

Outline of a general artistic design research program

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I General outline

What is it that defines a research field, a branch of science (research)?

To say in general terms that a field of research X concerns the study of Y does not tell us very much. We all know that it is irritatingly difficult to define a specific discipline, say mathematics, in this way. Yes it has something to do with numbers, but also with lots of other types of objects. There is also something about precision in definitions, something about constructing and proving etc.

Methods and general methodological considerations certainly belong to that which maps out and defines a research discipline. But then again, that is not all.

What is it that tells us about the nature, the characteristics, of a branch of science?

Results is clearly a key issue here. If I manage to grasp the true meaning of some fundamental mathematical results, say the definition of the Lebesgue integral or some basic results in complex analysis, I would surely have a good picture of what mathematics is all about even if I could not make this explicit in a few lines.

Similarly to know that musicology is concerned with the study of music does not provide me with very profound insights. But a careful reading of an in depth analysis of, say, the music of the Netherlands school, given that I understand what I read, will certainly tell me a lot about, at least a branch of, musicology.

As “artistic research” is establishing itself as a field of academic research (Biggs, Karlsson 2011), a branch of academic research, it is only natural that we ask what it is all about. Not only from the outside trying to understand this “new” member of the academic research family, but also from within the field itself discussing directions, defining new research programs, mapping out sub fields and sorting out ideological matters.

What is it all about? This should also be visible here in the characteristics and nature of results. So what can we see?

What is artistic research? Two rather distinctly different cultures emerge as we try to answer this question.

(A) Artistic research refers to artistic ways of doing research, i.e. to the artist as researcher.

(B) Artistic research refers to ways of developing artistic practice, i.e. to a long tradition of artistic development work.

It is (A) that makes the distinction between scientific research and artistic research a methodological distinction; there are scientific ways of doing research and there are artistic ways of doing research. While (B) on the other hand defines artistic research as, more or less, just another field, branch of research, i.e. the “faculty” of artistic research.

In the discourse surrounding (A) it is often said that artistic research is a new way of working in research, while the way we understand artistic research in (B) explicitly emphasize that it builds on a very, very long tradition of development work.

It might seem that the question “what is artistic research?” is a purely “philosophical question” with little relevance for the practice and politics of artistic research. That could have been the case if (B) would have been the common understanding of artistic research. In that case, a somewhat naïve and intuitive understanding would certainly have been good enough as a foundation for practical research work. But (A) makes things a bit different as it introduces a new basic distinction between scientific research and this other thing “artistic research”. What does it mean to use artistic practice as a basic methodology for research? Is it a parallel universe – artistic sociology, artistic physics etc – or what?

The typical examples where methodological outlook is central in identifying research tell us about an approach to a subject; critical theory (the Frankfurt school on issues of social science), algebraic topology (using algebraic methods to explore topological problems) etc.

Two questions:

(i) What is so special about “artistic methods” that makes artistic research very “different” from scientific research?

(ii) What are we actually referring to when we talk about “artistic methods”?

Academic subjects that fall within the category of scientific research are full of aesthetic considerations, critical explorations, challenging examples, provocative interventions and so on:

- a theory is judged by what it manages to capture, but certainly also with respect to issues of form and expression. To introduce new good notation and strong new foundational concepts is in a non-trivial sense artistic work,

- looking for a strong research issue (question) in, say, social science is a matter of critical exploration that just as well could be a project within free art,

- the strong challenging examples that questions given perspectives is dependent on the expressiveness of formulations,

- what Kuhn (Kuhn 1962) refer to as a shift in scientific paradigms is a sort of forceful intervention,

and so on.

Is it just that science prove things and art show things? This line of distinction is certainly not easy to draw with any interesting form of precision.

If it is difficult to say something about what makes “artistic methods” so different from “scientific methods” it is not easier to explain what “artistic methods” are in a more general sense.

A further problem with the distinction between artistic research and scientific research is that it is notoriously difficult to say anything reasonable about “scientific” in a general sense. If we look at the academic subjects that “scientific” is supposed to cover things do not get easier; from philosophy and literature studies via cultural studies and experimental psychology to physics and mathematics and everything else in between.

Or is this reading of (A) – as a matter of methodology – wrong and what marks out artistic research is the character of results, they are works of art in some sense. There is a clear danger of mystification of research results here; not scientific but artistic...

So what is then the difference between art as such and artistic research? This is of course impossible to answer directly in any interesting way, but it should be possible to discuss the results we expect as an “outcome” of artistic research, just as we can discuss the character of results we expect as outcome in say historical studies or in mathematics.

Now let us say that we want to discuss the issue of artistic research from the perspective of results in the context of (B). What types of results do we expect as contributions to the development of an artistic practice? Certainly methods and techniques, but also brave new directions:

- Methods

- Techniques

- Programs

What is common here, irrespectively of the artistic subject in question, is that the result comes in the form of suggestions.

Methods, techniques and programs are not propositions stating facts, but suggestions about ways, and directions, of working.

If that is the characteristics, and nature of result content, what is the bearer, what is it that brings forth the result?

In all three cases it makes perfectly sense to think of the bearer in terms of text providing for general presentations, descriptions, explanations and discussions. But what is missing in such a more general presentation is what suggestive and convincing examples bring forth; expressional implications.

If it is a performance, an intervention, a painting, a piece of music, a film, a theater play, a building, a text etc that display methods, techniques, programs by example, then it is in the design of the performance, the intervention, the piece of music, the film, the theater play, the building, the text etc that the result, with respect to expressional implications, resides.

Take as an example the idea of *historically informed performance* as a program for the performance of baroque music (Harnoncourt 1985, 1987). We can of course present and explain this idea in the form of text, a general definition together with perhaps some example descriptions. What an example in concreto brings forth is what this idea is, or could be, in terms of expressional implications. We so to speak “see” what *historically informed performance of baroque music* is, provided the given examples are strong in expression and suggestive enough.

What does it mean to say that it is the design of the examples that is a key factor here? It is the way in which we shape the performance as concrete gestalt that displays the result, i.e. in this case the idea of historically informed performance of baroque music.

Similarly when an artist after years of research presents a new technique through a series of paintings, in a series of films, a series of compositions or a series of buildings etc.. It is in the design of the paintings, the films, the compositions, the buildings etc that we “see” the technique through its expressional implications.

Not just that it is historically informed performance of baroque music, or a cubistic painting, but more the very way that it is done, i.e. the particular design of the performance, the painting. To talk about a film in terms of the story it tells, but not how the film in concrete terms tells it, is a prime example of avoiding speaking about the result of artistic work.

So we could say that what is central here is *design as research results*. It is then, of course, important to note that “design” is used in a very general sense; the forming of (concrete) expressions. As research results it is suggestions we put forward in the form of concrete examples and it is in the design of the examples that the true content of the results lives. The question then is how this defines, characterizes artistic research as an area of research.

II Design as research result

1 Research results

A result is that which comes out of doing something.

What does this “comes out of” really mean?

There is a direction in doing something – even if that direction is visible only much later –, and there is a distinction between doing something and achieving something.

I turn on the light and the room lights up; from dark to light. I go into the bathroom for a shower and come out fresh and clean in new clothes; from sweaty to fresh and clean.

That which comes out of doing something are expressions of achieving:

- As a result of the volcanic activity on Iceland recently people went by bus or train through Europe instead of going by airplane,
- As a result of systematic mass vaccination smallpox has ceased to exist as a “living” disease.

Research; an act of searching closely, i.e. searching, searching, searching and searching again. Research results are consequently, that which comes out of, arise as a consequence of, searching; from searching to finding.

Presenting research results is then a matter of describing and discussing such expressions of finding. As outcomes it indicates it is something open to take away and use for further work; what for, for whom?

Searching is in general understood as searching for something given. It is tempting to think about research results in terms of what comes out at the very end of a systematic search process. But what is it? Something we initially are looking for, something we under way understand that we are looking for, something we actually find, something we should have been looking for, or something we found by pure chance as we were looking for something else?

I was looking for X, but see what I found and by the way the working process is perhaps even more promising as a result of my work – not to mention that we years later can see that the very basic result was more related to some initial notions that defined the foundations for the work. Or we might be looking for fame, for a job, for money, for time to be left alone to do more serious work etc.

Can we, in general terms, really say much more than that research results are *expressions of finding* in, more or less systematic, acts of searching, whatever it is we are searching for?

The idea of setting up a clear line of demarcation between scientific research and research with respect to other means and ends is really not very helpful in guiding research work.

What is for instance result of scientific research as such suppose to mean in general terms as opposed to result of “other types” of research? The idea of expressing facts, proving facts etc is a bit limiting, to say the least.

It is more or less common practice in discussions *about* (scientific) research to say that it is all about searching for knowledge. This focus on knowledge is problematic as it somehow implies that research results, by their very nature, are carriers of knowledge.

There is a clear distinction between seeing things and knowing things – as in the classical distinction between seeing a ship and seeing that it is a ship. Finding often enough means that we see things, but as yet don’t know what it really means. There is a result we can display, but in answer to the question “what is it?” we perhaps have to answer, “ I really don’t know...yet”.

To say that results are expressions of finding is not to say that they are carriers of knowledge; results we display can be the puzzles that inspires search for knowledge.

Trying to sort out the knowledge residing in the very different expressions of finding inevitable leads us into a scholastic morass of epistemological distinctions; implicit, tacit, theoretical, practical, performative ... knowledge.

Exploring, searching; what we *see* we can carefully *describe*, what it *is* we can understand through *interpretations* and *explanations*.

In describing, interpreting and explaining we say something about something. So clearly propositions and concepts are, in a very general sense, basic things in research. What we then search for is precision in proofs and definitions. What this means differs of course between different areas of research, there is a long way here, in both directions, from say cultural studies to theoretical physics. But to let ideology replace the quest for precision in results leads by necessity to a mystification of research work – the Sokal hoax (Sokal 1996a,b) is an interesting and luminous example of this.

Standards of clarity and precision come from convincing examples, beautiful results, powerful tools and far-reaching methodology. This is something we certainly try to generalize and make the most of, but there are always missing things and other ways of going about searching.

Talking about “propositions”, “concepts”, “proofs” and “definitions” might give a smell of a “positivistic” research ideal. The basic “ideological” stance here is that these notions are much more fundamental than that and that precision and clarity in results is, more or less by definition, a basic driving force in research – that this is a difficult matter, that it takes time and lots of work by many people, that we go astray very very

often, that we often enough don't know and understand what we are doing and that there most often are lots of missing gaps to fill and so on, is very much another story. Post-modernistic, as well as pragmatist, relativization of truth and reason somehow builds on neglecting the basic difference between us thinking (doing things) and what we think (what we do) – like an echo of psychologism in late 19th century philosophy a trace of the fashions of recurrent skepticism.

Concepts are, of course, as important as research results as propositions. The problem is that we, for some reason, tend to expect propositions as results of research – research as the search for factual knowledge. But if there is nothing there to talk about, what is the point in trying to say something? Problems with intellectual rigour in research is not only a matter of the ideologicalization and mystification of foundational issues, but can also be the lack of foundational rigour in empirical research. In both cases there are problems with conceptual foundations.

As expressions of finding research results display what was found in the process of researching. The ways in which we express findings matters of course. The expressions themselves open up a window through which we can have a look at what was found eventually. These windows provide perspectives, ways of presenting different aspects of our findings. This does not entail a relativisation of results in any way, it just says that results, as expressions of finding, seldom tells the whole story, covers all perspectives.

Findings in processes of searching are insights, things seen, something we have to express in order to introduce them as results into a research discourse. This distinction is a logical one, between the insights as such and the various expressions we introduce to paint their portraits.

We expect that a typical result of scientific research come in propositional form stating facts of some sort. Take a mathematical theorem such as Hilbert's Basis Theorem – If R is a Noetherian ring, then $R[X]$ is a Noetherian ring, where $R[X]$ denote the ring of polynomials in the indeterminate X . (Kline 1972)

But what is the actual insight we express here, what were we searching for, what was actually found and what is it the status of this theorem in relation to what we were searching for?

No matter what we initially were looking for, what was eventually found was the actual possibility of a construction providing the foundation of a proof of the theorem. As an expression of finding the theorem propose, show something the actual finding, so to speak, proves. It is like a house that shows something that a new building technique can realise.

The relation here between finding and result is intrinsic to the relation between proof and theorem, just as the relation between a house and a foundational building technique is intrinsic to the relation between building (as verb) and building (as noun).

The theorem is not very interesting as a research result if it is trivial or doesn't tell us anything new. A house is in the same manner not very interesting as research result if it is it vague in expressing the findings or doesn't tell us anything new.

There is a major difference in between these two general examples. The theorem and the house express findings in very different ways. There is very little in the formulation of the theorem (although this must not always be the case) that tells us anything about the more detailed nature of the way in which the proof proves it. On the other hand, the way in which the house express building techniques must be of a much more illuminating nature. The house would otherwise be a poor excuse for a research result.

What is of particular interest in looking at these two examples is that the findings in both cases have lots in common with respect to the nature of insights, it is in both cases a matter of techniques and constructions, whereas the results as expressions of these findings are very different in nature. The theorem, as a proposition, states a fact, whereas the house gives us an example.

2 Examples

2.1 Experimental exploration

Becquerel discovered radioactivity by discovering that uranium salt emits rays resembling X-rays. In search for substances beside uranium salt that emits radiation, Curie discovered a new substance, "radium"; a new element with certain remarkable properties (Curie et al 1898).

As a research finding this is a discovery within a process of, more or less systematic, experimental exploration.

Such a discovery can be founded on a very sudden, or more gradual, insight. It is a matter of "seeing", in this case seeing that there is a certain substance/element with certain remarkable properties.

You are looking for something you might or might not know what it is. You search by explorative experimentation. Eventually you perhaps find something. It is a discovery by experimental exploration. That is the character of finding in this case.

The results are expressions of discoveries by experimental exploration. You show the "thing" you found in searching. This "showing" defines the more direct relation between finding, insight, and result expression.

But findings in experimental explorations of course also open up for more "derived" results in many different ways. In this case it is an insight that opens up for development of methodology, i.e. ways to obtain/produce the substance; for a re-definition of our understanding of things within a certain area of understanding – what

was found is that uranium salt is not the unique substance with respect to radioactivity and the finding thus opens up for a re-definition of our classification of the elements in a certain sense.

The interpretation of baroque music by historically informed performance is another example of search by experimental exploration. We introduce a suggestion; this is the way it might sound using “historical” – replicas or original– instruments in this or that way. It certainly opens up for development of methodology and of redefining interpretation. Cf. for example the interpretation of music by J. S. Bach by *Concentus Musicus* (Harnoncourt 1985, 1987). Research results within musicology are what inform the experimental exploration in this case.

We explore something, more or less clearly visible, in a more or less systematic way. As we find things along the way we try to describe our findings as distinctly as possible.

How could we recognize them as research results without knowing that they express findings? It is only within the boundaries of the duality between searching and finding we recognize this; listening to *Concentus Musicus* performing a cantata by J. S. Bach, I cannot per se recognize it as a demonstration of experimental findings.

When we, in the process of exploring possibilities in doing something, see an opening, we naturally try to display these findings in actual working examples. Such examples build strong “arguments” (Dunne, Seago 1999).

It is, for instance, clear that the design of a camera is a more or less obvious way of expressing findings in experimental exploration of, say, digital photography. This is by large characteristic for constructive experimental research, such as for instance the experimental development of new materials. As an example the resulting design provides an expression of something we found out in the process of exploration. It is as an example an explicit “presentation”, “picture”, of something seen in a process of searching.

What the camera does as a research result is that it, as an example, shows us what digital photography could be in concreto.

The example is something representative, a model, a representative substitute for that something.

The development of new techniques, methodology and programs within areas of artistic research is to a large extent experimental, explorative research. The example plays of course a central role here in expressing findings.

Something also very much present in the development of sports techniques, just take the Fosbury Flop, a technique for high jumping developed by Richard Fosbury, or the V-style in ski jumping pioneered by Jan Boklöv, a technique re-discovered by pure chance during training (Harris 2009).

2.2 Interpretations and explanations

In 1934, Fermi and colleagues performed experiments bombarding uranium with neutrons. A conclusion was that the bombardment produced a new element, Hesperium. Not everybody was convinced by the given analysis. Later on Hahn, Meitner and Strassmann performed similar experiments in Berlin discovering that barium was one product coming out of bombarding uranium with neutrons. This was difficult to explain. Meitner and Frisch offered an explanation in 1939 (Meitner, Frisch 1939) saying that the nucleus had roughly split in half, a very insightful theoretical interpretation of experimental work.

This is a research result in the form of an explanation. It could be that we observe something in the process of exploration, but we don't know how to understand it. It could be that we feel there is something missing in given interpretations. This is where we start searching for an explanation.

There is something given in need of further explanation, something you do not quite understand or something you feel in need of further interpretation. Eventually you understand what is going on. There is an insight that helps you offer an explanation. This relation between understanding and explanation defines the intrinsic relation between finding, insight and result expression in this case.

In the humanities for example, interpretations and explanations are very common as research results.

What form can the expression of findings in the search for theoretical interpretations and explanations take? It is an interpretation and/or an explanation in relation to a given, so to speak, background theory. As such it can come in all sorts of forms; from precise derivations providing for explanations, to poetry and artwork expressing interpretations. But to recognize the result we have to know that it is an explanation, an interpretation – we have to see the theoretical foundation.

The interpretation of Meitner and Frisch is concerned with a theoretical interpretation of given experiments. Explanations and interpretations, of course, go in the other direction as well. Typically we explain the power and ramifications of a theory by examples.

The design of the atom bomb in the Manhattan Project is a scary large-scale example of that (Rhodes 1987).

Another example of this is the Well-Tempered Clavier by J. S. Bach as an interpretation and explanation of a theory of well-tempered tuning, such as that one of Andreas Werckmeister. (Barbour 2004)

Given a research program, strong examples provide both interpretations and explanations of the program; look at the examples and see the basic ramifications of the program, look at the examples and see what the program means *in concreto*.

In experimental artistic research the research program takes the form of a design program. The “theoretical” framework of the interpretation resides in this case in the methodological foundations of the design experiment itself.

Consider for instance Dunne and Raby’s program for Critical Design (Dunne 1999, Dunne, Raby 2001): to use design to open up for a critical review of certain issues, and in ways only possible to reach through design. What this actually means is something we of course can describe, discuss and explore verbally – but it is through the design examples materialising the program that we can actually see the possible force and directions of such critique. This is what good design examples bring forth.

Theoretical interpretations and explanations – be it interpretations of experiments in chemistry and physics or interpretations of literary texts – (re-)define things and thus contains strong components of definitional results.

The development of new techniques, methodology and programs within areas of artistic research is to a large extent experimental, explorative research. The example, the actual design of an example, plays of course a central role here in expressing findings.

2.3 Foundational axioms

The theory of special relativity is based on two foundational postulates (principles, axioms): The first axiom states that we can formulate rules of nature that do not depend on our particular observing situation. The second axiom – the speed of light is the same relative to any observer – means we can define the speed of light, c , as a fundamental constant of nature (Einstein 1905).

Explanations and explorations build on, implicitly or explicitly given, theories, i.e. frameworks of foundational concepts, axioms, rules etc. In developing a theory we search for axioms providing a foundation for experiment, explanation and exploration.

As results foundational axioms are expressions of foundational insights. You look for the most elementary and logically clear axioms to express this insight as to provide for a logically strong and clear foundation. Issues of aesthetical considerations are of utmost importance here.

Now, the very formulation of such foundational axioms is a research result – basic axioms as results. As a research result this is a suggestion that introduce foundations for experiment, explanation and exploration. Furthermore, the developed theory of special relativity is a research result – theories as results. As a research result this explores and interpret given basic concepts. And, the outcome of a calculation within

the theory is a research result – theoretical derivations as results. As a research result this explores and investigates a given theory. Finally, the outcome of a test of a derived prediction is a research result – practical experiments as results. As a research result this evaluates the validity of a given theory and thus also its conceptual foundations.

Another example of foundational axioms is the basic “axioms” of symbolic interactionism – a theory of micro-scale social interaction – that Blumer introduced:

- “...humans act toward things on the basis of the meanings they ascribe to those things.”

- “...the meaning of such things is derived from, or arises out of, the social interaction that one has with others and the society.”

- “...these meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he/she encounters.” (Blumer 1969, p 2).

Just as the basic axioms of special relativity theory these axioms provides a foundation for explanation, exploration and experiment, in this case related to the understanding of social interaction. It is a matter of research results that builds the foundation of a theory.

The idea of the graphical user interface opens up a design program, but also is also a theory of human computer interaction. In the latter case the design of the first pioneering graphical interfaces at Xerox PARC (Hiltzik 1999) can be seen as a way to introduce the axioms of the theory. Further development can then be understood in terms of derived constructions within the given theoretical framework. It is clear that expressional aspects are of major importance in this theory and expressions of axiomatic foundations by design examples seems not only natural, but also somewhat necessary.

If a theory is all about expressing and expressiveness, it is natural that foundational notions are introduced by examples. It is foundational axioms expressional in nature.

2.4 Empirical testing

In 1796, Jenner performed a variolation experiment – using his gardeners eight-year old son James Phipps – to test/confirm the country-lore saying that cowpox infection would protect you against smallpox infection. The experiment was, fortunately, successful. James was first violated with cowpox material and later on, when recovered from a mild cowpox infection, violated with smallpox material. The boy did not develop smallpox “proving” the country-lore to be true. (Riedel 2005).

In the variolation experiment Jenner tested a hypothesis, a test that led to the insight that the hypothesis was correct. A careful description of the experiment documenting its

outcome provides a proof. This also gives us the direct relation between insight and, in this context, a most basic result expression.

The introduction of a smallpox vaccine is then an obvious derived result that opens up for a more in depth evaluation of the experiment.

Full scale experimental testing of economic theory in political practice could be another example – such as how Keynes (Keynes 1936) ideas about unemployment as it have influenced economic politics.

Here, we ask for the true meaning of a given observation, propose a hypothesis and perform an experiment to test the hypothesis. The outcome of the experiment is as a result a “proof of a proposition”. As such it can prove the hypothesis, falsify it, show the hypothesis to be badly formulated, provide a counter example and so on. It is, in a certain sense, a matter of a final result with respect a given observation. Empirical proofs of given hypotheses also comes in various different forms; from the controlled experiment to the pure descriptive examples, from explorative experiments to bare demonstrations.

A design experiment can of course “prove” an idea, a concept, by showing the possibility of doing something in a certain way; let us “see” what you promise. As a result it is a proof by example, a “proof of concept”.

Typical examples would be all kinds of, what we usually call, inventions that challenge and test an idea, a vision; the pioneering washing machines and refrigerators, moon rockets, pioneering models of mobile phones and so on.

The concept of “applied research” is a bit misleading here. It is as if once the basic theories and calculations are there, it is “just” a matter of applying them. Another way of looking at things would be to say that it is here that design as research results is what matters. Empirical testing has its foundations in the design of a test that is a central research result in its own right.

This type of “testing” comes naturally out of more open explorations. We observe something in the process of open explorations, formulate some sort of hypothesis, design an experiment and test the idea to see if it holds.

Empirical testing is central in artistic research. We develop techniques by testing.

2.5 Definitions

Topology is the branch of mathematics that investigates properties of objects that remains invariant under topological transformations, i.e. when the object is being “twisted”, “stretched”, “squeezed” etc, but not cut into pieces. Clearly dimension should be such an invariant. But what is that more precisely? In the late nineteenth century a

series of intriguing examples were given showing that the “simple” idea of dimension was problematic.

A precise definition of the notion of topological dimension was independently given by Brouwer, Menger, Urysohn and Lebesgue in the beginning of the 20th century. This was certainly a major achievement. As a research result it is a foundational definition that we initially “motivate” by demonstrating that it covers all basic examples, including that it “solves” the given intriguing examples (Crilly, Johnsson 1999).

Here, we ask for a precise definition of a, at first intuitively, given notion. The answers to such questions provide results in the sense of basic notions we use to formulate theories and make experimental work precise. A definition is neither true nor false. It is a matter of initial results that provide the basic building blocks for research work. To formulate good a definition is often enough a very difficult task. It is work that really requires a good understanding of what “poetic precision” means and paints a clear picture of the practice of theoretical work. You could well say that axioms, definitions and constructions give us the poetry of research; you cannot do good research with “ugly” definitions.

If the definition itself is the result, what is the insight? You could say that this is the logic of the definition, the basic rationale that makes the definition work.

Another example could be the definition of “neurosis” in psychiatry, as it is given in, for example, the work by Horney (Horney 1950).

Introduction of basic notions provides the definitional foundation for research efforts and professional practice i.e. the basic conceptual framework. How do we find precision in foundational concepts? This is a question of precision in definitional logic, i.e. this is where the logic (in its original meaning of being about the form and structure of arguments) of given definitions matters. We can certainly express definitions in various ways, but usability with respect to further research is central here. It is “initial” results that we use to build further research, use for explanations and interpretations etc.

A design of something X always defines and redefines X in a certain sense. Following this we refer to design examples as a kind of definitions: The Villa *Savoie* by Le Corbusier defines functionalism (Sbriglio 1999), the Neue Staatsgalerie in Stuttgart by Sterling defines post modernism (Jencks 2002), the PC by IBM defines a personal computer (Campbell-Kelly et. Al. 2013), etc. As such the design examples are results of research, i.e. definitional expressions of findings in a process of concept exploration.

A design experiment may introduce a foundational axiom through its own principles of design. The example becomes a canonical example “stating” a given concept. It is not because it could not be in another way, but because the design in some way is fundamental. There are lots of examples of this in, for instance, product design. The Fender Stratocaster electric guitar (Freeth 2002) is a good example, an archetype for

the solid body electric guitar. It is a basic example that lays out a foundation for further explorations and development.

So when is all this a matter of research and when is it simply a matter of ground breaking product development? There is something that is fundamentally wrong with this question. If in this case research is a matter of, systematic, search for understanding, insight, through design work it does not make sense to look for a precise distinction between research work and developmental work other than in differences in work context and work rationale. The research result as an expression of finding can only be understood as such in relation to a given duality between searching and finding.

Introducing theoretical foundations in research in general is a matter of design as research result. Artistic research shares in a general sense working methods with many other areas of research. What characterizes artistic research has much more to do with issues of precision and rigor than with design as a basic form of results.

Artwork, performances that introduce a “style” of artistic practice is something we refer to as a sort of foundational definition; a series of canonical cubist paintings (Antliff, Leighten 2008), the groundbreaking recordings by John Coltrane (Ratliff 2007) etc.

Canonical design examples can work as explanations, axioms and definitions.

2.6 Working methods

Given a computer program developed to solve a certain problem it is, in general, by no means trivial to prove that the program is correct with respect to initial requirements. One idea has been to develop formal methods for derivation of programs from given formal specifications, ideally resulting both in executable programs and proofs that the derived programs are correct with respect to given specifications. Several such systems have been developed that provide methods – and computer support – for deriving program from specifications along with proofs of program correctness. Early examples are systems and methodology developed by Dijkstra and Hoare (Dasgupta 1991). As a research result it is mainly a matter of methodology, it suggest working tools for solving a problem.

Findings of ways of working to solve problematic issues are expressed in terms of methodology. We try to verify and validate such a methodology with respect to correctness, efficiency, usefulness and so on. It is a matter of a final result that provides new working methods. To “prove” methods with respect to some given hypothesis is another matter – methods as such are results in their own right.

To express working methods can be done in the form of specific guidelines or rules, by guiding examples, by demonstration of working tools etc. Suggestiveness of results are of course important, to open up for possibilities inherent in given methods, but equally important is honesty in expression – strong advertisement for weak methodology is bad medicine.

The “art” of teaching is an area of research and development where methods, methodologies are typical results. The work on pedagogical methods by Montessori is such an example (Montessori 2002/1912).

Artistic research – in the sense of research for the development of practice – is also an area of research where the development of methods and methodology are central issues: methods and methodologies in theater and film acting practice, music practice, dance practice, fine art practice and so on, and so on.

We may write down and explain working methods in detail, but we need to prove them by examples. As such the design examples are central as expressions of finding in a process of exploring methods of work in a given area of artistic research.

3 An example

Let us consider a process of design research where we explore an extended design space. As example we take the exploration of textile sound design where a given design space – that of traditional textile design – is extended with a new basic variable – in this case “sound” as a design variable. (Zetterblom 2011)

The main aim of this research program is to introduce textile sound design as design practice through techniques, methods, programs and expressional understanding.

There are several natural components of such a program:

3.1 Experimental and explorative work - we could for instance in a series of experiments explore the idea of textiles as sound absorbents. Typically we test the absorbing properties of a material by acoustic measurements. That definitely tell us something about design possibilities, but an actual textile design installed in a given space tells us things that the measurements cannot tell; about actual design possibilities. It is a demonstration of possibilities in concreto. Such a result can be interesting or just trivial, general or somewhat specific just as measurements can be. It is a natural way to express such explorative findings as it opens a design space.

A thick, large-surface wool fabric; what does it mean to tune the density of the fabric?
How does it sound?

As a result this is not an application of insights, a derived corollary, but a basic result in its own right. It gives a *concrete direct expression of design possibilities*.

3.2 Foundational work – in extending the design space of textile design with a new variable we need to introduce new foundational concepts. This is a matter of theoretical work just as in any other area of research and results typically come in terms of a conceptual and axiomatic framework. What is essential is that it is foundations for possibilities in a design space. A design can express such foundational findings thus becoming an axiomatic example, not demonstrating possibilities, but defining a design space.

A hard surface textile telling us that this is what reflection is all about in textile sound design for example.

It gives a *concrete generic expression of design axioms*.

3.3 Interpretational and explanatory work - in extending the design space we need to interpret and explain the expressional possibilities visible in explorative experiments. What does for instance an expressional quality such as “soft” mean in the new design space? This is where a series of designs makes a difference as an initial interpretation, an initial explanation.

A series of textiles explaining by example expressions of softness in textile sound design.

It gives a *concrete interpretative, explanatory expression of design variables*.

3.4 Methodological work – to develop practice with respect to the extended design space we need to introduce new design methods. To introduce working methods is a matter of meta-design – designing designing (Jones 1972). To express the careful methodological balance between acoustics and design aesthetics in textile sound design is a typical challenge here.

The interaction between measuring and listening in textile sound design can be expressed through a series of design examples within a given sound environment classified by different methods for measuring data of absorption and reflection.

It gives a *concrete instructional expression of design methods*.

3.5 Technological work – to develop practice with respect to the extended design space we need to introduce new design techniques. We need to find descriptive precision in introducing new techniques, but the expressional possibilities of design techniques must also be shown in design work. The design as result is an illustrating example. Design examples can typically display textile techniques for absorption, reflection etc.

It gives a *concrete illustrating expression of design techniques*.

3.6 Programmatic work – to develop practice with respect to the extended design space we need to introduce new design programs. A design program concerns what

your design is all about, the direction of design work. A design as result is here a guiding example showing the direction in concreto. This is where the good and original examples of textile sound design make a difference.

It gives a *concrete guiding expression of design directions*.

In all these cases it is a matter of definitional knowledge.

4 Propositional – definitional results

What is common for all these – in more than one sense related – examples is that design as a research result are expressions in concreto of findings. A design is not a proposition, it brings forth, in concreto, something seen, a possibility, an interpretation. It is not true or false, but it can be useful, powerful, suggestive, interesting, enlightening, provocative and so on.

Logically speaking precision is in this context a matter of *definitional precision*.

A design as a concrete thing – in the most general sense of the word – has its foundation in the design as a definition, i.e. the definition of the thing.

To understand the result means to understand the design and its rationale, which resides in the logic of the design as definition.

Say we explore the notion of sustainable living and come up with new ideas about renewable energy systems with very small carbon footprints. An actual design of such a system would of course be a major result of our research efforts, a very natural way to express our findings. Now what does it mean to understand such a research result?

It is to understand what it is and to understand why it is designed the way it is. What this brings is an understanding of what renewable energy systems with very small carbon footprints can be all about.

It is important here to note the span between a renewable energy system as a definition by example and a definition of the notion of a renewable energy system. As research results it is in both cases a matter of design as research results, but there is a difference between a specific example of X and a general definition of X.

If there is any more deeper reasons at all to make a distinction between basic and applied research, such a distinction has certainly nothing to do with a division between research results as propositions and as definitions (designs). Experimental artistic research, where results mainly comes in form of design work, can most definitely be basic research in the sense of the OECD Frascati Manual (OECD 2002) “...experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or

use in view.”
(OECD 2002)

But there is a difference in propositional results stating facts in abstracto and definitional results displaying notions in concreto.

For propositional (factual) results it is natural to discuss the validity of the proposed proposition and its factual consequences; what is the proof of the result and what follows from the proposed proposition? Is it true, what does it mean?

For definitional results it would then be natural to discuss the clearness of the proposed definition and its design rationale; what is it we can see in the result and what is the logic of the proposed definition? What does it show, is it sound and complete?

We constantly go back and forth between definitional and propositional results in research. We build theories by definitional results as foundations for propositional results. From propositional results we try to “derive” definitional results, typically in designing working methods on basis of factual results. While going from definitions to propositions is rooted in research from the very beginning, going the other way is less well established as we have these difficulties in seeing a design, a definition as the end result in research.

In this context it is important to make a distinction between

- The design experiment as a foundational example introducing/proving/exploring/displaying concepts,
- The design experiment as a proposal to solve a given problem.

In the first case the resulting design is the main result and in the second case it is somehow standard procedure to try to prove the design by technical measurements or/and through an empirical user evaluation, which then gives us the main result. In the first case it is a matter of definitional understanding and in the second case it is a matter of propositional knowledge.

This is a distinction that is difficult to grasp if we so to speak “identify” research too much with empirical research. Design research in the first sense has much more affinity with mathematics and engineering science than with, for instance, behavioral science.

A typical example could look something like this. The idea is to explore a given research question:

- Can we design and build products that satisfy (a given property) X?

by experimental product design. Let us also assume that X refers to properties of use, which for example could involve issues of improvement.

We use X as a basis for a more developed brief and then we initiate experiments as to design and build a series of experimental products Y1,...

We carefully motivate the design with respect to the given conditions and propose the "hypothesis" that Y satisfies X.

To "prove" the hypothesis we perform an empirical user experiment/evaluation of the design.

Can the design of Y itself be seen as a basic result and the empirical experiment a way to draw conclusions from the given result? Or, is Y just a tool in designing the user experiment, if so, what does that really mean? What is it that we actually prove in the empirical user study? Why is it so difficult to stop with Y and present it as a main result of an experimental research project? Is this because we have difficulties in recognizing a design as a research result in its own right?

Aesthetics is important in research in general, expressional precision in theory and practice is a key issue in research work. This is even more obvious in artistic research. As it is a matter of presenting results by design expressions, the precision in expressional logic involved is of course central. This is also why practice based design research with main focus on developing design aesthetics is a form of artistic research. It is artistic research in the sense of experimental and theoretical development of the artistic foundations of design practice. Typical research results then come in the form of methods, techniques, design programs and conceptual tools.

The status of propositional knowledge refers basically to truth; being true or false, being a conjecture etc. In that sense propositional knowledge relates to *an act of closure*; now we know for a fact that this is necessary so. Assume that we propose a design as a solution to a given problem. Empirical evaluation of the proposed design is a search for propositional knowledge; to close the matter.

Definitional knowledge on the other hand relates to *an act of disclosure*; now we see for sure that this is so possible. It is a matter of opening up a space, a world to explore, to provide foundations for further investigations, further research.

Assume that we introduce a design to open up a design space. In this case an empirical evaluation does not make sense as a way to bring forth "a result". Status of design as result here refers to that of being well defined as disclosure.

There are two basic perspectives of this: the intensional one that refers to the logic of the design as a definition, and the extensional one that refers to the design as disclosure.

So given a design presented as a research result, what is it that we know now? For a proposition we know that something is true and for a design we see that something is possible. In both cases this can provide for instantaneous insights or require lots of work before we understand the true meaning of the result. In both cases the research discourse concerns consequences, in the first case the necessary consequences we may derive in exploring the given fact and in the second case the possible developments we see in exploring the space that the given design opens up.

What role does verbal and/or textual explanation, argumentation etc play in the presentation of design as research result? In case of the Fender Stratocaster it was enough to just say it is a guitar and it works like this to open up for exploring the design. Later on questions about the construction might need further explanation. In general the text, or the verbal communication, has to provide the context, introduce possible research program, explain and describe techniques, methods and so on and discuss possible consequences. The main difference with respect to propositional results is that we do not prove the design, so the ubiquitous IMRAD (Introduction, method, result, analysis, discussion) model for writing does not make sense here.

Rigor in research usually refers to well-defined concepts, systematics and transparency in methods, sound reasoning and clarity in presentation. There is no reason to think that this would, or should, be different for experimental artistic research. But it is a matter of definitional rigor, not propositional rigor; the way we demonstrate (display, present, show) possibilities through design.

III Experimental methodology

The design example is central to the type of research results discussed in this program.

We use examples to display findings, *but* we also use examples to derive findings.

In the first case we *cover* results and in the second case we *uncover* results. In displaying things there is a need for explanations and deriving results has its foundations in interpretations.

Take the idea of historically informed performance of older music. After researching historically sources and designing a performance methodology, the obvious thing to do is to perform music to display the findings. The performance of, say a cantata by J. S. Bach is then an example displaying findings, the performance covers certain findings.

But do we understand what is going on? In what way does the performance offer an explanation? If there is no pre-understanding at all, we can hardly understand this as an example of those given findings. It is something we might find very suggestive, but it will be hard for us to see what it actually is – once again the distinction between just seeing a thing and seeing that it is that given thing. Thus there is need for explanations. Such an explanation is not an alternative description, but something that provides understanding of what it is that we display.

Now take material explorations where we end up in a series of design examples, it can be a matter of exploring the expressional potential in new materials. If we are lucky there are interesting findings more or less hidden in some of these examples. What that might be is something we have to derive by interpretation, by close reading of given examples. Such an interpretation is a derivation of findings that resides in the examples, the interpretation uncover findings.

What is then an explanation in this context, and what is an interpretation in this context?

Explaining what it is we display makes clear *what it is we see*. An interpretation of a given example provides *meaning to what we see*. The main difference here has to do with directions. In the first case *we know what it is*, we just have to make it clear to make the result presentation complete, in the other case *we don't know what it is*, we have to find out by searching for meaning in the given examples; explanation is part of expressing findings, while interpretation is search for findings.

To fully explain what is going on in a given example is often enough a very demanding task. In some sense it is a matter of providing a theoretical foundation for the example. But still, what the example does is something different. It displays in concreto things that a theoretical explanation cannot be precise about.

An interpretation of given examples that provide a derivation of results is not necessarily something we must, or can, explicitly describe and explain. What we see in

the given examples might be an inspirational spark for alternative ways of thinking, or it might provide a road map for systematic generalisations or all kinds of different ways there in between.

With respect to (design) methodology there is a big difference between explorative design examples and displaying design examples. In explorative work we do something to see if we can see something, whereas in displaying findings we tell about something seen. In the first case we want to uncover things and in the second one we want to cover things. There is a difference in methodology here between that of experimentation and that of presentation.

Clarity and to-the-point is of course of basic importance when we present a design example to prove a concept, to prove a hypothesis. The example has in this sense to be closed in nature, whereas in experimentation the example is meant to introduce possibilities and has to be open in nature.

In experimentation the design example is an explorative experiment, i.e. let us see what might be hidden here. The results we derive from such an experiment are not to be understood as results proved by the experiment. What we provide is material for interpretation. Methodology is *unbounded* for examples as experimentation.

In presentation the example is proving findings in that it display and make findings concrete and alive. Methodology is *bounded* by given findings for examples as presentation.

IV Theory

If the idea of research developing artistic practice as practice-based experimental research is rather natural, what is then its theoretical counterpart, i.e. what is theory all about in artistic research?

In physics when we talk about the distinction between theoretical and experimental physics, we roughly refer to a distinction between mathematical modeling to explain and predict and experimental work to explore and test.

What mathematical modeling to explain and predict correspond to here could be modeling to define (describe) and derive; *to define what it is and derive how to make it.*

It is a matter of open up for programmatic directions as well as generalizing results inherent in given examples.

In physics mathematics provide for the basic tools of theory, i.e. for modeling, but where do we find a proper foundation for theoretical work in artistic research? This question might seem a bit strange. How could there be such a thing?

What is actually involved in the foundations for defining, describing “things”? What is actually involved in the foundations for deriving methods and techniques to make “things”?

These questions seem so general as to make it more or less meaningless to try to dwell on them looking for some sort of systematic answer.

To define what it is involves on the one hand questions concerning the ways in which material build the thing, i.e. what it is as a thing as such, and on the other hand questions concerning ways of intended interaction, i.e. what it is as a thing to dwell with and use.

It is clear that foundations for this may come from many areas of research; materials science, social sciences, mathematics, philosophy and so on. But there is also a strong challenge to further develop a specific theory for artistic research, i.e. theory aiming specific for the foundations of designing.

This can of course be understood in many different ways, but if we narrow down the perspective to the most essential it is difficult to avoid the issues of form and material. (Itten 1975).

Thus the foundations of theory in artistic research can to some extent be found in general theories, methods and techniques that help us to handle the issues of form and forming with some degree of, at least informal, rigor.

- To define what it is; form – material.
- To derive how to make it; forming – materialising.

Form of a thing as such can be understood as the way in which material builds the thing, while form in relation to what a thing is as a thing to dwell with and use relates to interaction form. If function is what a thing do as we use it, dwell with it, and interaction is what we do as we use, dwell with, the thing, then interaction (design) form can be understood as the way in which the thing relates function and interaction to each other (Hallnäs 2011).

In the process of designing there is an intentional object (the design) in focus. So we think of the thing we design as built in a certain way and certain intended acts of use that define what it is as a thing to dwell with and use. Once the designed thing is there we can of course see, and use, it in ways that differs from the intended thing as it is defined in the process of designing. This is what gives the distinction form-forming a rather specific meaning and is what makes it essential to make a distinction in between aesthetics (form-expression) and design aesthetics (forming-expressing).

Even if we make a distinction between form and interaction (design) form there is a common more elementary notion of form underlying them both; *the way in which...* material builds the thing/the thing relates function and interaction to each other.

“The way in which...”, what does it mean?

A way of doing something can, figuratively speaking, be seen as a way of travelling to a certain destination. Eating with chop sticks or fork and knife are two different ways of eating, two different forms of eating. Walking and running are two different ways of moving forward, two forms of moving.

What a way of eating is doing is that it defines what the act of eating can be like; it provides one definition of the act of eating. The definition is in many cases implicit, showing itself as we present our way of eating by simply eating.

Forms of eating can thus be identified with definitions that define ways of eating.

In defining eating we identify variables – definiendum – and provide ways of defining them, i.e. definitions of the definiens.

When we say things like “that’s a strange way of eating”, we recognise an act of eating somehow, but fail to understand the logic that builds the definition.

The way in which... is the *how* it is done. It is a *definition* of that *what* we are doing.

Following this line of reasoning it is natural to think of the *form* of something as a *definition* of that something.

This is somehow a strange conclusion. If we look at something and say it has a nice form we somehow talk about an inherent, intrinsic property of that thing. But this is what defines the thing, i.e. a definition.

The idea to think of form as definitions of things is natural from the perspective of designing. Variables, i.e. design variables, are form definiendum we define in the process of designing. This is the way in which we build things.

From the perspective of looking at, using, the ready-made thing this idea is perhaps a bit more difficult to make sense of. Given a certain object we can of course think of it as being defined in many different ways. So what does it then mean to talk about *the* form of an object? Is there a *true* definition that so to speak is intrinsic to the object, the true definition that defines the object as what it is? This is what we so to speak recognise when we see that the object is what it is, that we not only see a house, but see *that* it is a house. On the other hand, the way in which we use a thing provides for a performative definition of the given thing.

The definitional understanding of the notion of form has in this sense a clear meaning as a foundation for design aesthetics (the logic of designing) at the same time as it provides an explanation of what the difference between design aesthetics and aesthetics could be all about.

This understanding of form furthermore is one way to explain the idea of design as a process of form-giving, i.e. why the notion of form is central to design aesthetics. Design means defining something in concreto, that is forming some-thing.

So where do we find a proper foundation for theoretical work in artistic research? Given that form is understood as one central foundational notion, then a definitional understanding of that notion suggests that a foundation for one perspective on theoretical work in artistic research could be found in techniques and methods for systematic descriptions. So the basic challenge in this context is then to further develop that type of descriptive tools that helps us to introduce precision in definitions and descriptions and provides tools for reasoning in relation to matters of form.

In some sense this is more than obvious if we think of forming, building houses, cars and all sorts of things that require some sort of in depth precision in terms of construction – which of course include most things we design and construct. But it is, of course, of equal importance in reasoning about the design of a film, a dance performance, a novel or a piece of music.

There is a long history here of development of various tools and methods and the search for more foundational unifying perspectives must be a core issue in developing the theoretical foundations of artistic research. This is also what aesthetics as a foundation for artistic work is all about; *not the analysis of the experience of art, but the logic of forming and expressing, not the philosophy of art, but the methodology of art.*

This way of thinking about the theoretical foundations of artistic research is in line with a *material* turn and contrasts the strong prominence of social science and the humanities as foundations. It is a material turn that really has very little to do with

ideas of post humanism and the new materialism, it rather connects with a very long history of artistic development work.

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