a *parti* will help the designer to make many types of judgements and decisions in order to create a whole system. A *parti* or 'guiding image' is always 'tentative, generic and vague' (Arnheim, 1995). But this is not a drawback, instead it opens up a whole range of possibilities without commitment to any one of them. Arnheim writes, 'Being undefined in its specifics it admits distortions and deviations. Its pregnancy is what the designer requires in the search for a final shape' (Arnheim, 1995). In Stolterman (1992) it was shown that information systems designers almost unanimously described the first idea in a way that fits the understanding of *parti* and the 'guiding image' from Arnheim. In Stolterman (1992) the concept 'vision' was used with the same meaning.

The key phrase here is *the whole*. A design, an artefact, will probably not be recognized as a consistent system or artefact with integrity and unity if the designer fails in the transformation from *parti* to *format*.

Every information system has a specific *format*. A format is the *overall organizing structure* of the final system. In other words, the format is how the *parti* expresses itself in the world, in the final artefact. The format can be understood as the sum of the fundamental design principles *implemented* in the actual design. The format is not the same thing as design principles guiding the design process. It is not about process — it is the principles actually implemented. The format should be understood as an intrinsic property of the system. The format can be consciously designed by a designer, but it can also be an unanticipated outcome of separate design decisions not directed towards the creation of a specific format — not guided by a *parti*. [Ullmark (1996) discusses the concept of *format* in architecture and how it can be used in critical case studies as a tool to understand the basic characteristics that make up the 'wholeness' of a building.]

The format of an information system, for instance, can be the totality of an idea about structure (for instance, the use of a relational database to structure information), an idea about functions (for instance, that all functions in the system should focus on time efficiency), and an idea about form (for instance, derived from the symbolic language and structure already present in the system's context). When these ideas are assembled, they can be seen as parts of a format. But the format is not the parts, but rather the whole. It is the 'substance' of the system that gives it a sense of integrity. To some extent the format can be compared with the idea of a *gestalt*. A *gestalt* is understood as an 'irreducible perceptual pattern', as a whole which 'exhibits qualities that are absent in the parts' (Capra, 1996). Capra

also discusses other ideas where the whole of a system is seen as something different from the 'sum of its parts'.

If a format is implemented in the system and if this is done well, it might give the system a sense of wholeness, a sense of being designed as a whole. If well worked out, this whole can help users to get an overall understanding of the system, where all details seem to relate and where each detail seems to relate to the whole. The system will be understood as a unit. We could describe this system as *architectonic*.

When a system is designed without a format, it can still function as a system, but it will be a simple cause-effect system without organizing principle or with only locally (or regionally) organizing principles. We can describe such a system as *tectonic*.

Architectonic should not be confused with 'top-down' or deductive design — instead it is a *compositional* design. Working architectonically should be understood as a process where the relation between details and the whole is always dealt with, where every detail is as important as the whole. This can easily lead to a complexity crisis, which emphasizes the importance of the *parti* in design work (at least in architectonic design), i.e. having a strong sense of the organizing principle that will appear in the final design.

A format does not guarantee good quality or good design. We can find many bad formats in the world, in buildings, in road systems, in urban design, and in our cars and homes — in all the things where we find the relations and the symmetry between structure, function and form to be inadequate or ugly or morally wrong. But in many cases where we have these experiences, there might not even be a format. We find a thing or a system incomprehensible as a whole, with no emergent qualities, without any sense of wholeness.

Sometimes in things or systems we recognize a certain kind of format reminding us of a *style* or *fashion*. When we put certain design principles together and try to implement them in all things or systems we design — then a style is born. Some design schools have fostered the idea of a specific format, i.e. a specific relation between structure, function and form, and consciously applied that style in all their work. Sometimes this style has become famous, e.g. Bauhaus. To a person familiar with the Bauhaus style, it is quite easy to recognize a design in the style without knowing the actual designer. Styles are often created to reflect a certain culture or society without therefore being a consciously designed format. Most people will recognize Scandinavian furniture design or Japanese home design. This recognition occurs because the characteristics of some general styles are well known.

To 'read' a format demands a certain kind of skill. Sometimes the reading may be difficult. The viewer may get a strong impression from a certain system or building but cannot describe what makes the system so 'strong'. The format can be subtle and the composition delicate; in these cases, it takes much skill to discern the format.

In other situations, perhaps more common, we can recognize the format of a building even if we are not architects. We can become very upset when someone tries to change the exterior of a building by replacing windows in a way that 'destroys' the proportions and the 'idea' of the building. The same thing happens when the entrance of the building is changed so that the inviting space inside the entrance is removed, or when the command structure of an information system is changed by the latest update so that it is no longer uniform throughout the system.

This kind of format change we can easily recognize. Sometimes we do not object, because the format will still hold together and give us a sense of the whole.

A format is about details and relations — about composition. It is not easily visible. It is very much an emergent quality of a system. Every detail in the system will contribute to the overall format. The structure, the function and the form must be in relation to the context and the purpose. The way a designer combines and composes all these aspects will determine whether the format will be *strong* or *weak*, whether it will be a success or a failure.

The strength of a system's format can be measured by the skill and effort needed to detect and understand it. A strong format makes it possible for almost anyone to 'see' it, or at least to be unconsciously influenced by it and to adjust one's approach to the system. A strong format also has a strong influence on the people responsible for managing the system, because they will recognize the format and may even feel compelled to adapt to a strong format when making changes to the system. For instance, if a system is strictly modular, based on a hierarchical structure with similar screen design, it is difficult for a designer to change that format. On the other hand, a weak format may invite any kind of changes — local, global, radical or small — without considerations for the existing format.

A weak format is not easily detected and may not affect people responsible for managing the system. But the format is still present, and to some extent it will influence the user's conception and usage of the system.

To decide whether a format is successful is difficult. A system with a strong format but situated in a context for which it is not designed or in a context that has radically changed over time can obstruct change. But if that system is situated in a suitable context, it may create stability in the midst of a complex and changing environment. This situation often appears in urban design where design judgements must always be made between the life and well-being of each single building and the overall design of the area.

A very strong building can influence design possibilities in a large area around it. In an area of buildings with weak formats, anything can be done, and at the same time the area will probably lack a sense of wholeness and stability. The same holds true for information systems in an organization. A strong format can affect the entire organization and influence the design of all other systems. In an organization without strong format-based systems, anything goes, any changes can be made. We have a situation without stability, at least not in the artefacts or systems being used.

Almost every format will eventually have a *breakdown*. When changes are made to a system (building or information system), it affects the format. The format will be affected by even the smallest changes over time, and at a certain point, as a result of further change, the format will not hold. The system will have a format breakdown. This means that the format will no longer have impact on the people using the system or managing the system; from that point almost any changes are possible.

When we reach the point of format breakdown, we have a very sensitive and unstable system to deal with. Even small changes can have dramatic effects — for instance, if an information system's basic structure (e.g. a pure relational database) is constantly 'attacked' over time. The attacks may consist of new functions difficult to implement in the existing structure and therefore

implemented as 'temporary' solutions based on a different structure. If these temporary solutions grow, they will eventually threaten the basic structure, and ultimately the relational database will be difficult to treat as a 'pure' database. This problem will effect the possibilities of handling the system as a whole, and it will radically change our perception of the system. The format will be distorted or may even disappear.

But a breakdown is not inevitable. It is possible both to manage a format and to replace it. A careful and dedicated understanding of a format will guide new changes so as to preserve and maybe even develop the format. If changes are made consciously, a format can also be replaced by a new one. Ullmark (1996) gives an example of both a format breakdown and a format replacement in a large building. To succeed, format replacement demands serious design effort and skill. And that is why it sometimes seems easier to let the old format go and instead create something new from scratch.

## WHY FORMAT MATTERS

Why should a designer of information systems bother about such an abstract and philosophical concept as format? The question has several answers.

The most obvious and practical answer is that a strong format can make management easier because it will function as a guide for all redesign situations. The system itself will restrict the space of possible actions and thereby keep the system strong and stable. Of course, this can be either good or bad news depending on the situation. But there are more general answers with implications beyond the design and management processes.

All artefacts in our environment, which is mostly designed and artificial, can be seen as bearers of formats. If this is true, then formats will all determine or at least influence our understanding and appreciation of reality. Together, they strongly affect the way we will design our future society at large, but also our workplace and home environments. We often talk about places and things as having special meanings for us, as if they had soul (Nozick, 1989; Hillman, 1989, Csikszentmihalyi, 1991). We seem to attribute 'soul' to a thing when we are struck by its internal strength. This does not have to resemble the religious understanding of soul. Instead, it can simply be understood as a way of ascribing a core of wholeness to a thing.

In this everyday sense most of us subscribe to one of the main ideas of the Romantic tradition, namely the idea that reality is a coherent whole and must be understood as such. Moreover, this reality is created, developed and thereby historical. According to a general and simplified understanding of the Romantic tradition, there is only one way to reach and perceive this wholeness — this is via *immediate experience*, either intellectual or aesthetic. This immediate experience is neither magic nor supernatural: it is the consequence of a certain approach to reality, and a result of intellectual and practical training and practice.

The idea that things should be regarded as bearers of a whole (a format or a soul) is alive today, one of its foremost advocates is the psychologist James Hillman:

'Not only are animals and plants ensouled as in the Romantic vision, but soul is given with each thing, God-given things of nature and man-made things of the street.' (Hillman, 1989, p. 99)

This claim does not concern the form of the artefact, nor its structure or functionality. The soul (or format) is portrayed in the image we get from the artefact:

'An object bears witness to itself in the image it offers, and its depth lies in the complexities of this image.' (Hillman, 1989)

There is a symmetry between the time, effort and caring put into the design of an artefact and the time and effort demanded by its user to appreciate the design. So, how is it possible to reveal the soul of an object? Hillman refers this careful study of artefacts to the concept *notitia*:

'Attention to the qualities of things resurrects the old idea of *notitia* as a primary activity of the soul. *Notitia* refers to that capacity to form true notions of things from attentive noticing.' (Hillman, 1989)

For similar discussions on *notitia* see Flyvbjerg (1998) and Nozick (1989). Both authors discuss *notitia* as a possible way to reach to a deeper level of understanding of artefacts.

A design that has been given energy, time and carefulness in the relation between details and the whole must also be treated with respect. The care in the details will be reflected in the richness and expression of the whole if we pay enough attention. To do so demands a respect for the meaning of technology and the courage to take time (Grudin, 1990).

This observation implies for information systems design that we must respect good design, because it will be part of the overall reality people live in. When people are living in an environment defined by high-quality products, it will affect not only their efficiency and effectiveness, but also their well-being.

But even when we are not directly involved in using an artefact, we may still be strongly affected by it and its format. A strong format will create a system of integrity as well as a space of possible actions in a large domain around the system. For example, a building with a strong format 'demands' to be treated in a specific way. It is difficult, for example, to build a modern bungalow close to a medieval cathedral, because the format of the cathedral probably demands significant open space. A further example may be an information system with such a strong format that it might function as a structuring principle for a whole company.

Artefacts have an impact, and when they are put into context, realities emerge that we must deal with, whether we are users or only 'in the neighbourhood'. Thus, formats matter.

## INFORMATION SYSTEMS DESIGN AND FORMATS

To design information systems is a very complex task. Needs, wishes, demands, requirements and hopes together with preconditions (such as limited resources and time) create an almost impossible situation. In this complexity, it is the designer's task to form a solution that is both

relevant and practical. Sometimes a framework for design is already established by a client or decision-maker; sometimes all that exists is an idea that 'information technology might be a way to solve our problems'.

When an information system is designed, the designer must use his/her formative skills to give form to the 'non-given'. In the very early design process, the designer must come up with a concept, a structuring principle, an idea of the system, i.e. a *parti*. One of the most important skills for an information systems designer is the skill to transform a *parti* into a format, and to make it *visible*, *communicable* and *understandable*. But how is this done? How is it possible to present a format when we have defined formats as an emergent property of the final system?

This process is the art of *diathenic graphologue*, which is a concept coined by Harold Nelson and built on the Greek root meaning 'letting a thing be seen through representation' (Nelson, 1997). In every act of design, we need to use our formative faculties to make the imagined design 'be seen'. The process of diathenic graphologue is one of the most important aspects of design work, but unfortunately one of the most neglected.

Diathenic graphologue deals with the skills and techniques concerned with creating a new design. This may happen through sketching, or by the use of static or dynamic models, visual or mathematical models, art, text or sound. The process is about the creation of an image, of the whole, of a *gestalt*.

The practising designer always need to make the idea of a future system visible to users, clients and decision makers. The visibility of the basic idea is often a prerequisite for communication. And communication is necessary to make all parties involved understand the proposed design.

This process is insufficiently dealt with in information systems textbooks. The techniques presented as important during the early parts of system design mostly deal with other aspects of the design process.

We can, for instance, find many *creativity techniques* (brainstorming, future workshops, envisioning techniques, etc.) that are often described as important in early design work. These techniques seldom focus on making ideas visible and understandable. They are primarily seen as tools for the designer(s) responsible for developing a basic design idea — not as tools for communication.

We can also find techniques focused on helping the designer to take the next step, after diathenic graphologue, i.e. when the whole is already designed and the format is known. These techniques focus on the design of database structures, information flows, screen layouts, communication networks, etc. This group of techniques is the most common one. Here we can find almost all techniques in database design, human computer interaction (HCI) design, basic communication structure design, etc.

HCI has a special position in this group of techniques. Because HCI is usually understood to be a true design-based activity where creativity and form play a major role, it is easy to understand HCI as an activity where the formation of *parti* and format takes place. This is sometimes the case, but HCI design, both as activity and technique, usually demands that an overall design already be in place. There are exceptions. Some recent HCI researchers have

focused on new and radically different ways to perceive information systems to create better, new designs (Laurel, 1993; Tognazzini, 1996; Winograd, 1996; Janlert & Stolterman, 1997)

We can also find many examples of *communication techniques* (design dialogues, team building techniques, presentation techniques, documentation techniques, etc.). These techniques, however, are not focused on the design of the whole, but more on the process of communication and collaboration.

There do exist some attempts to focus on the design of the whole, for instance in more systemic approaches. In the field of social systems theory, developed by C. West Churchman and Russell Ackoff among others, there is a real interest in the wholeness of a system (Churchman, 1968; Ackoff, 1981). These authors provide a solid and valuable foundation for the idea of wholeness and of systemic thinking, which is consistent with the ideas presented here. But their ideas are on the level of general systems theory and are not developed specifically for information systems. A similar approach, which has been used successfully in information systems design, was developed by Checkland (1981). Checkland's soft systems methodology (SSM) presents an approach intended to capture the whole of an existing system, as well as the target system. The techniques of SSM are very simple; still, they seem to work, at least in the hands of trained designers. This assumption is based on the many case studies and theoretical studies where SSM has been shown to be suitable for overall systems design.

Some of the techniques mentioned above can be excellent for the design process, but only a few explicitly focus on the wholeness of the system as discussed in this article. I argue that information systems design has not sufficiently dealt with this issue; the field therefore lacks knowledge, understanding and techniques for this aspect of information systems design.

This lack has important consequences for the practice of systems design. If the formation of a *parti* and format is not sufficiently dealt with in the predominant methods and theories but recognized by practitioners as a real problem, we have a mismatch between systems design description and experience.

## INFORMATION SYSTEMS AND SKETCHING

The art of sketching has been neglected in information systems design, and thereby also the possibility to develop a language suitable for this purpose. In other design fields, such as architecture, urban and industrial design, sketching has always been at the core of professional skill.

Sketching can be a way to capture a *parti* and to transform it into a format by working back and forth between details and the overall structure. Arnheim describes sketching as a dialectic process where the sketch is a way for a designer to find a place between the 'goal image' (*parti*) and its realization (format). In this way 'a sketch is a reflection of the guiding mental image; but it is not, and cannot be, identical with it, and this difference is precisely what makes it a precious instrument for the designer' (Arnheim, 1995). The sketch occupies a middle ground, a way to experiment and test details and the whole, and relations between them. It is not only a way to visualize existing ideas, it is about shaping new ideas. The material 'talks back' to the designer (Howard & Barton, 1986; Schön, 1992).

Sketching is therefore both a matter of *reading* and *writing*. To sketch is to externalize thoughts and ideas onto paper or some other medium. Sketching is also about reading the material (the sketch) and interpreting, explaining and rewriting it. Writing and reading are here understood in a very general sense: this has to do with externalizing ideas and interpreting external representations as ideas. The process involves working with the not-yet-existing by going back and forth between the external material and the imagination.

In textbooks on information systems design sketching is not usually mentioned explicitly as a possibility for forming the initial ideas and formats of a design (Duchek *et al.*, 1996). Why is this the case? Is sketching not a suitable technique for information systems design?

In an experiment with six groups of information system students (at the end of their education), we found some interesting results related to sketching. The students were not in the same year or course. The six groups (three to five in each group) were given the task of designing a first proposal for an interactive system for car buyers and car salespersons. The only specification was that the system should be able to show different car models and to help the customer to make a choice (Duchek *et al.*, 1996). Each group had one hour to prepare a proposal. The groups knew that they had too little time to fully complete their tasks, but only enough to complete a first design proposal.

Even if this experiment was carried out with students and not practising designers, we believe the results to be generalizable to some extent, especially because they are consistent with other similar studies (Howard & Burton, 1986; Schön, 1987; Goldschmidt, 1994). I will only mention a few results here, as well some conclusions from this experiment.

First of all, it was obvious that each group used sketches in the design process. They did not sketch in any methodological or formal way, even though they were trained in traditional methods and techniques. The sketches were free in format and consisted of words, text, drawings, diagrams, maps, etc. The sketches showed small details but also attempts to capture the whole. It was also possible to see how the sketching generated new ideas, some of which were further developed and some of which were abandoned (Duchek *et al.*, 1996). These findings are in line with both Goldschmidt's (1994) idea of 'interactive imagery' and Schön's (1992) expression 'designing as reflective conversation with the materials of a design situation'.

The conclusions from this study that are relevant to this paper are as follows: (1) all groups used sketching throughout their work; (2) sketches were used to focus the work; and (3) the sketching dealt with both details and the whole. All groups tried to use sketches to capture the proposed idea (system) in a *context*. They tried to determine the relations between the system and its surrounding (Duchek *et al.*, 1996).

It seems almost natural or even inevitable to use sketches in design; also, sketching is used in ways not supported by the usual techniques and methods from textbooks in information systems design. These techniques often assume that what is needed is more analysis, which is natural when dealing with the 'given'. Sketching instead focuses on the forming of the 'non-given', which is a process of composition and synthesis. This focus on the non-given generates specific demands for techniques.

What could be a more general conclusion from the study? I interpret the results as showing that groups tried to catch the essence of a *parti*, and to make this visible, communicable and

understandable. Sketching was used as a technique to form a first proposal for a format. The groups tried to achieve what Arnheim describes as 'a symmetrical, coherent, and well-balanced whole' (Arnheim, 1995). This process might be understood as especially important when time is limited. What is necessary to develop during such short time is a *parti* that can function as an organizing principle for the remaining work. To understand early design work as sketching could therefore also be seen as a way to make the design process more efficient and effective. A *parti* and a format become bearers of many judgements and ready-made decisions, which narrows the space of possible actions.

### TO CREATE AND READ FORMATS AS AN ACT OF JUDGMENT

How is it possible to know that you have 'read' an artefact in a way that reveals its true format? The answer is that you never know and you cannot know. To read an artefact with the goal of seeing and understanding its format is a process characterized by *imagination* and *judgement*. We must imagine possible interpretations, and judge and make decisions about what we see as the format. This is a *dilemma situation*, because it is impossible to determine a correct answer. But we nevertheless must always do so during a design process. We will never find a design technique to reveal the correct design in a specific situation. A designer always faces dilemmas, because every design decision offers a choice between what will become reality and what will not.

Aristotle acknowledged this dilemma as important and as something we must accept and understand. Nussbaum shows how Aristotle argued that we must accept a third type of choice and action beyond the *quantitative approach* and the *guess* (Nussbaum, 1990). To Aristotle, the third way is based on a *qualitative judgement* and also on understanding the nature of every part of the whole (situation).

Nussbaum argues that there is no reason why we should be defensive and assume that the rhetoric of *measuring* is the only way to act so as to be rational. For Aristotle, it was not possible to reach a true understanding of a situation's complexity only by means of science. It is *practical wisdom* that lets us achieve a sensitivity towards important aspects of a concrete situation. It is an overall judgement, where we accept the contributions of each aspect without trying to reach overall logical coherence. Aristotle argued against the idea that all aspects of a situation can be compared. He defended the specific judgement before the universal one, as well as the importance of feeling and fantasy as aspects of true rational judgement and choice (Nussbaum, 1990).

Within scientific thinking the goal of the process of inquiry is to build a complex description of reality, by reducing reality into its smallest parts by analytic thinking. These parts are then assembled in a way consistent with the laws of nature and logic. Qualitative judgement works the other way around. It takes place when we (as humans) are faced with a reality of a high degree of complexity. We must handle a reality we cannot fully understand, a reality without any (or at least blurred) visible structures or logic, a world that overwhelms us in its richness and detail, a reality full of dilemmas. Judgement is needed when we encounter complexity and are almost paralysed but still *have to act*.

A designer of information systems must be able to make judgements about a system's format, even if it is impossible to analytically deduce or calculate the best format in a given situation. It is rather a question of having the ability to give form, to create, on the basis of qualitative judgement. This approach sounds possibly too subjective and relativistic to some, but according to Aristotle, this is not the case. We know that people trained in a specific field often make similar judgements of the quality (and format) of their artefacts (see the history of arts, crafts, music, literature, architecture, etc.). Judgements might change over time, but they still seem quite stable and resistant to relativistic tendencies (Berger & Luckmann, 1967). It is also necessary to remember that the important word here is *trained* people.

'In the supreme art of life the tools must be less mechanical; more depends upon the skill of the artist in their manipulation, but they are none the less useful. Our mastery of a required case of action would be slow and wavering if we had to forge anew our weapons of attack in each instance. The temptation to fall back on the impulse or accident of the moment would be well-nigh irresistible. And so it is well we have our rules at hand, but well only if we have them for *use*.' (John Dewey in Hickman, 1990)

This statement means that to be 'useful, as opposed to burdensome, tools must be used within, as well as be continually reassessed by, the work of active intelligence' (Hickman, 1990).

For students to learn how to design information systems with strong formats suitable for a specific context and purpose, they must be trained. Today's training is mostly focused on analytical and logical skills, which if not dealt with, can lead to a *tectonic way* of designing. These skills are of course important and highly necessary, but they have to be complemented by training in the reading and design of formats in an *architectonic way*.

Architectonic training has both *theoretical* and *practical* sides. To be able to develop a sense of formats and also skill in sketching, students need language(s) in which all aspects of formats can be formulated and discussed. That is why we need theoretical studies in the history of information systems as a history of different schools of thought. Some attempts have been made in the field of product semantics (Krippendorff, 1995).

Krippendorff introduces product semantics as 'a study of the symbolic qualities of man-made forms in the cognitive and social contexts of their use and the application of the knowledge gained to objects of industrial design'. His proposal consists of an approach called 'sense making', in which a design can be understood in four different contexts: operational, socio-linguistic, genesis and ecological. Krippendorff also discusses how these contexts can be analysed and understood as part of an overall 'sense-making' process of an artefact. The point here is not that Krippendorff's model provides the desired language of formats, but that he shows the possibility of approaching the problem in a systematic and theoretical way.

Another example of a product-oriented approach used to develop a sort of product semantic is the work of Alexander (1964). Alexander worked in architecture, but he had impact on developments in object-oriented design. This approach is an interesting theoretical attempt to form a foundation for product knowledge.

Petroski (1992) shows the value of a careful study (notitia — see above) of a specific artefact. In his many studies of everyday objects Petroski reveals the complexity that resides in the

simple but functional design. His analysis presents a new and often surprising understanding on how designs are born and how they evolve over time. What is especially interesting is how that kind of analysis brings forward the core (format) of the design, and an understanding of the amount of time and energy needed to conduct these studies. Petroski's examinations of everyday things may be more valuable to design students than many traditional methods and techniques, because it is a good example on how it is possible to foster a sensitivity in finding and interpreting formats in designs.

These examples show that in the development of design, judgement skills requires closer examination of existing artefacts. These studies seem to be valuable, even though they do not provide prescriptive rules or guidelines. Instead they influence the judgement skills of the designer in a way that will lead her to create other designs.

To develop a sense of formats and an ability to make judgements, a student also needs practical experiential studies. One such approach, the Qualitheque, a project driven and managed by the Department of Informatics at Lund University, Sweden, is an attempt to create an opportunity for experiential studies of information systems on the Web. The Qualitheque is considered to be an on-line world-wide web-based exhibition of old and new information systems. The Qualitheque can be found on the world-wide web at <http://qualitheque.ics.lu.se>. The exhibited systems are described and evaluated by different reviewers. The purpose is to provide an opportunity 'to judge the quality of a system in use according to structural, functional and formal aspects' (Ehn & Löwgren, 1997).

Even if the Qualitheque is focused on three aspects of a system — structural, functional and formal — Ehn and Löwgren emphasize 'that these are three aspects on one phenomenon, and must be dealt with in a holistic manner' (Ehn & Löwgren, 1997). The Qualitheque also stresses another aspect of acquiring a sense of format (even if the authors do not use the term 'format'), and this is by advocating the notion of *critique*. By giving critique and by taking part in others' critiques of a specific system, a sensitivity to the whole and its many aspects can be reinforced and trained. This idea resembles that of the traditional 'design studio', especially as presented in Donald Schön's 'practicum' (Schön, 1987).

By 'reviewing' current and historical systems, and by studying the critique of other designers of these systems, a sense of the whole and its format may be acquired. This is the product-oriented approach taken in architecture and art, where the study of historical styles and exemplars are an important part of the curriculum. When this practical training is combined with theoretical reflections, it can lead to improved skills and judgement.

## TO PRACTICE DIATHENIC GRAPHOLOGUE AND FORMATIVE SKILLS

The final and first question remain: How do you practice the ability to make judgements, and is there any guarantee that you will make good judgements, i.e. that you will be a designer of information systems with strong and moreover good formats? It is easier to say something about training the skills to create and to read formats; it is harder to say what determines a good format, because it is contextually and teleologically dependent. Below are some

comments on training skills and judgement related to the creation, reading and evaluation of formats.

First of all, it is important to accept that formats are more closely related to the product than to the process. This implies that formative skills must be developed in close relation to existing artefacts (as discussed in the previous section). Every information system's designer is surrounded by systems that might be subjects for an exercise in reading and evaluating formats. Such exercises are probably always done, but often unconsciously, or at least without explicit description and evaluation.

If system designers wish to develop a better sense of formats, these descriptions and evaluations must be made explicit. In the process of making them explicit, there is an opportunity both for a shared understanding of formats and for a 'language' to appear (such as Krippendorff's semantics). As long as these processes are not explicit, they will not sharpen our conceptual skills and will not deepen our appreciation of nuances and the relation between details and the whole.

Both the writing and the reading of formats must be followed by evaluation. This process is necessary if designers are to be challenged by each others' interpretations and evaluations. This is how our skill in making judgements is developed — by facing a situation where our evaluation will be challenged by another's. This is when the question 'why' will lead to further exploration and development of universality and precision in the use of concepts and means of evaluation, and also to greater appreciation of elements of a strong and a good format.

For a practising systems designer, it is also important to try to incorporate these reading and evaluation skills into active design of new systems and formats. This can only be done by intense practice in making formats, and being criticized and redesigning and exploring new possibilities, without fear of causing damage or irreversible problematic situations (see Schön's discussion of the idea of 'practicum', 1987).

There is another important aspect of this training that must be emphasized: the meaning of *conscious focusing*. If the practice of reading, evaluating and creating formats is to have a significant impact, it must be a conscious process where all participants know their activities and goals. Otherwise, one may well end up in a situation where people attack each other's attempts on the basis of taste. This view is not the same as one that sees the training as a way to unfold a degree of intersubjectivity. Schön describes this as the process of acquiring a profession, where the master or mentor transfers the language of the trade to the disciple through conscious deliberations on the important aspects of making judgements in the professional field (Schön, 1987).

To summarize, skills in reading, evaluating and creating formats can be developed by the following practice activities: (1) reading, and studying, existing formats; (2) describing existing formats; (3) evaluating and criticizing formats; and (4) practising diathenic graphologue.

Such practice will be more efficient if the available time is limited. This claim is based on the idea that limited time, combined with a complex situation and difficult judgement, will force the designer to make leaps in the process that otherwise would be difficult. Of course, there is also a need for in-depth analysis and reflection, but design seldom has such time available. Thus, in order to develop the right kind of judgement skills, it is important to practise when time is restricted.

By repeating this process many times, one begins to start to recognize the feeling of when to make certain judgements, when to take the next step, when to stop to reflect, and when to act.

Design has a distinct dimension, not to be found in science or art, that is caused by limited time and resources, a too complex situation and contradictory demands. This dimension can only be mastered by simulating the situation: the fast process; the complexity of the small details and the whole; the contradictory demands; and the qualitative judgements.

## CONCLUSIONS

Every design that leads to a new artefact will increase the artificiality of the world and make our environment more man-made. Because all these artefacts do affect how we perceive the world and ourselves, it is of great importance that such design is based on intention and guided by knowledge and skill. Information systems design has not sufficiently acknowledged the process of forming the wholeness and integrity of information systems, although there are exceptions. In an increasingly complex environment, the practising information systems designer must be able to handle this complexity, and to create systems with strong integrity and stability over time. The practice of information systems design will therefore increasingly demand a designer with architectonic design skills.

To give form to the non-given is an act based on formative skills. These skills can and must be trained. But they also require theoretical reflection. With the concepts of *parti*, *format* and *diathenic graphologue*, it is possible to start to recognize and to conceptualize this process. Such an understanding can form the basis for a changed education for information systems designers. The approach presented in this paper can also help practitioners trying to reflect on and conceptualize their own experiences by supporting them in recognizing, legitimizing and also challenging their present practice.

When we also recognize the importance of *judgement* in this process, we are on our way to an understanding of the design process that will acknowledge the necessary creative and qualitative judgement skills. This understanding moves us towards a situation where ethical considerations becomes a natural and integrated part of design, and the designer becomes fully responsible for the proposed design.

An understanding of information systems design based on concepts such as architectonic design, *parti*, *format* and sketching is developed on the basis of research on design practice, i.e. it is an approach that tries to formulate some of the basic principles found in design practice, but not an attempt to prescribe how design should be carried out. It is an attempt to conceptualize parts of design that seems inevitable from the perspective of a practising designer. But it also provides an intellectual framework and conceptual tools that make reflection on practice both challenging and rewarding.

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## Biography

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