

Relating theory and practice in the design research discourse

This paper gives an example of how we can frame a discussion about the practice of practice-based design research through two-dimensional geometrical visualisations, relating theoretical foundations of design work with stages of product development. The starting point was at one hand a wish to be able to get a clearer overview of how researchers actually work within practice-based design research, and at the other hand a wish to be able to externalise different thoughts on possible ways of performing this type of research. We found that we were able to put words to different questions and concerns by visualising design work in relation to theory and practice through the use of geometrical concepts, like points, areas and directed lines.

Through providing a rather concrete example of how to frame a discourse, the aim is to open up for further discussions about how design work affects research outcome.

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INTRODUCTION

One way to view issues concerning research and design is through the relation of design work to on one hand theoretical foundation and on the other hand to product development. By positioning these two aspects on two axes one can construct a diagram visualising different types of design work with respect to issues of research. The diagram presented here is a development of the diagram discussed in [11].

Through visualisations we can discuss and compare the relation of design to research intention in our own and other peoples' work, and compare different design research work. We also found that we, by drawing a directed line, or by marking out an area, can question design research work and discuss aims and benefits.

Since our aim of visualisations is to open up for a discussion about how practice-based design research can be performed we bring up some of our derived thoughts, ideas and speculations. We also give examples of how we interpret other peoples work with respect to the discussed relation, and we discuss with the help of directed lines different approaches and directions of design research.

It is perhaps necessary to make clear that the word "product" in this paper, not only refers to artifacts, it can also be designed activities, systems, services, time and space etc. Products do not necessary mean just physical things. And by "theory" we understand models or conceptual frameworks for understanding and explanation.

Theoretical foundation

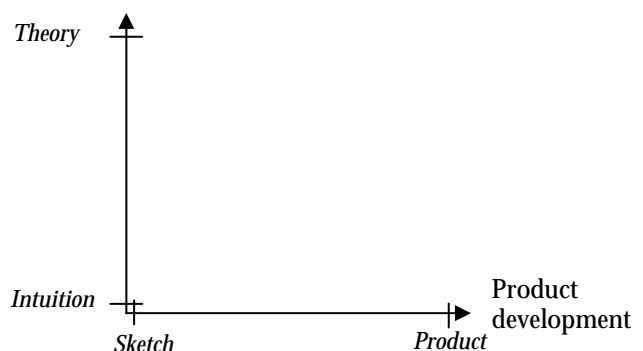


Diagram survey

The diagram is a diagram representing design work, i.e. things, systems etc. Every point within the diagram refers to design. The aspect of research we discuss here relates to design as the UK Council for Graduate Education describes it in their report about practice-based doctorates, that it is not research about practice, or to advance knowledge within practice. It is research work done *through* creative work [15]. This means that this diagram only contains *design work* that is part of

research *through* design, and not design work that rather is research *about* design.

Research carried out through design can be presented as different lines related to stages of theoretical foundation and to stages of product development. The x-axis of the diagram indicates the stage of *product development* of the design work and the y-axis indicates the *theoretical foundation* of the design work.

The scale representing stages of *product development* goes from simple sketches, like pure conceptual design proposals that do not have a strong representation and that exist only as sketches, for example in the form of text or as drawings, to products ready for use. In between there are more developed sketches, mock-ups and design examples of different sorts.

Within product development these stages are often seen as phases on a time axis where models are done before the final product is produced. But, in the diagram discussed here, the x-axis is not a time axis. Design research work can end as mock-ups, prototypes, or as part of a product. And the direction of research can also go from products to sketches – the aim is often not to produce products ready for use.

The scale of *theoretical foundation* starts with design work that has been carried out from pure intuition and ends in design work that is deeply rooted in theory. This means that in the upper region of the diagram, but not in the lower region, the design is derived from theory in some sense, or proven correct with respect to theory (deduction). Hence, the further up in the diagram, the more theoretically-founded design is to be found. In the lower regions, where the design is more founded in intuition than in theory (induction), a design rationale explaining and motivating work is lacking.

Areas

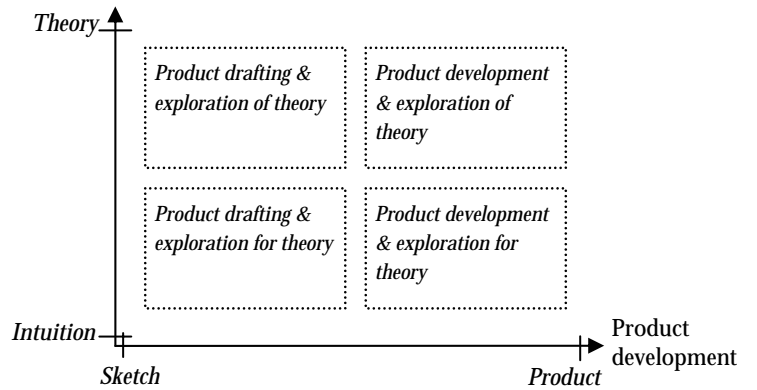
Four basic schematic areas can be isolated within the diagram discussed:

Product drafting & exploration of theory: This area relates to product specifications and drafting of sketches and models with a foundation in theory. Therefore the design work can be seen as an exploration of theory. Within this area, research can end up if it is significant and original but too hard to carry out practically, or if the research contribution is more important as an idea, than as a product.

Product development & exploration of theory: This area also contains design work that is theoretically founded, but the design work here is to a greater extent developed and implemented. Work in this area can be very communicative since it ends in examples of concrete design that is easier for people to relate to.

Within these two upper areas, research starts off from theory, but the intention is not necessarily to develop or come up with new theory. The aim can be rather to just instantiate theory through design.

Theoretical foundation

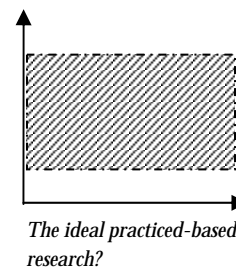


Research carried out by design in the lower areas however, which is work that is not theoretically founded, implies that the researcher relies on that something will emerge from the design process, or from an analysis of the design outcome afterwards. If a design is neither derived from theory nor directed towards theory, the question is in what sense it is research.

Product drafting & exploration for theory is about exploring by product specifications and drafting with the aim to develop theory. If all design work is carried out within this area, though, and if there is not any clear result neither in practice nor in theory, it is debatable if the design work will be accepted as design research. Besides, it can be almost impossible to give a meaningful evaluation of work based on conceptual sketches and non-founded theory. But a theory can of course be a result of design carried out within this area, (the design is then an example of a theory coming). If the derived theory is instantiated through a design, then this design should be positioned further up in the diagram.

Design work within *Product development & exploration for theory* is done through product design with the aim to end up with a theory. Work to be found here can be an important foundation for the development of theory, or work as good examples of a theory, and thus be relevant as references.

A common view of practice-based research is that it is ideally neither at top, nor in the lower regions in the diagram, but in between. Not right at top since the design work there is “instantiated” theory, like a kind of strongly derived product development, on the edge of what we usually call design. And nor in the lower regions since the work there is carried out too much by replacing theoretical foundation with pure intuition.

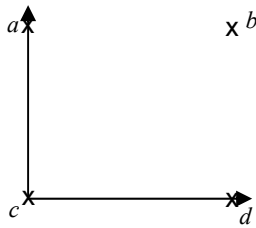


Boundaries

The outer limits for design work carried out in the context of research can in the diagram be interpreted as follows:

a. A conceptual construction based on a solid theoretical foundation. Example: the construction of a mathematical proof.

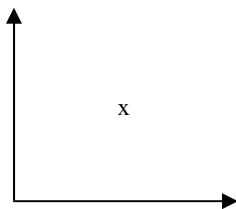
b. A product strongly founded in theory and ready for use. Example: a car with functions and security based on ergonomics, human cognition and psychology aspects, like alarms or built-in constraints for drowsiness, inattentiveness or drunkenness etc.



c. An intuitive sketch. Example: an idea of a shape that is seemingly an underived idea.

d. An intuitive product ready for use. Example: the introduction of SMS (Short Message Service) as part of the GSM standard. A service set out as a by-product, due to the fact that the technology for it already existed, and without a specific purpose or a calculated impact.

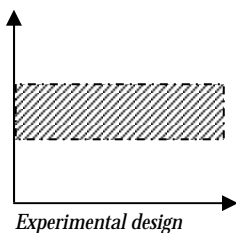
A, b, c, d make up the boundaries of the diagram. Whether design at these points can be design used for research can be debatable, the idea though is that things beyond them can not be.



In the centre of the diagram we position design work that has been carried out as *design examples* according to the x-axis, which means that they are more implemented than mock-ups but not “real” products. And they are, according to the y-axis, done in symbiosis with theory, and therefore work that can be seen as *experimental design*.

Experimental design

Theory can be a research result of design work no matter if the design is derived from theory or from intuition, and it can be constructed after the design act, or at the same time. And there is one area within the diagram that can be interpreted as an area where theory and design are developed side by side, more or less at the same time and influencing each other. This area is positioned in the middle of the axis of theoretical foundation and presented as experimental design.



The description in the UK Council-report of “the more likely” procedure of PhD-research in the practice of art related subjects, exemplify one way of looking at experimental design:

“This kind of research does not, typically, begin with a predetermined set of questions or assumptions but arises from particular situations or contexts, which can be described with sufficient precision for a project to emerge which can be scrutinised and approved by the institution on dialogue with the supervisor. ‘Emergent’ is the key element as, significantly, decisions and directions within the project are determined by the development of the project.” [15:13] This could also be a description of design that lies below experimental design, but the ‘key element’ of being emergent is what is important with respect to experimental design. Within experimental design it can be hard to tell in advance where you will actually end up, and with what, even though you can have a clue and a goal that actively guides the process. The way to go somewhere is done by experimenting, trying to find out how to go and reflect upon what the experiments imply and involve.

What is also mentioned in the report is that this way of working demands a lot of the researcher. The researcher has to be able to constantly be self-reflective, to critically analyse the ongoing work, and to evaluate the process and reflect on the ways in which practice relates to theory. Knowledge, transferable and constructed, can otherwise be missed. Compare with the notions of *reflection-in-action* and *reflection-on-action* [14]; a practitioner should aim at putting words to their *knowing-in-practice*, that otherwise easily can be made ungraspable by simply calling it talent or wisdom.

There is also another way of looking at experimental design that can be represented by the critical design done by Dunne in his PhD-thesis *Hertzian Tales* [3]. The design proposals in his thesis are meant to be questions instead of answers and stimulate a discussion about our relationship to electronic objects. The proposals and the theory, in the PhD-thesis, are very well separated without any clear method describing their relationship, he simply mentions that his conceptual design proposals are “*by-products of an investigation into a synthesis between practice and theory, where neither practice nor theory leads*” [3:14]. And that the proposals are not illustrations of the theory, but that they evolved simultaneously and are part of the same design process [3:15]. It is quite easy to imagine that the design proposals are inspired by and derived from theory read, and that the theory written is inspired and derived from the design proposals; therefore they also give an example of experimental design.

Axioms and definitions

We regard that construction and definition of a theory is clearly something positioned in the lower end of the product development axis. But where should we, for example, put foundational definitions on the theoretical foundation axis? It is clear, for example, that we would position an axiom (that is not proved) lower than a theorem (that is proved). But what about the position of an axiom and a definition? Could for example the parallel axiom (given a line *l*, and a point *p* not on *l*, there is exactly one line *i* passing through *p* parallel to *l*) perhaps be positioned lower than the definition of circles, like the parallel axiom in the origin of coordinates and the circular definition a bit further up?

DIRECTED LINES

The diagram proposed here is a tool for discussing research carried out through design, not to simplify essential questions but find ways to bring them into the light and open up for a discussion where parallels between works can be drawn. We need ways to relate to other peoples work but also to plan our own, and see tendencies. And this can for instance be done by indicating directed lines within the diagram.

The lines can partly work as an analysis of work done, partly as a discussion tool of aims and evaluations of research work, but

also last but not least, as a tool for a more concrete visualisation of concepts and ideas.

Why the lower areas are of interest

Exploration for theory by product drafting and product development can be a way of redefining and questioning a field of research. Buchanan brings up the issue of fields of research with open boundaries: *“Frankly, one of the great strengths of design is that we have not settled on a single definition. Fields in which definition is now a settled matter tend to be lethargic, dying, or dead fields, where inquiry no longer provides challenges to what is accepted as truth.”* [2:8]. Compare with Kuhn’s description of a period of professional insecurity preceding the emergence of new theories, and together with discoveries a paradigm shift [10].

Within several areas of design the issue of basic definitions is for sure not a settled matter. It is still necessary to look for the boundaries. Therefore, we would say, it is still interesting to carry out design work in the lower regions, without starting off from a given theory. To start out from theories from other areas and try them out within another area can also be a way of questioning a given area, however we should not neglect the possibility for new things, unforeseen, to emerge from experiments more or less guided by intuition. We should perhaps not neglect to explore phenomena so to speak with an “open mind”, without the preconceptions of what it is on basis of a given definition. This can be highly relevant within rather new areas, and perhaps also as Buchanan describes it, necessary to keep a field alive.

Exploration through experimental design is perhaps in some sense a more open form of design research. One could probably compare this with technology driven research where one does things just because it is technically possible. The difference is though that in this case it is the possibilities of the design area that are in focus, rather than the possibilities of technology; this is possible to do, let us try it out and get a better understanding of a given area.

One way to understand the intuitive starting point is that of opening and broadening an area of research. Jones divides the design process into three phases, divergence, transformation and convergence [9]. The first one, divergence, is about opening up for new ways of thinking, and leaving old thoughts that are taken for granted conscious as well as unconscious. It is about intentionally opening up for uncertainty, to get around preconceived assumptions and the established routine of problem solving. And this is a description that relates to starting out closer to intuition than to theory.

The point is not to say that starting out closer to intuition is the only desirable way to perform practice-based design research. Rather to say that research could actually gain something from it, since the definition of “design” is not clearly set yet, and the field is thus not static in its foundations.

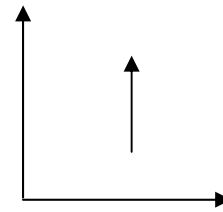
Why leaving intuition for theory

Jones describes the phase following divergent work as a phase of transformation. That is about finding patterns and structuring the outcome of the divergent phase, and by that get basic insights about the problem at hand. The transformation phase is to set the boundaries of the design problem.

In the last convergent phase one should finally make decisions, hopefully on good grounds as a result of work done in earlier stages of the design process. Here, one is working in the direction away from abstractions and reducing the uncertainty, down to concrete and detailed design. [9]

The phases of divergence and transformation can be seen as producing a foundation for decisions; a foundation upon which

future design decisions could be made. We think that these three phases accordingly can be represented by moving upwards through design, towards a theoretical foundation. Which means an upwards direction that finally ends in the convergent phase where the final design is carried out – out of the produced theoretical foundation.



Jones describes the transformative phase (here to be compared with the area of experimental design on the y-axis) as the most creative phase whereas the convergence phase in some cases can be automated. If all facts are already gathered and structured, the design solution to a problem could be given and therefore simply be derivable by something or someone else than a designer [9:68]. This view relates to the absolute top position in the diagram – to do design work completely founded in theories, to derive the design. Is that something non creative, where the foundation leads, so to speak by definition, to a given design? In some areas this pure derivation is desirable, like in safety-critical HCI-systems where the human factor is central. The question is though if it is possible and what it actually means.

A directed line upwards means to gradually create theory out of design work. In the end a progress upwards is desirable, but perhaps not with the aim to go right to the top. The reason is that design carried out on basis of pure intuition can not give an example of how theoretical knowledge can be transferred into concrete design. The transfer of knowledge is of course of central importance in research, and the role of the design object is in this context a central issue (cf. [8] [13] [15]). One way of transferring knowledge through design work is to start out from the lower areas and move upwards; we build theory out of design work, and in the upper regions put that theory into practice. This gives a concrete example of how to put the theory, the research outcome, into practice, as an illustrative example demonstrating transferability.

Evaluation - upwards

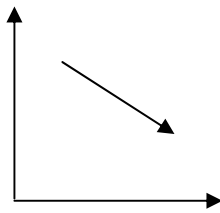
In the scenario sketched above, an evaluation of the design work with respect to usability is perhaps a bit misleading. There is no initial theoretical foundation - no initial requirements to fulfil. The aim is to build theory rather than to solve an explicitly described problem. It should therefore be more meaningful to look at how transferable the design work is with respect to the knowledge produced. Final design work should be evaluated with respect to how much it actually contributes to the produced theory, and whether this could have been done in a different and better way.

The central question for evaluation should in other words be how well the upper most design works as an example of the theory constructed, and not to forget, how the given design work has contributed to knowledge in the field.

Working in a direction upwards probably requires, to a greater extent than other directions, that the researcher/maker reflects both during the design process and afterwards. One part of the evaluation can therefore concern the success of reflection, which means that reflecting skill can be improved and made more open for others.

Direction downwards

Let us now turn to the issue of lines with a downward direction. An example could be a line starting out in *product drafting & exploration of theory*, approaching, but not reaching, *product development & exploration for theory*.



This example would imply that we start out by doing design sketches and models founded in theory, and then continuing the work further down, which involve further implementation and product development that will influence and change the theoretical foundation. And, in reaching the lower right area, the work ends in design based more on compromises within the design process, than on theoretical foundations. But, it can still be a design work that afterwards can be analysed and evaluated. The last part can be seen as the final realisation of the product, more based upon learning from the process, than upon a derivation from a given theoretical foundation.

It could be a matter of developing a system within the field of Human-Computer Interaction with focus on usability issues. Heading out from theories concerning human behaviour and/or analysis of human behaviour from observations etc, a rough sketch can be made. The process is then iterative, and the theoretical foundation should be reconsidered as design problems occur. At this stage both design, by prototyping, and theory, by putting it to practice and being tested, are developed. When a solution answering the specification is found, the product just has to be realised.

This directed line is also a visualisation of a common problem of translating theory into design; the gap between analysis and design. As Buchanan describes it: *“What is perhaps most important to remember as designers move deeper into the human sciences is that the universal propositions of the behavioral and social sciences do not lead directly to the specific, particular features of successful products. There is a profound, irreducible gap between scientific understanding in this area and the task of the designer.”* [2:16]

A line in downward direction can be a visualisation of the gap since an ideal line would start out from the same spot but instead go straight to the right. The design would in that case be strictly derived and therefore easier to formally explain, defend and argue in favour of. But the difficulties of translating a “scientific” understanding into a design (temporal and spatial), forces us downwards towards experimental design. And this can widen the perspective. If the gap is recognised the designer can work on it, try to reduce the gap through design experiments and perhaps come up with a more “practical” interpretation of given theoretical foundations.

If the starting point is theory, we would say that a direction downwards can be more realistic than a horizontal one. A horizontal line in the uppermost region would for example imply that we should be able to automate the design as already mentioned; i.e. actually “derive” the design from theory.

Evaluation - downwards

For the downward directed line discussed above it is probably more interesting and worthwhile to evaluate the final design work with respect to given requirements, i.e. the more traditional HCI-way based on the specification of

requirements. The reason is that the direction of the line assumes that the research *intention* is different from the intention connected to the upwards directed line discussed earlier. The intention behind the latter example, about development with focus on usability issues, is rather to develop a product with regards to a known context, and known users etc, than to broaden and explore an area through critical examples. Evaluation of outcome of research in a downward direction therefore concern the way in which design work has influenced and altered knowledge about initial given theoretical foundations.

These two different research intentions, and their corresponding evaluation approaches, is perhaps also reflected in the different sections People, Form and Process in the book Design Research : methods and perspectives [12]. The section People contains essays that present perspectives of designing in relation to the people the design is aimed towards. The section of Form is rather about form, structure and materials, and the section of Process contains how design research can be carried out. In the schematic overview of the book, the Form section contains several essays that are described concerning research methodologies as experimental and speculative, and not as qualitative or quantitative (only one essay out of seven is described as qualitative). The sections of People and Process on the other hand, contain quite few experimental and speculative essays, almost all of them are though seen as qualitative and some also as quantitative. Although these sections contain design research methods and perspectives and not the actually design work carried out in a research process, we wonder if they could not also be described as two different directions for lines, related to at least theoretical foundation. Like upwards for Form and downwards for People and Process? Design research concerning form and material can also be more experimental with an aim to broaden and open up an area. But methods that are described as qualitative and quantitative can perhaps not allow or support research that strives to open up for new ways of thinking - hence a difference in evaluation between upwards and downwards directions.

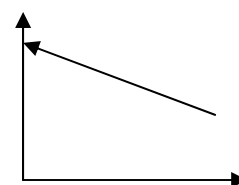
EXAMPLES

Below we will give some examples of interpretations of practice-based design research to further explain and illustrate the use of directed lines.

From product development & exploration for theory to product drafting & exploration of theory

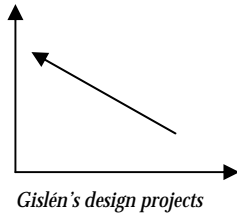
At the Ulm Hochschule für Gestaltung, a design practice was developed that we would positioned in between the upper and lower regions. The design was supposed to be grounded in social awareness and informed political practice [1].

Even though Bauhaus ideas to cleanse students from prior academic training, to open up for free creation, somehow still influenced the teaching, the Ulm school evolved to give courses in engineering sciences, scientific theory, and semiotics at the expense of sculpture and basic design [1]. The directed line of the design work in the school could perhaps be described over the years as moving towards the left end of the diagram, and perhaps even further left since they turned out to leave the practical work behind and only work with design theory.

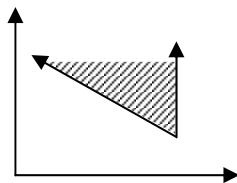


Ulm Hochschule für Gestaltung

A political motive of design can also be found in the PhD-thesis of Gislén where design is seen as a way to break up views of science by question prevailing power structures [7]. We would though position her design quite low in the right area heading left upwards.



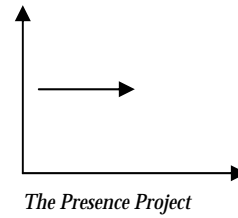
Most of the design projects presented in the thesis are explorative within the field of collaborative narrations, hence the low right position, but one part of the project Avatopia is based to a much greater extent on a theoretical foundation, but only a part though that was not implemented, only sketched. That the directed line goes towards sketches instead of remaining closer to products is probably something unwanted. The aim seems to be to start off from the same point but instead continuing straight up. The reason why this was not done was probably due to issues like compromises with other participants, funding issues, or other partners research interests. Hence, most of her design presented in her PhD-thesis does not work as an example of her political standpoint, but the design that is close to products can be seen as an influence for the standpoint, and the part of the Avatopia project that remained as a sketch, can be seen as a sketch of how an instantiation could have looked like.



The potential differences between intended directions and actual work directions could be of interest to map out and discuss within research practice. Where do we intend to go, and what happens if we end up elsewhere? How does this difference affect research outcome?

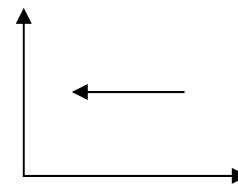
The Presence Project

The Presence Project [4] could be described through a directed line within the area of experimental design, heading straight to the right and ending in design examples. It starts out from material collected using *Cultural Probes* [5]. The probes were material in form of maps, cameras, postcards etc that they gave to the elderly in three different suburbs in Europe. The researchers/designers encouraged the participants to respond through the different items and post them back as they wished. The project team related to the material as a source of design inspiration, and not to something that somehow contained a solution to design problems, or defined some given needs. Therefore we position the project in the middle of the theoretical foundation axis in the area of experimental design.



The design outcome, in the form of a slogan bench and an image board, is interpreted as design examples and the reason for the straight horizontal direction is that they themselves in a way are instantiations of the cultural probes method. The bench and the image board are supposed to portion out images and slogans from project subjects to the neighborhood, which is quite similar to what the probes resulted in for the project team. The design is therefore a concrete instance of the theory they started out from and developed, i.e. their “cultural probes” method. Our guess is that if they had, in a way, killed their darling, the directed line would probably have been directed a bit downwards instead.

Let us consider a directed line going in the opposite direction. That would be to start out closer to products but heading towards design examples and sketches, founded as much in intuition as in theory.

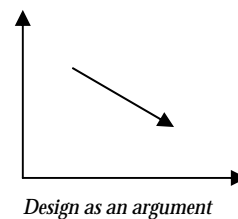


We realised that we had some colleagues working in this way, starting out with design of a product and by investigating issues addressed by that product designing more and more separate parts and also approaching future concepts through models and sketches.

Design as argument

If the design outcome should be able to be argumentative in itself, without the context of an instructive complement, it would rather be positioned further to right than left, because a more developed and more final product tends to be more persuasive.

The directed line might go downwards, which would imply that the design is not only instantiated theory, it is also something that we can build theory from. It can provide a basis for more profound design, and at the same time, as it moves in the direction of intuition, it makes the argument easier to grasp.

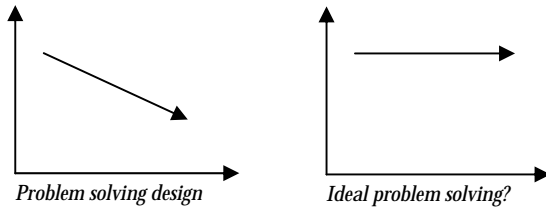


We can think of at least one exception though, that is if product development in itself leads astray, away from the main idea

into more insignificant issues of “form”. (With “form” we then understand both the physical and temporal shape of things and systems as well as the form of interaction.) If form is not the main point and the product can be taken for a product ready for production at anytime, it can happen that we turn our attention to wrong things, away from basic arguments. Compare with Dunne’s idea that just the *thought* of use can be fruitful and open up more than perhaps the actually use of more or less fully developed products or prototypes [3:106].

Problem solving design

When the aim is to solve a problem through design the direction can be similar to the direction that relates to development with focus on usability issues; a descending direction, and tangent to experimental design. This means that the process consists of work where theory has to be transformed into practical work and into a fully developed product. And the way of accomplishing this difficult task is to try to also develop and adjust the theory, through experimental design.

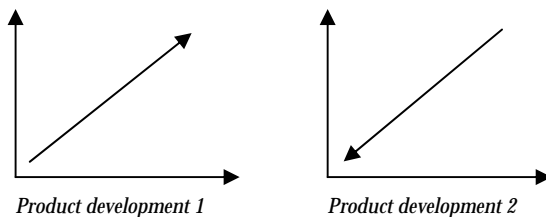


But a directed line pointing straight to the right could be seen as the ideal problem solving direction, as mentioned earlier, where the design is more evident given and where the design can be derived from theory to a greater degree.

As also already mentioned we think that the possible difference between ideal and actual directed lines can be fruitful to consider with regards both to research outcome, and to design outcome.

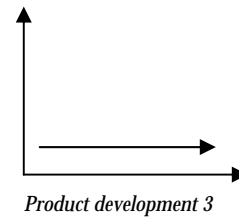
Product development as research

The horizontal directed line in the example above can also be seen as the ideal product development line. Other lines of product development could be of diagonal directions: one that starts out without any solid investigation or studies, but ends in a product that is theoretical grounded.



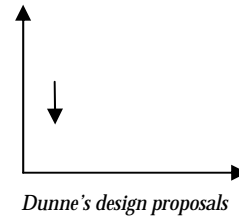
And one that does start out from a solid foundation in theory but ends in a far more intuitive sketch. An example of the latter one, the one perhaps more difficult to grasp, could be the design task to find a solution for a transport system in a city. One could of course start an investigation concerning the way in which this is done today, and give similar solutions based on the same foundation. But one can also give some futuristic sketches that are more speculative, based more on intuition and implicit knowledge. C.f. Jones’ [8]. Stating objectives – and Removing mental blocks methods.

There can, of course, also be product development that takes place solely in the lower region, without any theory involved. To use this kind of design work in a practice-based research should imply, as already mentioned, that the work done has to been given fruit to a theory and/or that the design can work as an example of that theory, even if not derived from it.



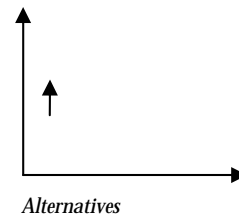
Experimental product drafting

The already mentioned design work of Dunne in his PhD-thesis Hertzian Tales can be described as experimental product drafting. The design in form of proposals is just sketches and the aim with them, is to make clear examples that support reflection and open up for discussions. They are founded rather in intuition than in theory, perhaps of communicative reasons.



We describe this through a direction downwards; as proposals with a starting point somehow in theories but ending up somehow in intuition. An example can be the “Thief of Affections” based on the realisation “*that electronic products are ‘role models’ and that when we use them we become the generic user they are modelled on*” [3:97]. This proposal is an object that embodies an alternative model of user, the perverse one. And with a line directed downwards the proposals contribute to a development of a theory and work as an argument of that theory.

The design proposals in [6] are also within the area of experimental design but we see them as a line directed upwards instead. These design proposals are concerned with the visualisation of different alternative values, (like diversions, influence, intimacy and mystery instead of efficiency and productively); the best embodiment of the values are the proposals themselves. Hence, the directed line goes upwards, a line that opens up for questions by visualisation and instantiation and not, as in Dunne’s case, through a question in the shape of design.



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