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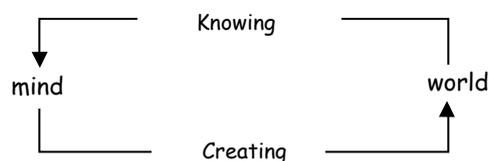
Towards a physically catalysed collaborative design process.

How should design actors with diverging values, norms, preferences, foci and languages collaborate in innovative contexts? Design oriented traditions are becoming increasingly aware of a need for an effective design process where the actors can interact creatively regardless of background and language. Should field specific thought patterns be allowed to induce such a process – or should scenarios be designed to embrace all differences? This working paper will briefly introduce and discuss some process approaches characteristic of different design fields. With a background in research on physically stimulated design processes, it will suggest some basic principles for how generative scenarios could be created with an objective to catalyse shared collaborative conceptualisation.

Design as mind – world interaction

Values, norms, preferences and emotions – of both future users of a product and design process actors – can be understood as *mentalities*. A physical result of a process can be understood as *materiality* representing these mentalities. A collaborative design process can be understood as creation of new materiality from a basis of (participating) mentalities. We can distinguish between (a) design processes with objective to form materiality from established mentalities with incremental changes and (b) design processes with objective to form materiality which builds on, but breaks with established and form new mentalities. (b) is most creative. Real processes will be positioned somewhere in between.

According to Gelernter (1990) designers have up through the design history searched for ideas either in the objective or material world (positivism/empiricism) – or in their subjective or abstracted mind (romanticism/idealism). He holds either of these polar views to be biased and looks for ways to reconcile them through interaction. His model can be seen as representing a basic problematic of design thinking.



In design practice mindful search can be understood as mental abstraction and worldly making as material action. Different design related fields have approached these poles very differently – some emphasising theory and some emphasising physical reality. When design actors from different academic fields are collaborating in teams with an objective to integrate their traditions, they will approach the shared problem very differently. In terms of abstraction or physicality focus; how can central design related fields be characterised? Can indication of an appropriate collaborative design process be acquired from such characterisation?

Some field based approaches to design

In *technological approaches* to design we find that theoretical abstraction is prioritised for essential parts of the process. The central elements in the *WDK-school* relating particularly to immaterial and physical representation are found in the four domains structure (Andreasen 1980): the *process* domain (transformation which takes place), the *function* domain (effects to be created), the *organ* domain (function carriers to create effects) and the *component* or *construction* domain (how organs are realised). A product can be completely defined in either of these plus the constructive structure of the components. The domain structure is hierarchical, going from abstract to concrete. The purpose of a product is its (abstracted) function, which is performed by means, meaning concrete solutions (Hubka & Eder 1988). Openness to possibilities is maintained through abstraction, and designing becomes the task of finding practical means to fulfil functions. When the problem is solved on one level, it can be assigned to a lower level – whereby physical specificity of assemblies is postponed towards the end of the process.

In *semiotic approaches*, where meaning is placed into what we perceive, a similar pattern is intended. Vihma (1995) divides a product into hylectic (material qualities), syntactic (technical functioning), semantic (formal expression) and pragmatic (use aspects) dimensions. The sign's message and relations to other signs and cultural contexts are central aspects. Søndergaard (2000) describes how (finished) product semiotics should be basically distinguished from *design semiotics*. In the latter the product does not exist yet and is intentionally defined through abstraction (e.g. words) describing sign carrier objectives and structure. A design process in accordance with this framework can be characterised as theoretical analyses eventually approaching physical representation towards the end.

In *ergonomic approaches* human behaviour, abilities and limitations are studied and analysed in relation to technical products. Usability aspects of different solutions involve theoretical and practical aspects. Vavik & Øritsland (1999) suggest that up-front theoretical analyses are supplemented with perceptual feedback from realistic possibilities when concrete suggestions emerge. Design processes with focused ergonomic aspects can be characterised accordingly – as analyses accompanied through perceptual experiences.

In *aesthetic approaches*, where the effects of product gestalt are studied, we find that theoretical abstraction and physical representation are intentionally integrated during the whole process. Rowena Reed Kostellow, as portrayed by Hannah (2002), has created a framework called *the structure of visual relationships* aimed at abstract analyses of visual complexity. She suggests that theoretical visual intentions should be accompanied by “3D sketching” (physical representations of formal structures) from the outset onward – through step-by-step procedures converging towards a final “visual statement”. Aesthetic approaches to designing can be characterised through intimate and continuous integration between mental ideation and sense-based material feedback in forming action.

Creative approaches to design are highly differentiated. Sternberg and Lubart (1999), in referring to large body of cognitive researchers, hold that multiple components including cognitive and personality elements must converge for creativity to occur. As Lerdahl (2001) describes, creative approaches are primarily central in early design process phases. Books on creativity agree that physical representations of very many different kinds seem to have a catalysing effect for emergence of creative solutions. But as a main objective of most creative processes is to leave the interpretative “freedom space” open, material “catalysts” are basically abstracted and intentionally kept unspecific.

In collaboration an overall objective will be to create scenarios where all field-based specialities should be given appropriate opportunity to contribute.

But can this be achieved without destroying traditional work-patterns? Let us briefly turn to design-related research from other fields to approach an answer.

Aspects from other research fields

Human mentality, which can process the input from bodily learning, is analysed in the cognitive sciences. Kosslyn (1995) describes some basic characteristics. Through *image generation* we can retain a perceptual image or activate stored information. Such generation or processing of imagery can be separated into *image inspection*, *image transformation* and *information retrieval* from long-time memory. *Pattern goodness* refers to the quality of perceptual actions behind them. Damasio (1994) holds *perceptual* and *recalled* mental images to be prior to language. Such concepts indicate important principles behind the process of forming *new image-based ideas*. But what triggers the establishment of mental imagery?

A substantial updated body of research supports the notion that individual and collaborative design action should be supported through thorough stimulation of sense-based perception, which Ehn (1989) calls *hands-on-experience*. Some selected exemplifying concepts are:

Star (1991):	<i>boundary objects,</i>
Perry & Sanderson (1998):	<i>procedural artefacts,</i>
Brandt (2001):	<i>things-to-think-with.</i>
Boujut & Laureillard (2002):	<i>intermediary objects,</i>
Bucciarelli (2002):	<i>linguistic artefacts,</i>
Human Computer Interaction:	<i>tangible interfaces.</i>

How are new ideas changed into reality? Neurobiology has launched the expression “the embodied mind” (Lakoff & Johnson 1999) which signifies that repeated bodily experiences result in physically locked networks of brain cells called *synapses*. Such structures are hard to unlock, but not impossible. If we are to design real changes, we accordingly have to change habits which can be understood as physical parts of users’ bodies. That is hard work. To prove superiority of the new to the old, repeated sense-experiences of the new are needed for new synapses to form – in particular where aesthetics is involved.

We thereby end up with a design-related aspect of these proceedings that indicates a need for stimulation of the senses both for the creation and for the realisation of new ideas. How can these aspects further indicate an appropriate structure for an innovative collaborative cross-professional design process?

Towards an integration of traditional work-patterns

A process aimed at engaging collaboration between actors representing different design-related fields should embrace all involved work-patterns and foci. From the above superficial and selected elaborations some basic principles can be suggested:

<i>Field</i>	<i>Early focus</i>	<i>Late focus</i>
Technology and semiotics:	Theoretical-abstract, diversity	Perceptive-material, specificity
Creativity:	Abstract+perceptive, diversity	Diversity / specificity
Ergonomics and aesthetics:	Perceptive/theoretical, specificity	Perceptive-material, specificity

If aesthetical gestalt evaluation of assemblies (wholes) is a central issue, as in all design action, postponement of perceptual-material feedback to later phases must be avoided.

In functional-ergonomic evaluation it is likewise. In technology and semiotics abstract analysis is focused in early phases and perceptual feedback later. Creative approaches (with early focus) are perceptive, abstracted and diverse – and a freedom dilemma arises if approaching specificity means leaving diversity. Can a shared approach for these basically different processes be found? And can some principle which could harmonise the diversity/specificity dilemma be introduced in collaboration procedures?

An integration appears difficult since some fields seem to prefer mind to matter up-front. But is a claim of avoiding perceptual feedback in analysis (to leave freedom space open) an indisputable principle? Gelernter (1990) indicates that separating mind and world is undesirable in design action. As shown, cognitive sciences and neurobiology strongly further support a notion of perceptual stimulation.

In Capjon (2004) these and similar interdisciplinary analyses conclude a basis for action. Eleven design cases are analysed according to a Participatory Action Research regime from a resulting assumption that collaborative processes should be actively supported all the way through material modelling (in playful experimentation). All the research results support a perceptual stimulation strategy as basically relevant in interactive engagement. The cases clearly show that the diversity/specificity dilemma can be overcome through development of *many parallel solutions* – which leaves the freedom space open in spite of specific exemplification.

One fundamental condition must be met, however, for analysis-focused fields to engage in such action: theory and abstraction patterns can be maintained according to traditions, but they must be *chopped up and mixed* with perceptual experiences of elaborated possibilities. Counter-arguments obscuring this conclusion have not been found so far.

Thereby I have indicated that in innovative collaborative design processes mind-focused traditions could appropriately be invited to participate in world-based scenarios since long established within aesthetics. Iterative material representations could be understood as catalysing toys for shared stimulation of ideation and realisation.

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