The Renaissance of Visual Thinking

BIRGER SEVALDSON
OCEAN north
Oslo School of Architecture
P.O.B. 6768
0130 Oslo Norway

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Abstract

The resent development of graphical 2D and 3D design tools has led to a new state of visualisation in the design process. A whole range of visual representation-forms have emerged and gained increasing importance and influence on the design process, and hence the final result.

From this follows that visual thinking is more important than ever. The visual is no longer limited to represent the product as such but extends to embrace all kinds of representations, from metaphor to diagram. Abstract levels of visualisation gain in usability and implementation.

The renewed interest in the diagram in the architecture of the 90ties and the invention of the generative and dynamic modes of the abstract diagram are closely linked to the emergence of graphical computing. Though the theoretical aspects of the diagram has been unfolded during the 90ties, its underlying conditions and reliance on visual thinking has largely remained unexplored. This essay will present some resent research in this field.

1. Introduction

Graphic computing in design professions, from 2D paint applications to 3D CAD systems and multimedia applications, has resulted in a more visual design process than ever. The computer aided design process is in an increasing degree based on the production of virtual visual material with the aid of advanced computer graphics hardware and software. Digital representation allows for an easy manipulation and reconfiguration of data. This has lead to an increasingly spontaneous and stimulus/response or trial and error based way of designing. This practice takes advantage from generative aspects of graphical computing. Through a playful manipulation of the software unanticipated results are produced and applied in an opportunistic manner.

But a design process based on graphic computing and advanced visual representations does not necessarily exclude cognitive design processes. Design computing can as well engage in the visualisation of abstract aspects of design problems, and the rendering of the relations between those aspects in diagrams. Also structural or compositional issues could as well benefit from graphic design computing.

This essay will present some examples of practice-based research in this field.

2. The visual process

The design professions have always been based on both visual work and analytical thinking. Basically the visual based design processes have been applied to the parts of the design process that are concerned with formal aspects, while analytical processes have been applied to the aspects of structural organisation, user needs, production technologies and similar structural aspects.

While visual based form-generation has been a process of trial and error, the analytical process has been based on cognition, though some times supported by graphic representations (sketches and diagrams). Only when one applies sketches and diagrams, there appears a connection between visual trial and error based design and analytical design. This is where visual thinking is most crucial and where we can identify a several different modes from the very abstract diagrammatic to the solving of technical engineering problems (Like Tjalve described it (Tjalve 1976)). The design profession is remarkable in the way it integrates and synthesises such a wide range of different ways of working. Our task is to bring these forms closer together by on one hand look at the generation of form as result of dynamic processes on the other to understand analytical thinking as a visual activity.

The resent development of efficient computer software for design has contributed to a design process where the manipulation of visual material on the screen has become more important. Such a design process is based on a playful interaction with the computer. The questionable ideal of a fully controlled design process or the idea of creativity as an internal process is replaced by a process where giving away control is a central aspect. Similar as in other known creative techniques, (like brainstorming) a little game unfolds. This game has rules, which resist the designer's urge for control. Such games bear the promise of surprise. (For a more detailed discussion on the issue see my essay "Dynamic Generative Diagrams" (Sevaldson 1999)) In an easy way the visual material is manipulated, filtrated and altered in diverse ways. This is done to take advantage from the generative power of the computer software. This generative potential of the computer comes from the fact that the software engages a high number of parameters, which in combination produce very high numbers of possible outputs. These variations are impossible to predict. The only way to investigate them is in a speculative, trial- and error-based way of working. A good example is the material shader library in the Alias|Wavefront Studio software. The number of parameters in the procedural based shaders is so big that there is virtually no limit to what shaders one potentially can produce. (Fig 1) The operation of such systems is in a large degree based on practical experience and intuition.

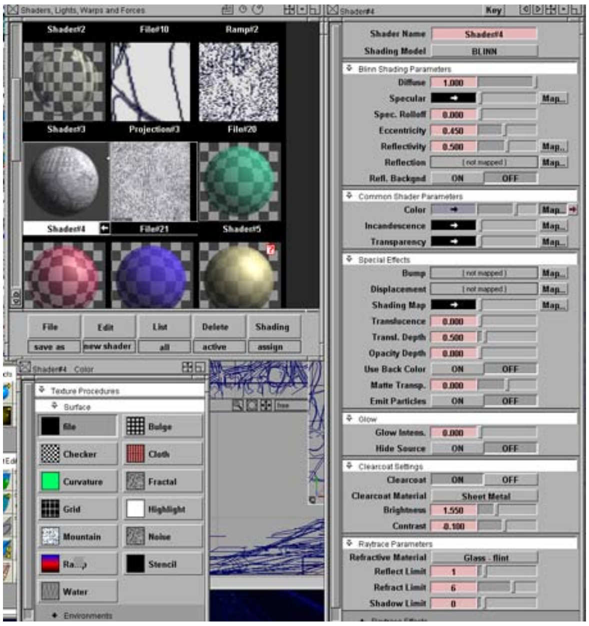

Figure 1. The shader interface in the Alias|Wavefront Studio software.

In the designers search for visual material the computer is used to instantly produce images of the unanticipated. But this is not a passive search. The search is done in a landscape that simultaneously is altered by the designer, who controls the initial set-up as well as the input parameters. The designer's role in these games is the one of the un-anticipator. This is a self-contradiction, since the designer speculates in producing new unseen imagery, he/she has to anticipate what is unanticipated.

Figure 2. An intuitive derivation of a physical 3D model from a particle animation. In this case the particle animation was used to produce a design template for a physical sculptural model that depicts spatial organisation between three systems. (From the "Building Dynamic Relations" Workshop Helsinki/Vaasa OCEAN Cologne, Helsinki Oslo 1997 Group 3, Jouni Rekola, Jani Ikkala)

Such a process can be productive when it comes to shear formal aspects like styling and form-giving of surfaces and the composition of spatial elements (Fig 2). Especially in graphic design such a process can be useful. But this type of process does not apply to the abstract structural parts of the design process. This has possibly contributed to widen the gap between visual thinking ("thinking with the pen" or visualisation tool) and cognitive design thinking.

3. Rule Based Design and Diagrammatic Abstraction

In Architecture there exists a tradition to integrate the generation of form as a result of procedural, or what I here call rule-driven processes. This is also referred to as parametric design when it includes the selection of concrete variables and the development of the resulting structural organisation and formal implications in time based speculative models. In all design processes and art works we can recognise a mechanism of restriction, which frames the issues, the appliance of techniques or the selection and interpretation of the problems at stake. This framing establishes a theme or relates to a context in a way that allows for certain rules to be followed. The design process creates its own logic. In many cases this logic can be very loosely defined and is even there just to be violated. In many cases the issues are treated in a superficial way as very often is the case in architectural projects where the program of the buildings is delivered from the client and applied unprocessed as a static design element, with no regard of the more complex issues of everyday social life or the dynamic aspects of the logistics in the building. Though such examples intend to react to parameters set by the environment (client defined demands, public regulations and site features) it is first when we investigate these parameters for their features that we can hope that the model will mirror reality. The program for a building is in that sense a primitive scenario, which at last needs to be tested for a few possible future alternatives. It is remarkable how shallow the future is treated in most design projects. Many architects regard their work as static. When there are any thoughts about the future at all, they appear as schematic built-in options for enlarging existing spaces. No models for best case or worst-case futures are introduced. No scenarios for the altering of the programs in the future are implied or even imagined. Still our cities are full of buildings that have gone through dramatic changes when it comes to their use. Warehouses are altered into offices, docks into housing. Retail facilities constantly change content and are redesigned. The normal for a building is that it is redefined and altered many times through its lifetime. Still many architects maintain a view on their works as masterpieces that are complete and that would decrease in value if their formal composition were disturbed by redesign. Such a role for the architect might have been relevant before capitalism, when the architects task was to design symbols of power, which off course needed to signal stability. In our time this attitude is not only outdated but also inadequate and reactionary and it produces unsuitable results. The client suffers from this because they have to bear large additional costs on reduced efficiency because the environment does not fit. Also frequently rebuilding adds to costs and delivers only new static solutions, which in turn will be outdated very quickly. The research into spatial management is still very rudimentary.

The introduced term "Rule Based Design" embraces both parametric design approaches and more loosely defined variations, where all kind of rule-driven processes, often with solely internal and formal variables, are explored. Examples of the diagram used as formal-spatial organiser are to be found in Peter Eisenmans work (Eisenman 1999) Advanced examples of parametric design are discussed in Michael Hensel and Johan Bettums article on Channelling Systems in AD (Bettum and Hensel 2000). General discussions on the diagram in architecture are to be found e.g. in ANY magazine 23. (Somol 1998; Allen 1999; Landa 1999) The term "rule-driven process" refers to the appliance of a more or less consistent inner logic in the design process and that this logic is followed in a more or less rigorous way, periodically overriding spontaneous design intuition. These rule-driven design methods have a lot in common with the simpler creativity games mentioned earlier though the motivation and sophistication differs. (In many cases the two forms are confused).

The output of rule based form generation is seen as a result of the play of diagrammatic forces. The spontaneous intuitive stimulus-response type of design process is often seen as techniques that are in contradiction to parametric design. Though in practice the diverse forms are often applied in a mixture. What ties these different types of approaches together is their intend to reach an unanticipated output based on programmed emergence, be it computer enhanced or other media. Both processes produce output, which is not foreseen. If the results could be imagined in advance it would not make sense to develop the often laborious games. Instead one could go right to the solution. So, the common and probably main motivation of all these techniques is to develop projects detached from the designer's motivation, to explore how systems develop independently over time. The designers motivation is seen partly unsuited because of either its lack of ability to operate very complex fields of variables and/or because it leans on predefined schemata in a degree that hinders the emergence of new solutions (operating as a creativity technique).

The most important difference seen from a methodological point of view, between an intuitive and rule based process is that the later establishes an internal logic that feeds from internal or external variables and follows its conditions through out the process. A certain rigour in the execution of this logic has an advantage beyond the metaphysical justification, being speculative in any case. (But speculative in a positive sense). A rigorous execution of a rule set is far more efficient in producing unanticipated output than the trial and error approach based on intuitive anticipation.

Rule based approaches are related to scenario thinking in the way they develop processes over time. Just as scenario techniques they do not predict actual futures but develop formation of speculated possibilities ("actualities"). The representations in these processes are therefore often vague and do not compare with mathematical simulation models (as weather forecast models). In many cases they operate between spatial organisation and the programmatic use of space. Often they introduce a smooth transition from the diagrammatic towards the built artefact. The different representations of the entities in these techniques are issues, which have to reach a more clear conception in the future.

Unlike from statistical/mathematical based scientific visualisation, in speculative modelling following rules without certain flexibility is not very productive. The models are as mentioned meant to produce unforeseen results. How to respond to the unforeseen is not possible to tell in advance. Therefore we need to know when to be flexible and readjust our tactics and when to strictly follow the rules. The inner logic evolves as the process unfolds.

It is essential to understand that the generative diagram is different from simulations of real life processes. The generative diagram applied in design processes has hardly ever taken any other role than operating as spatial, structural and programmatic organisers producing the underlying material for design projects. Because this is not a simulation the material should never been interpreted in a too direct way, but processed, modified and negotiated towards real life context and design intentions. In this remodelling lies the potential that the technique can contribute to build systems that respond in a flexible way to unanticipated futures and to the complexity of urban flows. (Sevaldson 1999)

Since the output from such diagrammatic processes always is used as one or the other kind of structural or organisational diagram, underlay, template or sketch for further design phases, one needs to select the elements that are useful and throw away the rest. This reduction of visual data is central in any generative process, but it is very evident in the rule-based process since it produces large quantities of samples. How to make selections in such a material is not an easy task. The selection process is driven by rules, other times by intuition. In any case the selection process and following design process is a negotiation between the internal logics of the games and final design intentions. Diagramming is to emphasise certain aspects on the cost of others, which implies data reduction and loss of granularity, details and noise data.

The resent discussion on the diagram in architecture involves deeply in these and many more questions, which are outside the frames of this essay.

4. Generative visual thinking

The generative material operates on a diagrammatic level in the sense that it is similar to the visual diagrammatic elements that describe a composition of any kind, be it music, building or object. The diagrammatic elements do not represent any thing but the spatial organisation and the relations between the elements in an artefact. Fig.2 shows an example of a still frame from a particle animation used as spatial organiser and generative diagram for a physical sculptural model, negotiating three structural systems.

What separates the generative diagram from the descriptive diagram is that the generative diagram is in its beginning without meaning or content other than its inherent spatial qualities. It is different from a descriptive diagram also because it is not reductive but includes a qualitative rendering of the spatial relations. (Fig 3)

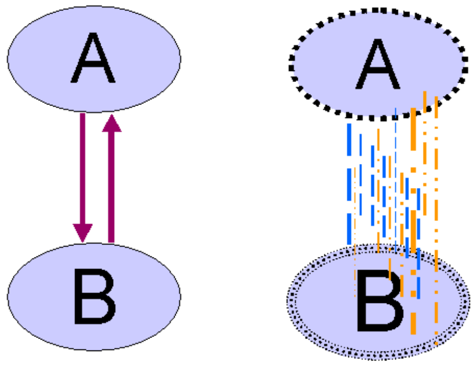

Figure 3. Two types of diagrams. To the left a normal bubble-diagram depicting relations between the entities A and B only as quantities. To the right a qualitative diagram which describes the border conditions of A and B and the density of several streams of information between the entities.

The reading and interpretation of these spatial relations is based on visual analyses. This implies that visual thinking (as described by Rudolf Arnheim (Arnheim 1969)) is the foundation and precondition of the generative diagram. The visual material is investigated for densities, intensity variations, directions, similarities and diversities, field and border conditions, distribution, flocking and grouping and in the end, types and phenomena. The generation of virtual phenomena (virtual types) is treated especially in the video "Virtual Phenomena II" 1998 (Fig 4) (Sevaldson 1998)

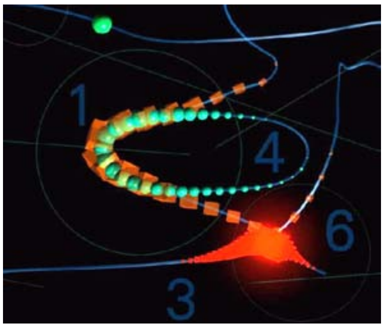

Figure 4. Virtual phenomenon derived from an event occurring between three animated cursors in an animation.

The generative diagram operates on the same abstraction level as when we analyse the composition of a painting. Analysing the composition implies to look through the content (the figurative and narrative) and look at the purely formal aspects of the elements and the relations between them.

Since the renaissance painters, art has consciously been concerned with formal and structural organisation and the composition of the elements of the artwork. These compositional configurations can be analysed and described in diagrammatic form. This analysis of the composition of art works operates on a level beyond the immediate perceptible. It deals with features of the artwork which are independent of its figuration and which are generic, since the same or similar compositional configurations can be applied to many situations. Though being abstract and dependent on visual analyses, these diagrammatic aspects non the less are equally real as the artworks colour or material.

Ucellos painting "Battle of San Romano" is a highly complex composition and in this example we will look at only few formal aspects. Ucellos painting is remarkably modern not only because of its introduction of the perspective in to open landscape scenes but because of its virtual dimension, expressed through dynamic elements enhanced through the appliance of an intricate structural composition. The painting appears almost as a snapshot or a single frame from a movie of the most dramatic moment in the story, the moment of victory and defeat, the very moment when all doubts and hopes are wiped away and replaced by euphoria and despair. This powerful dynamics stems not from the singular figurative elements (horses and soldiers) being drawn in a stiff and almost stylistic and statue-like manner, witnessing of Ucellos struggle with the new medium, the perspective in a scene of high complexity and no building elements to help. The power comes from the composition.

The frame of the composition is open both geometrically and time-wise. We can see that there is lot more going on outside the frames of the canvas, and we know that there has been much drama before the captured moment, and that there will be preceding events following. The main movement in the image goes from the left to the right, the winning army moving in and the loosing party fleeing into the background and out to the right. The lances contribute to form this movement. The movement is readable from the direction of the figures, especially the horses, but even more from the composition itself. The lances do form a virtual direction and movement totally independent from the figurative connotation of the painting. If we draw a diagram of the lances only they form a group of lines, which depicts an accelerating movement towards the right. (Fig 5) Other elements, like the almost scenographic arrangement of the background emphasise this movement. The diagram of the lances depicts one of many possible descriptive diagrams of this complex composition.

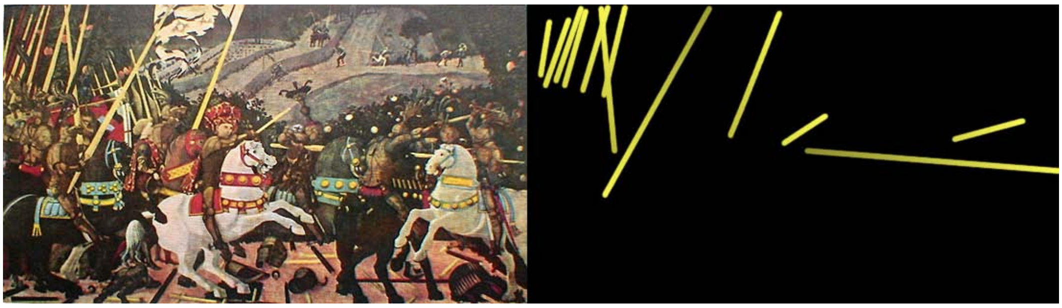

Figure 5. Paolo Ucello (1397-1475) "Battle of San Romano". To the right a diagrammatic illustration of the lances spatial organisation.

The generative diagram starts with this same level of abstract organisational structuring. From there it moves towards organisational principles and coding of content and negotiation towards its visual or physical representation. The generative diagram can be seen as reversed composition since it starts with diagrammatic information and arrives at structure, content, type and figure. But the generative diagram demonstrates its potential best when we extend it to operate on a level that addresses not only the singular components but also the relations between them, and in the end the interplay and relations between large numbers of entities that operate in systems over time. (urbanistic, economic, political etc) (Fig 6)

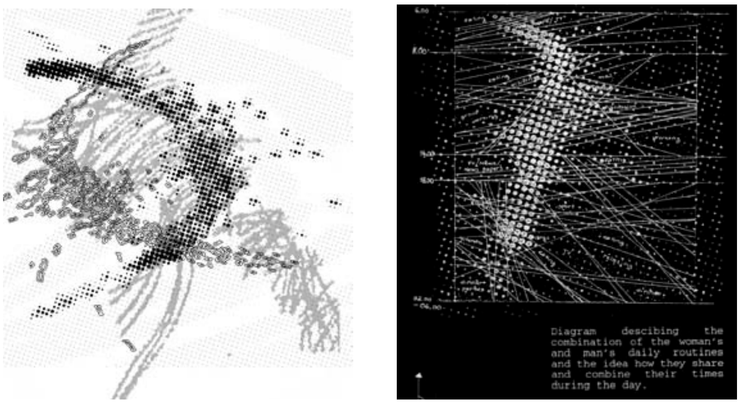

Figure 6. Generative diagram as scenario builder. A visual material derived form a particle animation used as intensity renderer for diverse activities during one day. The intensity fields could be displaced and hence render an infinite number of uncontrolled variations of the same scenario.("building Dynamic Relations" Workshop OCEAN Cologne Helsinki Oslo, Vaasa 1998, Group1 Riia, Sanna Paulina)

The use of the mentioned techniques seems to apply best to a certain scale. The intuition driven trial and error technique seems to be most efficient in small-scale object design, where the systemic and contextual aspects are conceived as less important. The more extended rule-based techniques seem to suite best in situations where spatial and systemic interrelations are central, in a scale from interior to city. (Fig 7)

(An early example in city scale, introducing the colour graft as generative diagram, is the project by Jeffrey Kipnis, Bahram Shirdel, Michael Hensel and others at the Architectural Association for the town of Haikou in Hainan province, China. (Jencks 1997))

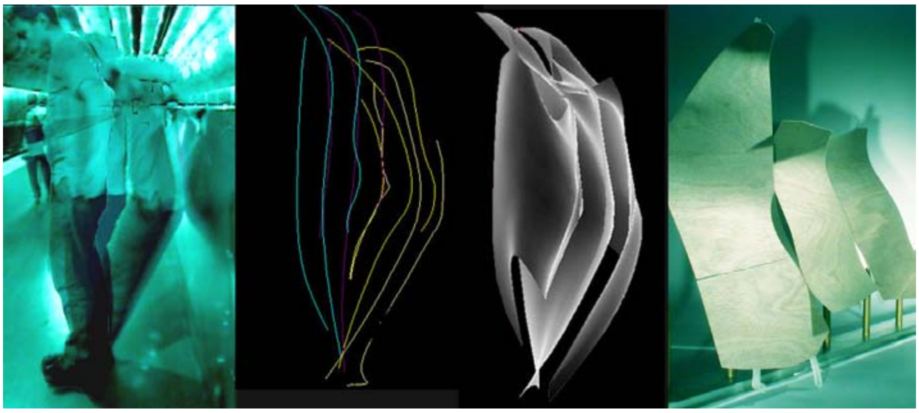

Figure 7. Video footage of staged typical movements used as generative material for the design of a leaning furniture. ("Conceptual Design Project" Oslo School of Architecture, Birger Sevaldson 2000. Group1, Lars Kløve Bjerke, Jens Andreas Pettersen http://www.ifid.aho.no/bs/konseptdesign)

5. An Example : "Ambient Amplifiers"

Ambient Amplifiers (Sevaldson and Duong 2000) is a design and research study aiming to explore how digital speculative modelling can contribute to the formation of generic concepts, (like programmability of built form) applied to a real life scenario. The project, located to a park area in the east of Oslo, treats a series of elements and sites within the area and indicates several interventions mostly developed to a sketch level.

The Tøyenpark is a relatively wide and diverse park area with a long range of public and cultural institutions and a varied landscape including hillsides and small forests. It includes the Botanical Garden with the Botanical, Paleontological, Geological and Zoological Museums. Amongst cultural institutions the two most important are the Munch Museum and the Tøyen Cultural Centre. The park as a whole, together with the Tøyen Bath and several sporting grounds forms the most important leisure facility in the east of central Oslo. Despite this richness of the park program there is hardly any synergy between the main actors, and the park is not used to its full potential compared to the Vigeland Park in the west, which is solely a sculpture park, lacking the programmatic richness of the Tøyen area. One obvious aspect is that the central area of the Tøyenpark is an undeveloped parking lot, a space which also is used for temporary events.

Fig. 8 Map of the Tøyen Park with the three categories of institutions, Art, Science and Leisure. The treated feeding corridor, the ethnic street Tøyengate is marked red. Central parking lot area north of Munch museum.

The design interventions indicated in Ambient Amplifier reinforce both the main central field of the park and the corridors that feed traffic into the park area. In the design study of the central park area a system of point attractors, a treatment of ambient surface paths and a reformation of the vehicular transportation systems were suggested.

Point Attractors

Three sets of "Islands" being spatial constructs in diverse states of "unfinishedness", from "footprint" to pavilion where to be distributed on the site in a way that would provide for the following:

- Establishing spatial and organisational relations between the three main actors on the site (Science, Art and Leisure).
- Prepare a ground for a wide range of activities to take place.
- To introduce a flexible system that could be re-inhabited according to unknown future activities, without necessarily big structural

modifications. This introduces the notion of programmability to design.

- To establish a pattern of attractors that would operate as a singular attraction on a global level to bring people to the site from distant locations.

- To establish singular attractor-points in the field, with varied quality and intensity, which allows them to operate towards a wide range of interests.

The three sets of Islands each represented one of three main actors or institutions on the site. This approach is meant to produce synergies between the three institutions on an organisational level but also on a spatial level simply by bringing satellites from one institution into the territory of another.

Ambient Surface Paths
The park has already a developed system of pathways for pedestrians. They follow however a strict transportation layout. The existing path system establishes a strict separation of functions, where walking and leisure are separated by choice of surfaces (grass and asphalt). The new surface paths introduce a soft border between walking and playing (bikes, roller blades, ballgames and others). It also provides additional modes of walking than only for transportation purposes (strolling, meandering),.

Programmable Street
The existing street system is redesigned to adapt to a wide range of possible events, some which already take place at the site. (e.g. circus) Rather than reducing the traffic or lead it away from the site it is distributed over a larger area in a way that allows it to adapt to real time events on the site. The branched street system allows redirecting traffic to give space to some events (e.g. concert) or to feed traffic into others (e.g. circus). Temporarily closed branches are used for parking and leisure. The system is dependent on a delicate treatment of the surfaces and its materials and redirection systems.

Design process
A particle animation was applied as initial generative diagram for the three interventions in the central field. The generative diagram in this case, was a particle animation fed by both generic information and contextual forces. (The particle animation was produced under a series of preceding design studies in the same area, "Synthetic Landscape I-IV" (OCEAN, Bettum et al. 1998))

Particles in animation software are used to render very complex geometries like smoke, splashing water, hair and similar. Since their input variables can be tuned freely they can produce spatial time based geometries in an abstract manner as well. Also the fact that the particle animation algorithms operate with forces (e.g. magnets, gravitation, draft, friction and mass) makes them very well suited for developing spatial constructs that feed on either specifically coded input variables or generative spatial systems. The particles from "Synthetic Landscape III" where produced from both generic input and site-specific geometries. The generic information was a colour-graft (a hand drawing by Johan Bettum Fig. 9) made specially to serve as colour space for "Synthetic Landscape II".

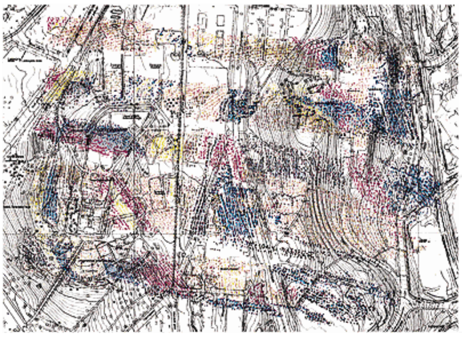

Fig. 9 Colour graft placed on site

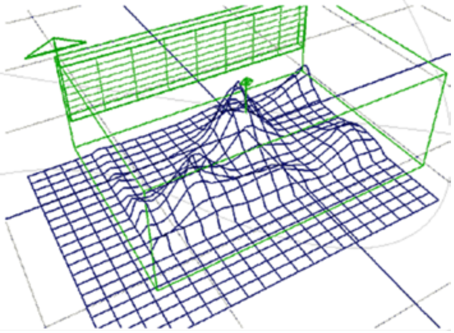

Fig. 10 Displacement of surface according to colour intensity.

The colour-graft was split into six colour channels (Photoshop) which where used as displacement information to deform surfaces. Peaks depict high colour intensity while valleys correspond to low colour intensity. (Fig. 10) These surfaces where wrapped to a topographical model of the site (Fig. 11). This produces surfaces that contain both the generative information and site-specific (topographic) information.

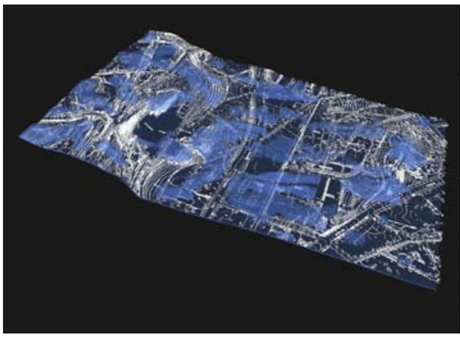

Fig 11. Displacement surface mapped to topographical site model.

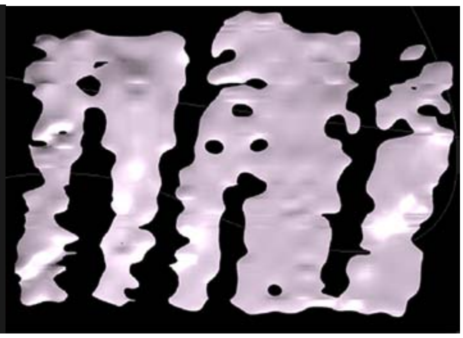

Fig 12 Contours of intersection lines. Visible only the part of the displacement surface that is above the topographical surface

To process the data further, to develop the site-relative aspects and produce a time based generative material (dynamic generative diagram) the data was processed in the following way:

- **Data reduction:** Intersection curves between the topographical model and the information surfaces where generated to produce a common reduced information set. (Fig. 12)

- **Data expansion:** The intersection curves where used as trajectories for animated particle generators, which introduces time as an element in the diagram.

- **Force instrumentalisation:** The particles where used to render qualitative spatial relations between some of the "static" elements on the site. (Scientific Museums, Botanical Garden, Munch Museum, Tøyen Bath and Finnmarksgate, as the main traffic direction through the site) To do this, these elements were equipped with magnetic forces that influenced the particle flows. (Fig 13)

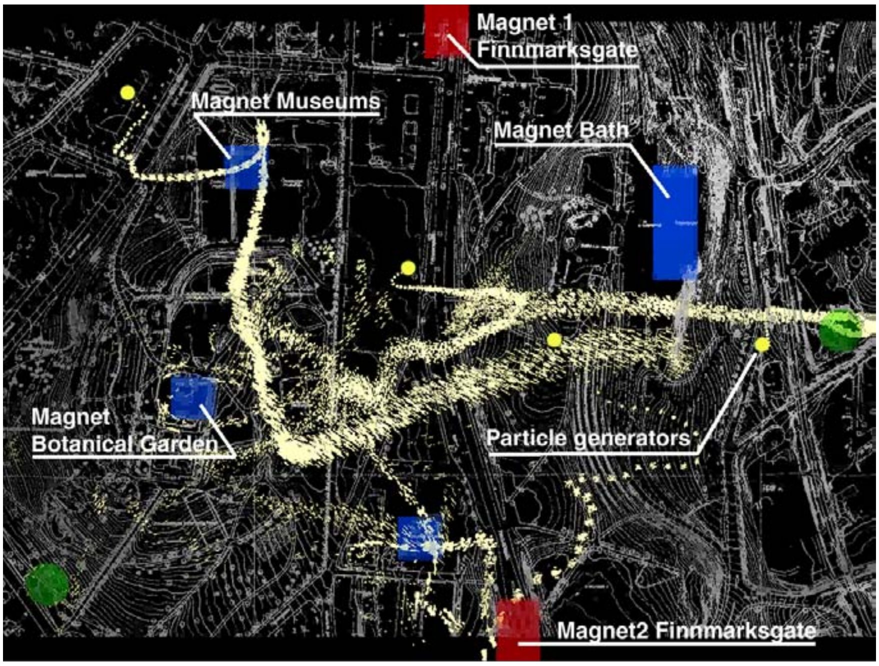

Fig. 13 Map of particle generator and force set-up. Trajectories not visible.

This set-up produced a series of six different animations intended as generative diagrams for an intricate urban analyses based on six channelling systems. (Parameter aggregates) (Bettum and Hensel 2000) The particles in the diagrams produce spatial configurations influenced by the grafted information (colour graft) and site information (topographical model and "static" elements) and the speculative development over time.

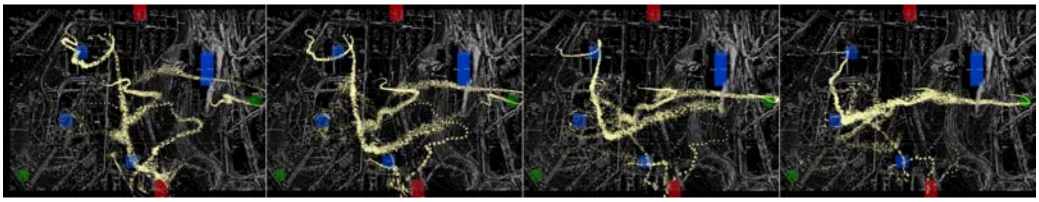

Figure 14. Series of frames from the particle animation used to inform the layout of the site.

"Ambient Amplifiers was conducted in the continuation of Synthetic Landscape but established its own agenda, besides the intentions already mentioned, there was a pressing need to investigate the implementation of the dynamic diagram further in a more narrowly framed and specific case.

The layout of the Islands was directly informed by a series of diagrams derived from the particle animations. The layout and placement of the Islands needed to be defined in a field condition rather than in the granulated particle flows that where the underlay. The selected still frames where therefore blurred to produce continuous gradients and contrast enhanced to establish slightly more clear borders. (Fig. 15) This translated the density formations of the particles into intensity maps. These image files were fed back into the 3D-model and used as underlay for the distribution of islands and the ambient surface paths.

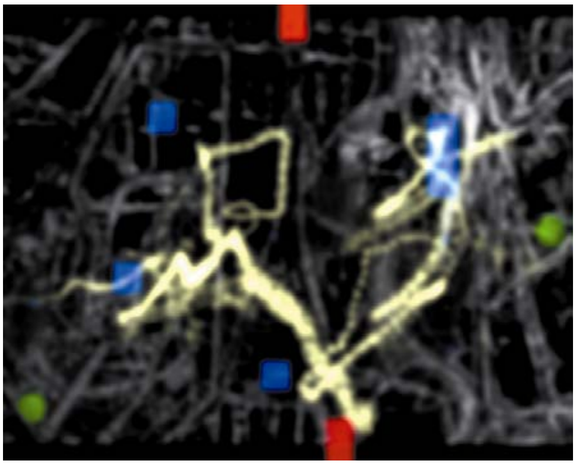

Figure 15. " Selected frame used for the distribution of "Islands"
The image is blurred to render fields of intensities more clearly.

This informed the placement of the "Islands" in positions which would hardly been chosen if the design was done in a conventional way. Some "Islands" lay in the middle of existing streets, some right on top of the fence, which divides the botanical garden from the rest of the park. (Fig 16) The placements were simultaneously coincidental (out of control) but closely related to the anatomy of the site. This is the unique quality, which is specific to the described computer based techniques.

Figure 16. Distribution of the three sets of "Islands". From the left: Science, Leisure and Art.
Botanical Garden to the left, Munch Museum lower middle, bath and park to the right.

When the generative diagram is implemented to the site specific design intentions this puts the designer immediately into a state of negotiation. Should the indicated positioning be rejected or do they indicate a potentially useful solution? In all cases where the position is questionable it either results in rejection or it triggers systems with larger implications. In most cases the problematic fits are the potentially most useful because they challenge the designers schemata. In both the cases with the fence and the street the island placement was rather negotiated towards existing situation and program instead of rejected. The existing street was modulated to bend around the island. In the case of the fence the islands took the role of a threshold moderator, which would contribute to solve the problem of the fence, which acts as a territorial obstacle for the site. This also triggered the concept of the programmable fence able to produce a number of varied access and closure states. In the case of the street it triggered the remodulation into a programmable system. (Fig 17)

Figure 17. The programmable street. Four scenarios for different activities at the site. From the left: rush-hour, tourists, circus and concert.
(Red: street, Blue: Parking, light blue: pedestrians and sports, white: fence)

The "Islands" where designed according to a flexible concept, which was based on four different states of "unfinishedness". This helped to negotiate the positions suggested by the underlay. In some cases the "Islands" embody themselves just as a subtle modulation of the surface or the shift of surface materials, creating an area suited for pick nick sunbathing or similar activities ("Footprint). In other incidents they provide platforms ("Foundation") and frameworks ("Frame") for additional services. Only in a few cases the "Islands" are fully developed into pavilions ("Core"). (Fig 18) The underlay derived form the generative diagram indicated a large number of "Islands", more than necessarily needed, which also contributed to the negotiability of the design template.

The underlays for the three sets of "Islands" where chosen from three different frames in the same particle animation, which provided an inherent relation between the three sets.

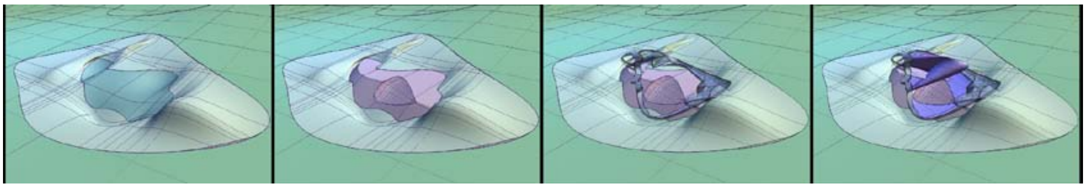

Figure 18. The "Islands" Four stages of "unfinishedness". From the left: footprint, foundation, frame and core.

Since one of the most important aspects of the "Islands" is to operate as devices for synergy between the three institutions, each institution manages one set of "Islands". In each set only one or two are fully developed. The chosen sets for each category where the ones, which produced the most intimate connection to the two other sets and their institutions (Art has an island inside the bath area and a leisure island occupies a site inside the Botanical Garden.)

The "Ambient Amplifier" project employs a series of additional techniques to the one described. In the adjacent streets that feeds into the park (Toyengate) a particle animation that feeds exclusively from contextual forces was used to create the generative material. It was later processed with an advanced skeleton technique, which in turn monitored a surface that was used as "scaffold" for the final design. This technique, developed by Phu Duong, introduces hierarchically ordered interdependent systems to the generative diagram. On the other extreme, the Pavilions for the "Islands" where generated from generative material that was produced through a deformation of the landscape surface driven by skeletons where the skeleton movement was totally non-contextual. The movement was "designed" manually; an example of the intuitive trial and error approach. Bringing design intuition "back stage" operating directly on the virtual engines that produce form. This hands-on technique is highly efficient and still has a potential for further exploration.

See also Malcolm Mac Cullough on generative systems:

> "…there are dynamic representations where not having control over lower-level operations yields a higher sense of control over a complete process. One can work at the level of derivatives, for example, controlling velocity rather than position. By altering the settings of a dynamic system…. ….one can improvise within the context of a simulation." (McCullough 1996)

6. Results

The implementation of generative diagrams to the site of the Tøyen Park initiated radical solutions for the site. It is not possible to conclude if other design methods would have produced similar results, because of the general methodological difficulties involved in research on design practice. (Sevaldson 1999; Sevaldson 2000) But one can discuss it from a practitioner based research perspective where individual observations and personal experiences are compared with other approaches. It is also possible to discuss the effect of design practices when comparing if similar techniques produce similar effects when conducted by other designers. This discussion will hopefully be developed further in the future.

Common to the different modes represented in the "Ambient Amplifier" project is the generation of a rich visual and spatial material, which is a resultant of both contextual and alien (grafted) information, as well as choices, modifications and visualisations based on design experience and intuition. The contextual grounding ensures a structural relation and a possible fit to the existing anatomy of the site and a potentially smooth future transition of these conditions. The alien information inserts the unanticipated, the unheard off, the resistance to schematic solutions and cliché typology (or finite typology).

All generative material in "Ambient Amplifiers" stems from animations. The use of animations implies two perspectives: The first perspective is purely methodological since animation can be seen as just a technique to produce an array of visual output of more or less densely distributed steps of topological transformation processes, from which one can choose singular frames.

Animations seen in this perspective take a central place in the rule based methods.

The second perspective is the problem of addressing temporal issues through the use of dynamic generative diagrams. This has turned out to be very difficult and has been referred to as the stop problem by Greg Lynn.(Lynn 1999) "Ambient Amplifiers" has not managed to move towards a suggestion of how to handle these questions and on this point the endeavour has failed.

The process from colour graft in "Synthetic Landscape" to the deployment of built interventions in "Ambient Amplifiers" is extremely laborious and continued over years. The same thread of information was in a period of four years reapplied and processed into many different speculative projects. In such a long-term relationship with a specific dataset, one develops a deep knowledge and intuition of the materials limitation and potential. The digital material almost takes on similar qualities as physical material.

Another central aspect is the smooth transition from diagram to construct where the reprocessing always develops new extracts, moving from the generic abstract towards the specifically coded and finally built form. In all these reformation-, selection-, reduction- and expansion-steps visual thinking as recognition off patterns, directions, densities, groupings, similarities and the isolation of generic types (virtual Phenomena) is at stake.

In any case, how the final design is derived from the generative diagram is crucial, since it is in that part of the process one chooses where to operate on the inherent gradient from shear context to alien "wildness". A radical generative diagram can therefore as well serve as underlay for subtle but still surprising interventions.

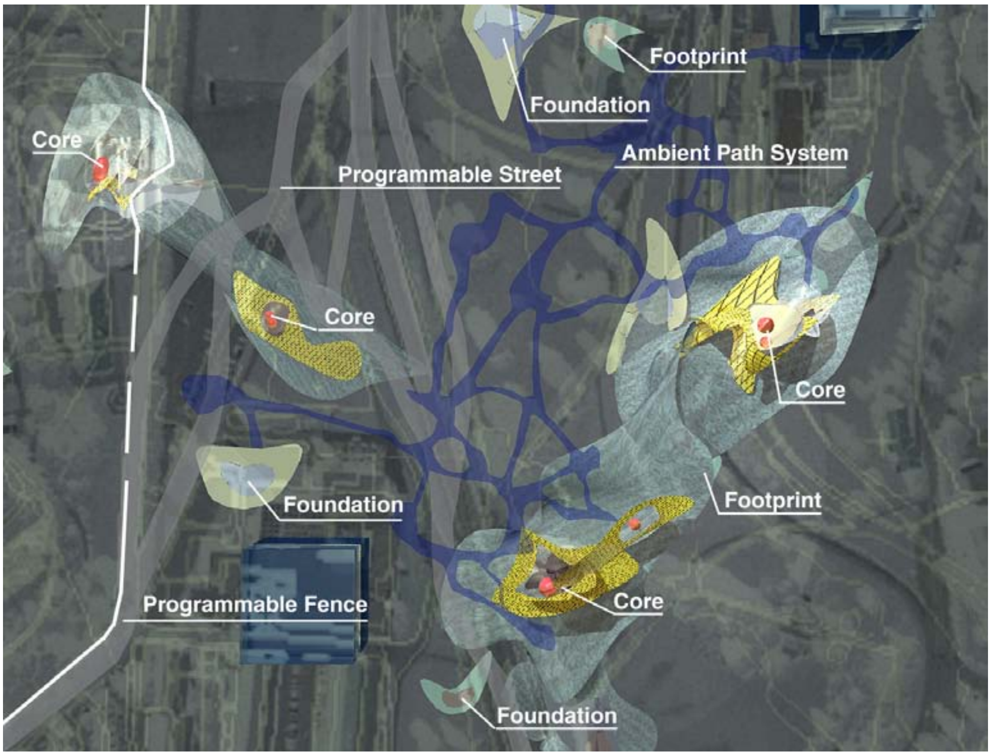

Fig. 19 The central field of the Tøyen Park showing Islands, Ambient Path System, Programmable Street and Programmable Fence.

6. Conclusion

To bring forward a new mode of visual cognition in design computing is not only possible but also necessary to bridge the gap between the emergent power of the computer and a cognitive and analytical design process. This demands an active interpretation and processing of the visual material produced by the computer, beyond the superficial look of things. Visual thinking is central in this process. This leads naturally to a diagrammatic way of thinking. The emergence of the computer and visual diagrammatic thinking, analytical visualisation and design intuition comes together in the generative diagram. This is one possible concept that could lead to a more active and dynamic appliance of visual computing in both formal and cognitive design processes.

The examples mentioned in this essay demonstrate just a few possible ways of a future computer aided design process where the computer actually helps fulfil Rudolf Arnheim's intent to bridge the gap between cognition and perception. The promise is that operating on a level of visual abstraction could help to trigger the inherent potential of graphical computing, initiating a renaissance of visual thinking.

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