STATE OF THE PRACTICE

Marcel Ritschel
User Interface Designer at M&M Software GmbH

ABSTRACT

Title: State of the Practice

Author: Marcel Ritschel, User Interface Designer at M&M Software GmbH

Design is a knowledge-based activity that involves doing, reflecting, and researching - which could make the problem of establishing a design practice one of: (1) Satisfying the requirements of stakeholders, (2) evaluating/analysing design outcomes, and (3) the production of new knowledge. As the title may suggest, the approach has been to capture and develop representational state: Part 1 deals with creative design methods used in the field, including two case studies; Part 2 generates a theoretical basis by investigating topics that are relevant to creativity and design; Part 3 provides a basic analysis of the practice using Grounded-Theory methods.

"There is no one method of research called design research. There is a possible collection of methods, approaches, ideas and practices that might collectively be called design research" (Downton, 2003).

State of the Practice invokes the designer-as-reflective-practitioner in order to examine relationships between a practical- and a theoretical body of knowledge, and to find contingent socio-cultural contexts and interpretative dimensions. Value was also placed upon the role of designer-as-author (*"the design remains the vehicle of the written thought"* [Rock, 1996]) - especially for conveying experiential or hypothetical content since, arguably, the task of writing about art and design is in itself a potential creative act.

The findings illustrate a productive interplay between client- & user-centred design and research through design in the development of a knowledge-based design practice. One of the outcomes was a list of factors believed to drive change and innovation in the design of industrial-software surfaces. And it was concluded that new technology with social implications must involve relevant consulting and participatory processes.

Keywords: Creativity; Innovation; Design Futures; Design Knowledge; Design Process; Design Research; Interaction Design; User Interface Design; Configurable Objects; Parametricism; State Awareness; Reflective Practice; Grounded Theory;

TABLE OF CONTENTS

Page

PART 1

PROJECTS, TECHNIQUES

PROJECTS, TECHNIQUES

Part 1 tries to establish *"appropriate structures for the design process"* (Clarkson and Eckert, 2005) and reflects on how design knowledge can be applied to design problems. It begins with a loose set of design methods used in the field, incorporates two compact case studies, and elaborates with cognitive artefacts. This part is in many ways concerned with the production of operative, or empiricist knowledge.

1 Basic workflow

1) Visualisation of the interaction framework

- Interaction requirements are associated with tools, controls and display areas;
- Creation of wireframes[1] and storyboards to render a user scenario.[2]

2) Layout design and visual structure

Spatial distribution: The screen area is divided into large vertical and horizontal containers.
Visual hierarchies: UI-elements are weighted by frequency of use and ordered using visual characteristics.
Spatial grouping: UI-elements are grouped by means of identical spacing and frames.
Alignment: UI-elements are positioned consistently according to a scheme.

3) Style and Branding[3]

Development of a design language and creation of design mockups; The look-and-feel of major user interfaces is worked out with reference to existing wireframes.

4) Prototyping

Development of click-dummies to improve communication and to collect project related data:

- Aims and objectives, including users of the prototype and level of fidelity;
- Construction with PowerPoint, Dreamweaver, or Expression Blend;
- Organised data gathering [usability test];
- Data evaluation, design reviews, developer support.

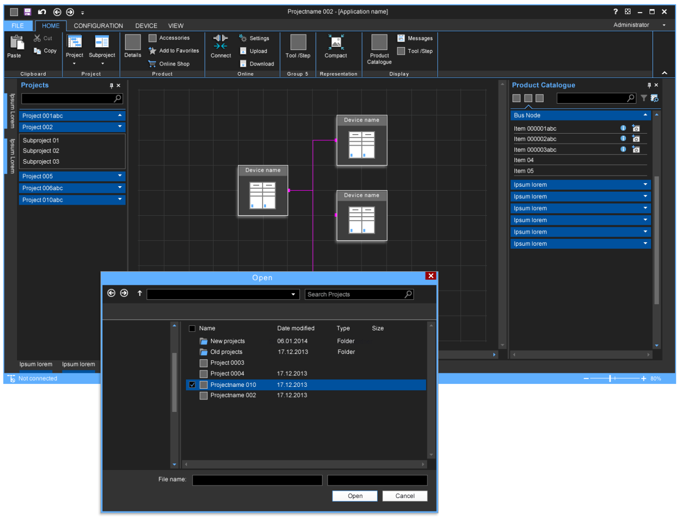

Figure 1 Design mockups for a presentation level, or user interface

1 Conceptual representation of a user interface, usually as a simple line drawing. A wireframe typically consists of several rectangles to represent UI-containers and basic UI-elements.
2 A scenario describes interactions between personas and the future product. Scenarios help explore representational state and behaviour, e.g. the actions of the user and the reactions of the system.
3 The term Branding refers to the appearance and qualities of a product which are unmistakably associated with the originating company. Brand values may focus on the look, tone, and behaviour of a product but ultimately encompass every human interaction with the company.

2 UI-Styleguide

Most styleguides communicate essential aspects of a brand or Corporate identity by specifying the correct usage of logos, fonts, colours, layout schemes.
A UI-Styleguide must, in addition, describe what the implemented user interface will *do* in terms of appearance and behaviour.

Problem space: It is difficult to statically represent every screen of a new interactive product in advance. Therefore, a UI-Styleguide needs to prepare for the future. It should be powerful enough to preserve an agreed upon look-and-feel; and it should be flexible enough to deal with human- and machine-driven variations.
Solution space: The UI-Styleguide was to provide a kind of toolbox (with specifications, patterns, guidelines, mockups, diagrams) that could be utilized by planners who write user stories and by developers who code them to build the interface. Important aspects of this endeavour would be to: (a) Preserve the integrity of the design language, (b) link with an online repository of digital assets, and (c) facilitate regular updating to reflect agile[4] developments. In the document itself, styleguide-content was structured around branding requirements, layout, icons, and UI-elements, with additional chapters on ribbon design, infographics, and transition animations.

3 UI-Design Seminar

A productive collaborative process requires compatibility between techniques[5] and a common vocabulary. The assignment involved the development of an inhouse UI-Design seminar for frontend developers. The aims of the seminar were to: (a) Transfer specialist design knowledge, (b) help participants use design representations more effectively in their work, and (c) improve interdisciplinary teamwork, including decision-making processes.

"Aus der Designvermittlung in designfremde Disziplinen resultieren zwei wichtige Ergebnisse: Zum einen wird dort eigene Designkompetenz angelegt, zum anderen entwickelt sich umfassendes Designverständnis." (Hammer, 2010)

Problem space: The opportunities provided by Windows Presentation Foundation (WPF) and HTML5/CSS3 led to new expectations in the usability and styling of industrial software, while suggesting overlapping areas between agile development and iterative design.[6]
Solution space: The seminar was to generate a dynamic and participatory learning environment by incorporating project-based documentation, as well as physical, digital and cognitive artefacts. The program included a lecture, a PowerPoint presentation, moderated discussions, and a practical exercise.

4 Process diagramming

4.1 Waterfall model

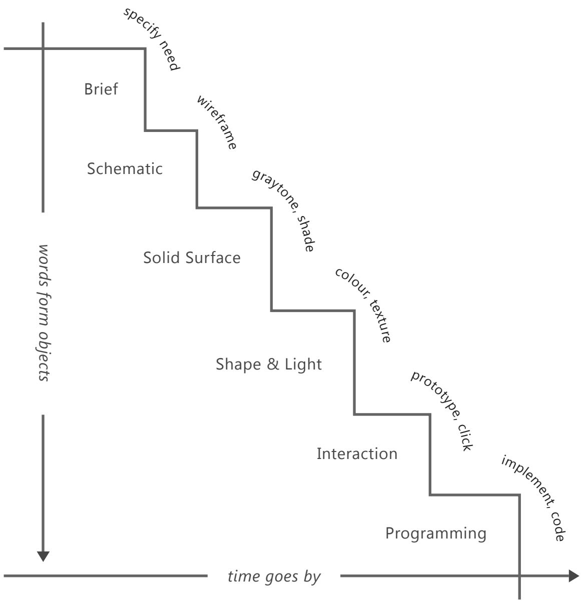

Figure 2 Design method based on the Waterfall model

Level 1: Brief, Requirements Specification
Level 2: Schematic, Wireframe
> All specified interface-components are assembled into a simple wireframe.
Level 3: Solid Surface - monochromatic, shaded
> Exploration of typographic options, contrasts, and area shapes;
> Sections of the wireframe are shaded to make dimensions, proportions, and the positioning of components appear more realistic.
Level 4: Shape & Light - colours, gradients, textures
> Correct application of corporate colours;
> Appropriate local colour schemes.
Level 5: Interaction - prototyping, click-dummies
> Construction of interactive prototypes {HTML/CSS/JS};
> FTP-based testing server for internal distribution and usability testing;
> Changes and optimisations.

---

4 Agility is an umbrella term covering: responsiveness, robustness, flexibility, resilience, adaptability, innovativeness.
5 See also: Nelson, E: 2002, *Extreme Programming vs. Interaction Design*
6 Sy, D: 2007, *Adapting Usability Investigations for Agile User-centered Design* in Journal of Usability Studies, Vol. 2 Issue 3

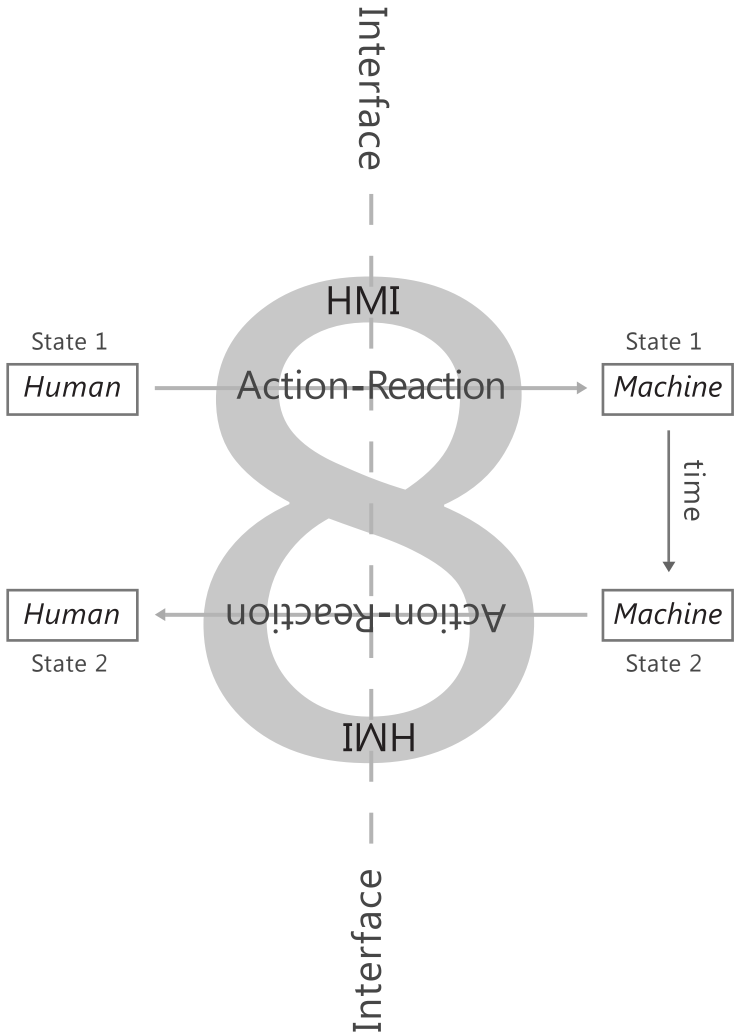

Figure 3 Alternating action-reaction pairs of a Human Machine Interface

4.2 Action-reaction pairs

The infinity symbol is used to represent a state machine where the HMI revolves around a dialogue driven by action-reaction pairs. The interface in the middle separates the human entity from the machine by 'splitting' the number eight to make two threes. As the traversal of space co-exists with the passing of time, each interaction marks a point of no return and thereby 'doubles' its entities (here shown by their sequential state).

```
{IF STATUS = ('PARAMETERS=>ready') THEN}

Calculate some problems
AND Display results
AND Adjust photo-receptors // Generate knowledge
AND Execute next action

{ELSE Display Error Message}
```

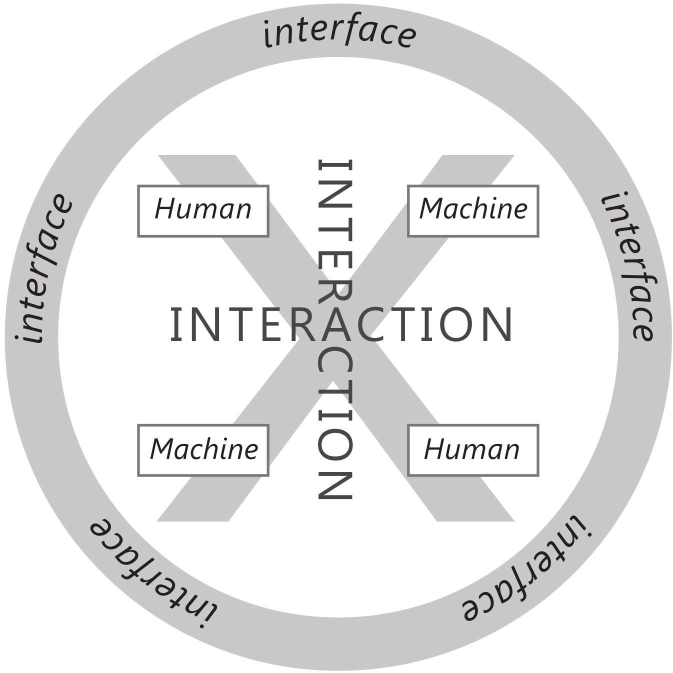

Figure 4 Interaction-entities

4.3 Interaction-entities

a) ***X*** stands for interaction - in this case between the synaptic activity of a human and the switching circuits of a machine. If discreteness and equality are mutually exclusive then entities must fluctuate in order to interact. Every interaction marks a reduction of difference simulated by interfaces and denoted by the shared letter ***A***.
A connection between the OTHER and the SELF is like a 'mingling of the stars' which is shown as a 'territorialising double' on the other side.[7]

b) In pervasive computing (ubicomp), humans, objects, and environments cluster into adhoc ecologies to form a *"multidimensional web of relationships"* (Aarts and Marzano, 2003). The model of a 'pervasive interaction' needs to include: (1) The user who *institutes* and (2) a responsive structure that *facilitates*. The evolution of a running system may be represented as an exponentiation - that is, ***a*** raised to the ***n***-th power, where ***a*** is the responsive system and ***n*** refers to the number of instantiations. A dynamic constellation could be modelled in a multidimensional phase space, where ***N*** stands for the number of entities in the system and each entity is linked with three position- and three momentum-variables to describe its trajectory in space.

> If it is impossible to know all stakeholders in a pervasive interaction, how are the concerns of clients to be transformed into a positive user experience? As the design of interfaces by assembling technological products and services around a future interaction must be subject to contingency, a design scenario also needs to consider socio-economic interrelationships. A reason for this is that each *individual* normally belongs to a *society*, while every member of society remains an individual.[8]

---

7 Oblique reference to Deleuzian Deterritorialisation and Reterritorialisation (Deleuze & Guattari for Architects, 2007)
8 One may relativize this statement, somewhat boldly, by quoting from Article 5 of the North Atlantic Treaty: *"The Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all."*

5 Design intervention

For this project, a makeshift syntactic shell was devised to help mark up[9] a designerly discourse. The impetus to synthesize a creative design method came from Donald Schön's *Design Worlds* and IDEO's *Method Cards*.

<word></word> <motion></motion>
<object></object> <reaction></reaction>

1) The first tag pair <WORD> was used to organise information from notes, collaborative documents, emails and instant messaging. Among the topics discussed were project goals, technical issues, design freedoms and constraints. Actionable information would be converted into sets of instructions.

2) The <MOTION> tag was to arrange evocative, even metaphysical aspects of the intervention. Tasks and instructions could be subjected to an energetic dynamism 'to push the project forward'. |Mot|ion represents the conversion of energy into animating life-force, tools, techniques, and HCI.
Motion might be seen as an interface between creative intent and future objects. In this context, the term relates to both speed and space - or the generation of space at the edge of infinity.

3) The <OBJECT> tag considered the reciprocal connexion between word- and form-finding, the creation of digital objects and their spatial arrangement. When objects themselves become building blocks they don't just occupy space but also contribute to its evolution, as in morphic resonance.

4) Reduced certainty due to inadequate reporting, especially in a cross-disciplinary context, can make it difficult to reconcile agendas. The last tag <REACTION> was used to co-ordinate feedback, evaluation, and change requests. This allowed team members to determine the status of the project and to: (a) Review methods and requirements, (b) recommend courses of action, and (c) redescribe the system.

9 Refers to markup tags as used in Generalized Markup Languages such as XML or VCML.

PART 2

THOUGHTS AND IDEAS

THOUGHTS AND IDEAS

"Design involves the application of knowledge and the production of knowledge, whether the objective is design research or the practice of design per se" (Ritschel, 2012). Part 2 pursues theoretical- as well as hypothetical directions that are relevant to creativity and design. The resulting insights will be used for a basic analysis of the practice in Part 3.

1 Reflective practice

1.1 Emergence and change

"The phenomena that [the practitioner] seeks to understand are partly of his own making [..] The action by which he tests his hypothesis is also a move by which he tries to effect a desired change in the situation, and a probe by which he explores it." (Schön, 1983)

a) Reflection-in-Action allows designers to act as researchers in a given context by developing new problem spaces and by adapting both ends and means. Donald Schön treated the design process as *"a reflective conversation"* with existing situations which (as Herbert Simon had proposed in The Sciences of the Artificial) ought to be changed into preferred ones. The interplay between *"changing things and understanding them"* does not invoke a self-referential system where practitioners freely interpret the objects they actuate. A robust reflective practice would be based on appropriate move- and hypothesis-testing in order to dis-/confirm predictions and intended results.
Iterative design methods can have a generative component, where concept solutions are formulated and artefacts made, followed by an evaluative phase where outcomes are checked against goals, requirements, and criteria. The system may also warrant a redescription before the next design iteration proceeds.

"Im Zweifelsfall lieber gleich sein und unfrei, als in einer freien Gesellschaft Ungleichheit auszuhalten?" (Nolte, 2010)

b) It could be the unknown objects of a new perception that will set in motion desire for change. The reason for social change may be convincing enough to engage individuals, groups, and societies.[10]
If one perceives design as *"the bridge between for example creativity and innovation, technology and the user"* [11] one understands that creativity is integral to human capital and not something requiring to be subsidised by society, or something limited to the realm of the creative industries. Hartley (2009) identified three models in the creative economy:
(1) Creative industries as *art*, which he says leads to a 'welfare model', (2) creative industries as *media industry*, and (3) creative industries as *knowledge* for an emerging economic model with evolutionary growth.

2 Continuum

2.1 Modes of being

Cyberspace has been described as a mode of being. The experience of 'being' in cyberspace, as opposed to viewing the same on a screen, requires a certain interactivity and virtual objects to simulate one's presence. Iconic representation ensures that my digital avatar will shake its head when I disagreed by typing the word 'No'. Avatars can be used to communicate in a group, but this requires the co-presence of participants in the one electronic space. 'Technological-human fusions' like AI-Chatbots can be invoked from multiple computers and at any time. In human-agent teaming, software agents collaborate with each other, as well as human operators.

> If the materiality of the body is not an 'account of the mind' then, arguably, all matter may be reduced to energy or data and reassembled in another space. And 'the projection of thoughts into liquid crystals' (by means of electric signals, bio- and technological materials) would be a result of *"the deconstructed self."*

10 Attention is drawn to Fukushima and the ensuing consensus in Germany to cease the production of atomic energy.
11 Commission of the European Communities: 2009, *Design as a driver of user-centred innovation*, Commission Staff Working Document.

3 Innovation space

3.1 Changing worlds

"What is real or what exists is whatever may, directly or indirectly, have a causal effect upon physical things [..] We may even take the abstract thought content of a theory to be the set of its logical consequences." (Popper, 1978)

Karl Popper describes a universe with three interacting worlds: A world of physical objects called world 1, a world of mental states, or world 2, and a third world containing products of the human mind. World 3 objects, such as languages, stories and works of art, may have one or many world 1 embodiments.[12] Neither the concrete objects of world 1 nor the abstract objects of world 3 can be known without the intermediary of a human mind.

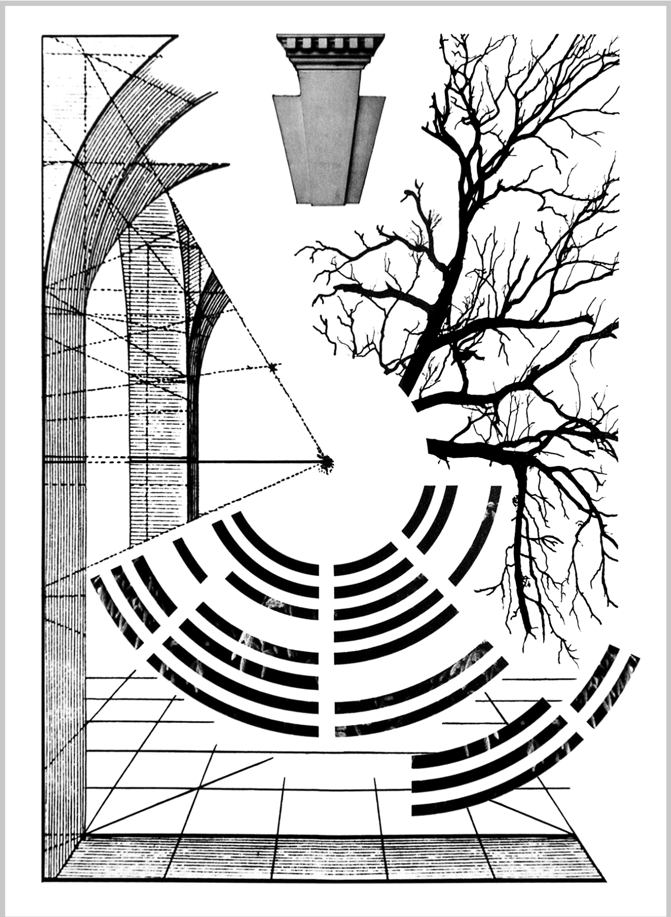

Figure 5 Splendor Solis, Photomontage by the author

Popper differentiates between subjective knowledge arising from mind-brain processes [world 2, world 1] and objective knowledge comprising *thought contents* from world 3.

> There is a certain constructionist interplay between *poiesis* and *techne*. Daniel Downes considers modern technology as *"the structuring force of reality"* and suggests that computers *"transform what we believe about ourselves"* (Downes, 2005).

> Henri Bergson said that *"intellect and matter have progressively adapted themselves one to the other [leading to] a certain agreement between subject and object"* (Bergson, 1907). And yet, what would happen to the non-subjective (atoms, gravity, DNA) if our knowledge of it is reversed? Every constructivist effort constituting human perception (and consciousness) is surely based on some objective order, that is ... *"was nicht anders sein kann als es ist"* (Romero-Tejedor and van den Boom, 2013).

> Design can be understood as a universal change agent: *"Design ist ein Prozess, der Wissen benutzt um neue Formen und neue (Formen von) Wissen zu generieren"* (Jonas, 2012). Also, the development of a strong basis for design thinking may be tied to three subject areas of design and design research, namely *forms* [products, aesthetics], *processes* [praxiology, logic] and *knowledges* [people, epistemology].

> Designers need to reinvent themselves constantly. Environments for creativity can help designers develop interdisciplinary skills to generate and prototype ideas: *"We encourage exploration by constructing (interface, interactions, software, and hardware) as a process that creates [..] objects to think with"* (Do and Gross, 2007).

12 According to Peter Downton *"design ideas belong to 'world three' [..] although they are represented in 'world one' via drawings or models"* (Downton, 2003).

4 Representation

4.1 Representational state

In Distributed Cognition, a given activity takes place by means of functional systems that bring structures and media *"into coordination with one another."* A functional system typically consists of environments, artefacts and individuals, as well as internal or cognitive processes, which together drive *"the propagation of representational state"* and the transformation of knowledge (Hutchins, 1995).
If the task were to link a present effect with an unknown cause, one should *"assign likelihoods to [..] various hypotheses."* A Distributed Cognition Analysis (Preece, 2007) enables *"an event-driven description"* of cognitive systems involving a problem space, co-ordinating mechanisms and human communications.

4.2 Representation and immanence

"Design consists in specifying an artifact [..] At a cognitive level, this specification consists of constructing representations of the artifact [..] Using external representations requires internal representations, in a continuous interaction between the two." (Visser, 2006)

a) The act of design may involve transforming an input representation into an output representation by duplicating, adding to, concretising, detailing or modifying it. With schematic design, the origins of a representation are conceptual, resulting in the simulacra of a reality ... *"eine Realität, in der Du dich mit deinen Gedanken aufhältst"* (Romero-Tejedor and van den Boom, 2013). And the space you occupy determines the time that you live in.

"Concepts are concrete assemblages, like the configurations of a machine, but the plane is the abstract machine of which these assemblages are the working parts. Concepts are events, but the plane is the horizon of events." (Deleuze and Guattari, 2009)

b) One might ask what precedes a concept other than the certainty of thoughts, but then the act of *thinking* would be deduced from *being* ... There needs to be something beyond names or representation, something 'other than consciousness' to presuppose "an image of thought." Deleuze and Guattari call this organising force 'the plane of immanence' - where immanence cannot be immanent to something that is actually a concept.

5 Combination games

5.1 Configurable objects

Configurators can be utilized to determine a product through the combination of components and by generating instructions for its fabrication (Brinkop, 2012). A freshly instantiated digital object, or product, is part of a wider context of building blocks, modules, and components. It also represents the total number of possible configurations. Assemblies of components are subject to dependencies and rules. *Engineer-To-Order* products (ETO) are more complex than *Configure-To-Order* products because the precise nature of their components will depend on emerging relations and properties.

Configuration structures allow designers to:

- Explore vital interactions between divergent and convergent thinking;
- Become *"an agent who packages and presents spatial propositions as transmutable material"* (Gow, 2002);
- Render mental objects digitally and print their model in 3D (virtual-to-real manufacturing).

5.2 Parametric systems

Architects who grasp the world in terms of forces and flows, rather than fixity and representation have used scripting techniques to generate completely new forms. According to Patrik Schumacher, responsive environments require: (a) Sensors, (b) actuators, and (c) digital tools for simulating kinetic systems: *"Auf dieser Basis werden hypothetische Architekturen entwickelt, die auf verschiedenste, aber funktional vergleichbare Weise, mittels künstlicher Sensitivität, Motorik und elektronischer Informationsverarbeitung ausgestattet sind"* (Schumacher, 2002).

In a digital environment, topology, time and parameters can be utilized to model a set of relations by linking them to the attributes and behaviours of a parametric structure via logical expressions. *"Because topological entities are based on vectors, they are capable of systematically incorporating time and motion into their shape as [continuous curvature]"* (Lynn, 1999).
A mountain, for example, enables the flow of water by geologically storing *"virtual force and motion."* By extension, the sets of relations existing between water, gravity, sunlight and trees must be such that a piece of wood can produce kinetic energy both by falling through air and rising through water.

Parametric responsiveness includes the *"real-time kinetic adaptation"* of physical structures and surfaces, electrically actuated transformations of materials at the micro level, as well as 'programmable matter' which is based on nanotechnology.[13]

6 Scenarios

6.1 Agent technology

BOWMAN: You know that we checked the two AO-units that you reported in imminent failure condition?
HAL: Yes, I know.
BOWMAN: You probably also know that we found them okay.
HAL: Yes, I know that. But I can assure you that they were about to fail. (2001: A Space Odyssey)

A stimulus-response mechanism comprising a sensor, an effector, and some connecting wire can act as a simple agent. With different sensors, with straight connections, crossed connections, excitatory and inhibitory connections, or by utilizing threshold devices and functional dependencies, the agent becomes more complicated. Internal modeling, memory and object recognition will, moreover, permit method and deliberation which outsiders might attribute to intelligence "just from the observation of behavior." The designers of the agent, however, would be aware of the sequence of steps which led to the state of the art, and probably also that *"all specified complexity must ultimately rise from simplicity by some kind of escalatory process"* (Dawkins, 2006). In this light, it could even be argued that the human brain is no ultimate explanation of the complex artefacts it creates since it couldn't recall the simple evolutionary beginnings of itself - that is, *"smartness arising out of nothing, or rather, out of not-so-smart premises"* (Braitenberg, 1984).

> The Goddard Agent Architecture (Truszkowski, 2006) consists of several software modules that implement functionality, subscribe to or publish information, monitor their own state, and interact with other modules. An agent typically receives system or sensor data as input which is modelled together with state information in order to formulate goals. The steps of a resulting plan are then ordered, sent off to be executed by various effectors, and their completion status is reported back.

6.2 Transparent citizens

> In the "aesthetization of design itself" the connected studio falls prey to the "society of the spectacle": Design-in-the-world then becomes a form of entertainment where designers play the role to look the part before submitting to a 'hyperreal theme park' [14] populated with equally uncertain "spectators of their own lives" ...

> Is the role of the designer, as the author and proliferator of concepts, to split the *idea* into action [agito] and reflection [imago]?

- A sharp divide between man and machine results in perpetual estrangement and therefore system states where interference can be minimised;
- A non-dominating system requires a reduction of difference to enable more effective representation, but this will put pressure on the amount of affordable non-interference in the quest for certainty;
- Turning estrangement by dissolving boundaries is a risk when similarity becomes vulnerability, the locus of control begins to shift, and the relationship was a mirror where the object and the subject can be reversed.

> Meaning can be discovered, or languages used to describe reality, but meaning can also be created. It could even be argued that genetic engineering emancipates Man from his role as 'a static receiver of appearance' to make him 'a manipulator of essence'.

13 See also: Shrinkage, minimisation, miniaturisation, and dematerialisation of goods, as treated in *State of the Art on Systems of Systems Management and Engineering* (Loughborough University, 2013)
14 Oblique reference to Jean Baudrillard's hyperreality, or "models of a real without origin" (*Selected Writings*, 1992).

PART 3

INSIGHTS, CONCLUSIONS

INSIGHTS, CONCLUSIONS

Part 3 examines vital relationships between Part 1 and Part 2 by using Grounded-Theory methods to establish three categories [as concepts], a set of properties each, and a basic conditional matrix. A number of theoretical frames are introduced to provide more context, including a model of socio-constitutive self interpretations, a theory to describe interacting social- and technological identities, and a transformation concept of filmic space. The attempt will be to sketch design practice and behaviour that is driven by client- & user-centred design, as well as research through design.

1 Creative methods

1.1 Properties

The application of knowledge also leads to the production of knowledge.
Intellect and matter do adapt to each other, but there is an objective order. The real may have consequences.
The representation of both physical objects and abstract objects requires the intermediary of a human mind.
Digital environments allow the mind to shape virtual artefacts capable of entering the physical world.
There is a reciprocal connexion between word- and form-finding. When objects become building blocks they don't just occupy space but also contribute to its evolution.
The definition of a problem space facilitates discourses about the unknown or the new.
It is better to prepare for the future by determining contingencies than to plan everything in advance.
Users of interactive technologies generate data which can lead to 'more evolved versions' of both technology and the user.

1.2 Conditions, actions, consequences

1.2.1 According to Heisenberg's uncertainty principle *"there is no process that can reveal any information about the state of a quantum system without disturbing it irrevocably"* (Roederer, 2005). This statement is significant also with regard to the reciprocal relationship between applying and producing knowledge that is experienced by the designer (as reflective practitioner and universal change agent).

1.2.2 Creative design methods may be employed to: (a) Understand more than the symptoms, (b) define problems, (c) lay foundations for a discourse, (d) work out a realistic solution space, and (e) prepare for possible futures.

1.2.3 An intuitive way to develop a complex problem space would be to mimick and augment our human capabilities, for instance by means of CAD, free-form fabrication, and a robotic assembler.

1.3 Wider context, relations

Social criticism requires a concept of social self interpretation to enable the analysis of social change. Hartmut Rosa thus designed a model to identify, reconstruct and analyse socio-constitutive self interpretations. It consists of: {a} Collective self interpretation, {b} social institutions and practices, {c} the reflective self, and {d) the pre-reflective self, or habitus; {a,b} together represent collective- and {c,d} represent individual self interpretations; {a,c} together represent explicit- and {b,d} represent implicit self interpretations.
According to the model, social change may originate from any source of self interpretation {a,b,c,d}.
It can flow between individual and collective self interpretations {c,d <-> a,b}; or it can flow between implicit and explicit self interpretations {b,d <-> a,c}.

In an elastic system, all the changes due to tensions and discrepancies would be responded to with many small adaptive steps, as in natural evolution. If the norms and values of one self interpretation are impossible to reconcile with those of another, however, the result can be radically different. For example, interaction between social institutions {b} and relevant social discourses {a} ideally permits a kind of co-creation, meaning that an institution will be reformed in reaction to new theories, or that the current doctrine will be adapted to a changing institution ... *"Denn während [die] Ideologie auf der einen Seite jene Praktiken legitimierte und rechtfertigte, gewann sie auf der anderen Seite an Plausibilität und Attraktivität erst im Lichte der Alltagserfahrungen, welche jene Praxis ermöglichten"* (Rosa, 2012). However, if the reigning ideology makes its institutions appear degenerate, or the institutions themselves are accepted while the established values are called into question, a crisis will begin to unfold. The result in that case could be a socio-political revolution to replace the institutions, or an ideological upheaval to change the doctrine.

2 Dual approach

The basis of this category is the parallel development of practical knowledge, gained in the workplace, and theoretical knowledge obtained through literature and library research.

2.1 Properties

Matter may be reduced to energy or data and reassembled in another space. Cybernetic modeling enables the discovery of properties in one [unknown] system by means of another [known] system.[15]
Creativity is integral to human capital. An approach where creativity and rational thinking interact freely helps people understand reality, find the actual problem, and work out solutions.
Involving clients & users in a participatory process allows designers to figure out their real concerns. Scenarios describe interactions between personas and the future product; Usability testing with prototypes enables the collection of design-relevant information.
A design specification conveys what artefacts will do in terms of appearance and behaviour, provides instructions for their implementation, or describes their intended use.
Design methods based on the waterfall model generally represent UI development as progressing in a linear manner from conceptual- to evermore concrete stages of the process.
A project can be represented via formation phases using a gated process. This permits each phase to be separated by a 'gate' where project outcomes must be checked before passing on to the next development stage.
The act of design may involve transforming an input representation into an output representation. If the origins of a representation are conceptual the result will be the simulacra of a reality.
There has to be a lucid moment near the decision point where light is separated from darkness and the angels will either ascend or descend the heavenly ladder.

2.2 Conditions, actions, consequences

2.2.1 Design situations are usually subject to the new, the unknown, or dynamic change - as well as rules and patterns. Designers can take a creative-intuitive approach (divergent thinking) and a rational-analytical approach (convergent thinking) in order to: (a) *"Combine knowledge with emerging patterns to synthesize objects,"* and (b) underpin their interdisciplinary teamwork with a shared representation (semantic interoperability).

2.2.2 The UI-design process can be delineated as a basic continuum: (a) Wireframes indicate layout and visual structure, (b) storyboards allow temporal depictions of a scenario, (c) mockups use colours and textures to instantiate a design language, and (d) interactive prototypes help simulate a user experience.

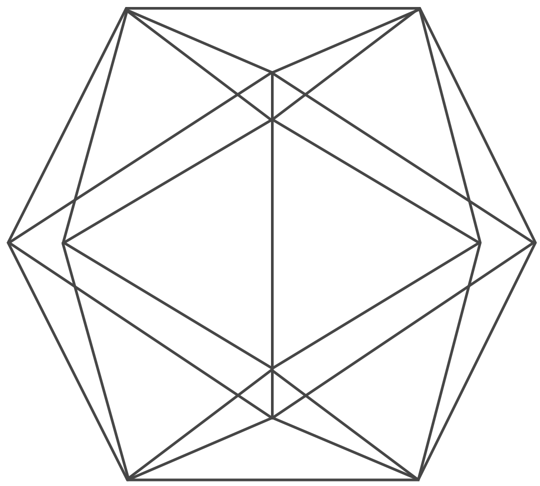

Figure 6 Platonic Solid

A continuum allows designers not only to apply tier-based methods, but also to progress non-linearly via different versions and iterations - that is, by jumping from any one point to the next.

2.2.3 A design practice that: (1) Is committed to client- & user-centred design, (2) cares about reflective practices, and (3) relates to socio-cultural contexts can contribute to: (i) Understanding the needs, requirements, and feelings of stakeholders, (ii) improving the design process through reflection-in-action and peer reviews, and (iii) developing theories[16] to frame a design, or to access new semantic fields.[17]

15 Klir, J and Valach, M: 1967, *Cybernetic Modelling*, Iliffe Books Ltd, London.
16 Making theories is beyond the scope of this paper. Attention is drawn to Ken Friedman's *Theory construction in design research* (2003).
17 Funke, R: 2010, *Design ist Bedeutungsarbeit* in Positionen zur Designwissenschaft, Kassel University Press.

2.3 Wider context, relations

"[Es] entstehen nun Schnittstellen, die nicht nur uns Menschen im Alltag, nicht nur die Sozial- und Kulturwissenschaften in Bezug auf ihre Gegenstandsbestimmung und Grundbegrifflichkeiten, sondern auch die Designprofession im Hinblick auf das, was es zu gestalten gilt, vor völlig neue Herausforderungen stellen." (Häussling, 2012)

Interface design enables connectivity and interaction between heterogeneous systems. This makes the intervention into social structures and processes by complex, distributed, and learning technologies increasingly significant. How do you analyse socio-technical relationships if the social cannot be explained without the non-social and all human actions can be simulated by technology? Neither social determinism nor technological determinism present the ideal analytical framework for emerging technologies: A deceptive machine could just pretend to keep the human in the loop; and to somehow suppress *"the mental representation of things or events that have not yet occurred"* (Roederer, 2005) could mean to lose a valuable technology.

Roger Häussling developed a techno-sociological theory based on Harrison White's work on social formations and patterns of relationships. It applies the concept of *control projects*[18] to describe the interaction between social and technological agents, or rather identities. The term *socio-technical ambage* [exploitation of relations to exert influence] and the term *techno-cultural ambiguity* [attempt to maintain interpretative flexibility] are employed in a two-fold way to analyse interactions between body-mind-consciousness and motor-sensor-artificial-intelligence.[19] Indeed, a process cannot by itself acquire the status of an interaction for this actually depends on the successful coupling of all contributions via socio-technical ambage or techno-cultural ambiguity. Hence, the task of design may be to conceive appropriate connectivities in a "multidimensional web of relationships" by addressing the action- and communication needs of both social and technological identities through form, materials, symbolism, or concealment of complexity.

3 Parametric design

3.1 Properties

A configurable object is part of a wider context of modules, components, and systems of systems.
The components of a user interface typically represent functionality, surfaces, and behaviours.
Assemblies of components are subject to dependencies and rules. With Engineer-To-Order products, the precise nature of some components will depend on emerging relations and properties.
Customizable software surfaces, device- and resolution independence may be achieved through *responsive design*, including progressive enhancement and graceful degradation.
A specification should preserve the integrity of the design language, or product style. It should also be flexible enough to deal with human- and machine-driven variations.
A responsive environment requires sensors and actuators. Topology, time and parameters can be utilized to model a set of relations via logical expressions. (Part 2 /5.2)
The ability to model, learn, reason, and plan allows [autonomous agents] to cross the divide that separates the future from the past.
It is harder to perceive acts and change - that is to say, the world in motion, than to perceive things and states.

3.2 Conditions, actions, consequences

3.2.1 The production of data by computers may be geared towards: (a) The digitisation and algorithmisation of the physical world [including analogue media-objects] and (b) the formation of a native digital world [like cyberspace]. There is also no reason to assume that two intelligent interacting systems able to mimick and augment each other's capabilities will not become "the structuring force of [each other's] reality" as well.

3.2.2 A computer-aided design synthesis[20] (human-automation system) requires a knowledge-based expert system with: (1) A working memory to model an existing situation, (2) a rule memory to store codified knowledge, and (3) a rule interpreter to match elements from (1) and (2).

18 Refers to social ambage [circuitousness of social connections], cultural ambiguity, and decoupling as treated by Harrison White in *Identity and Control* (1992)
19 See also: Manuel DeLanda's machinic phylum and 'mecanosphere' (*War in the Age of Intelligent Machines*, 1987)
20 Based on: Kowalski, T: 1985, *An Artificial Intelligence Approach to VLSI Design*, Kluwer Academic Publishers, Hingham.

3.2.3 Perhaps computers have become the most successful machine in human history because they are made in our image and we increasingly in theirs. Moreover, if the 'persistence of human consciousness' through algorithmisation, storage devices, connectivity, even sensorization and mechanisation were possible, how might a future society co-exist with 'non-organic humans' who don't breathe, never sleep, feel no pain, and continue to evolve at inconceivable speeds?

Figure 7 Aeropittura by Osvaldo Peruzzi

3.3 Wider context, relations

a) Process philosophy describes reality in terms of *change* and *becoming*, instead of *substance* and *being*. By considering film as a spatial practice able to transfer and model the motion of the world, and by setting the procedural and the transformative as a zero point, Laura Frahm has developed a transformation concept of filmic space. Motion does not, in this case, refer to moving actors or cameras. It is rather a limited synchronisation of evolving entities, at the end of which neither world nor film may connect with their original material state again. Filmic space can be understood as a *process* (Frahm, 2012) that involves both transformative spatial thinking and a fixing of representational space. One could even argue that the transfer of intrinsic motion into genuinely moving spaces can overcome the end-state of a medium per se.

b) Es gibt zwei Funktionen *"[die] sich bis heute in Strategiespielen manifestieren: die Idee, den Raum selbst zur dominanten Handlungsebene zu machen - und die Idee einer spezifischen Didaktik, die darauf setzt, im Sinne einer aufklärerischen Pädagogik abstrakte Ideen durch das Angebot des spielerischen Nachvollzugs sinnlich auszuhandeln."* (Nohr, 2012)

There is an essential relationship between space and strategy games. And yet, with media games there's really no space to occupy and objects only take symbolic form. According to Rolf Nohr, the driving force behind a strategy game is conflict: Players running out of resources need to acquire more territory (by developing technologies, creating armies) in order to access new resources - all of which is to be funded through anticipated gains. Strategy games usually require a carto-graphic interface and at least two opposing parties. This contributes to producing a binaristic view of the world [SELF vs OTHER] and segregation based on, for example, ideology, race, and civilisation.[21] The successful encoding, operationalisation, and packaging of specialised geopolitical knowledge into a vivid game experience may lead some players to see mediated global conflicts[22] in terms of socio-cultural strategy too. A reason for this is that computer games are very good at naturalising the artificial.

21 Oblique reference to Huntington, S: 1996, *The Clash of Civilizations and the Remaking of World Order*, Simon & Schuster.
22 Attention is drawn to Weede, E: 2008, *Nation-Building in the Middle East: The new Imperialism?*, Friedrich-Naumann-Stiftung für die Freiheit.

SUMMARY OF FINDINGS

a) *"[The practitioner] does not separate thinking from doing; Because his experimenting is a kind of action, implementation is built into his inquiry"* (Schön, 1983). This statement is significant because it allowed the interplay between client- & user-centred design and research through design to be examined in terms of doing, reflecting, and researching - with blurred boundaries between them and dynamic weightings. For the analysis of the practice, this would result in the category *Dual approach*; [2.2.3] gave relevant interrelationships by means of two triads; [2.2.2] outlined a tier-based method with non-linear courses of action.

b) The findings suggest that change and innovation in the design of industrial-software surfaces are influenced by:

- New and emerging technologies (products, services, systems);
- Growing usability requirements for new and existing technologies (semiotic engineering);
- Widespread acceptance of new interaction paradigms, including new hardware (consumer products & services);
- Styling as marketing factor, projection of modernity, and aesthetization of daily life (corporate branding).

c) Social determinism[23] and technological determinism may be pitted against each other, but from a people-centred innovation perspective[24] a new technology with social implications must involve relevant consulting and participatory processes:
If product development is purely client-driven the desired result may be difficult to implement; if it is developer-driven it may end up being difficult to use; if it is user-driven, the technological possibilities may not be fully exploited.

23 Attention is drawn to Beat Schneider's account of the Bauhaus school in *Elemente einer sozialgeschichtlich orientierten Kulturgeschichte des Designs* (2012). What seems remarkable is that such an elaborate social-change design should convey its principle of equality to an intellectual elite rather than the designated target group.
24 The term 'people-centred design' is used in *Design for Growth & Prosperity* (2012), DG Enterprise and Industry of the European Commission.

BIBLIOGRAPHY

Aarts E & Marzano S: 2003, The New Everyday, 010 Publishers.
Bergson, H: 2001, Creative Evolution, The Electric Book Company.
Braitenberg, V: 1984, Vehicles - Experiments in Synthetic Psychology, The MIT Press.
Brinkop, A: 2012, Marktführer Produktkonfiguration, Retrieved February 2013 from: www.brinkop-consulting.com
Bruell C: 2013, Kreatives Europa 2014–2020: Ein neues Programm – auch eine neue Kulturpolitik? ifa-Edition Kultur und Außenpolitik.
Clarkson J and Eckert C [eds.]: 2005, Design Process Improvement, Springer-Verlag London Limited.
Cooper, A [el al.]: 2010, About face: Interface and Interaction Design, MITP.
Dawkins, R: 2006, 'Intelligent Aliens' in Intelligent Thought, Vintage Books.
Dey I: 1999, Grounding Grounded Theory, Academic Press.
Do, E and Gross, M: 2007, Environments for Creativity – A Lab for Making Things, ACM.
Downes, D: 2005, Interactive Realism - The Poetics of Cyberspace, McGill-Queen's University Press.
Downton, P: 2003, Design Research, School of Architecture and Design, RMIT University.
Dapp T and Heine V: 2014, Big Data: Die ungezähmte Macht, Deutsche Bank Research.
Deleuze, G and Guattari, F: 2009, What is Philosophy?, Verso.
Frahm, L: 2012, 'Logiken der Transformation' in Raum Wissen Medien, transcript Verlag.
Goodwin, K: 2009, Designing for the Digital Age: How to create Human-Centered Products and Services, Wiley Publishing, Inc.
Gow, M: 2002, 'Electronic Purveyance Practices in Architecture' in Designing for a Digital World, Wiley-Academy.
Hammer, N: 2010, 'Designtransfer: Konkurrenz oder Unterstützung fürs Design?' in Positionen zur Designwissenschaft, Kassel University Press.
Hartley, J: 2009, The Uses of Digital Literacy, University of Queensland Press.
Häussling, R: 2012, 'Design als soziotechnische Relation' in Das Design der Gesellschaft, transcript Verlag.
Hutchins, E: 1995, Cognition in the Wild, The MIT Press.
Jonas, W: 2012, 'Design Thinking als General Problem Solver – der große Bluff?' in Öffnungszeiten 26, kassel university press.
Kubrick, S and Clark, A: 1965, 2001: A Space Odyssey, Screenplay.
Leach, N [ed.]: 2009, Digital Cities, Architectural Design, Wiley.
Lynn, G: 1999, Animate Form, Princeton Architectural Press.
Nohr, R: 2012, 'Strategiespiele und Diskurse geopolitischer Ordnung' in Raum Wissen Medien, transcript Verlag.
Nolte, P: 2010, Freiheit in der Bürgergesellschaft, Friedrich-Naumann-Stiftung für die Freiheit.
Popper, K: 1978, Three Worlds (The Tanner Lectures on Human Values), University of Michigan.
Preece, J: 2007, Interaction Design: Beyond human-computer interaction, Second edition, John Wiley & Sons, Ltd.
Ritschel, M: 2012, Melting the Crystal - A Design Intervention, Retrieved April 2014 from: www.20171115.net
Rock, M: 1996, The designer as author, Retrieved July 2014 from: http://www.eyemagazine.com
Roederer, J: 2005, Information and its Role in Nature, Springer-Verlag Berlin Heidelberg.
Romero-Tejedor, F and Van den Boom, H: 2013, Die semiotische Haut der Dinge, Kassel University Press.
Rosa, H: 2012, 'Triebkräfte soziokultureller Dynamik' in Formen kulturellen Wandels, transcript Verlag.
Schön, D: 1983, The Reflective Practitioner - How Professionals Think in Action, Basic Books.
Schumacher, P: 2002, AADRL Masterstudium: Entwurfsforschung, Retrieved September 2009 from: http://www.patrikschumacher.com
Seman, A: 2014, 'Autonomy is a Must for Ship Systems' in Future Force.
Stappers, P: 2007, 'Doing Design as a Part of Doing Research' in Design Research Now, Birkhauser Verlag.
Truszkowski, W: 2006, 'What is an Agent?' in Agent Technology from a Formal Perspective, Springer-Verlag London Limited.
Visser, W: 2006, The Cognitive Artifacts of Designing, Lawrence Erlbaum Associates, Inc.