The Challenge of Improving Designing

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This paper presents an analytical and conceptual investigation of research aimed at improving design practice. These ambitions and challenges of improving design practice are primarily analyzed in relation to the concept of predictability. A basic assumption of this analysis, grounded in contemporary design theory, is that the design process is impossible to fully control and because of that, cannot guarantee a desired outcome. As a result, there is a need to carefully reflect on how design research aimed at improving design practice takes on this task. The argument is made that research aimed at supporting or improving designing has to be grounded in a deep understanding of the nature of designing, in an understanding of the aspects that makes design an approach that can deliver highly creative and innovative outcomes. If that is not the case, there is a risk that attempts to improve designing will instead lead to detrimental consequences, potentially destroying what constitutes the core of designing, and the approach will no longer provide desired outcomes.

Keywords **–** Improving Design Practice, Design Research, Nature of Designing.

Relevance to Design Practice **–** Research aimed at supporting or improving designing has to be grounded in a foundational understanding of the nature of designing. If that is not the case, chances are that improvement attempts will have consequences that will destroy the core of designing, and the approach can no longer provide desired outcomes.

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Introduction

There are many human approaches aimed at inquiry and change, such as science, art, politics, and of course design. Each approach has evolved over time to produce a certain kind of outcome. Among these approaches designing might be the oldest and maybe also the most common (Nelson & Stolterman, 2012). Designing is an approach that through history has proven to deliver outcomes that other approaches cannot or, at least, are less likely to produce.

However, the design approach does not always deliver expected or desired results. Even though the design approach can deliver the most wonderful and spectacular outcomes, it can also lead to unfulfilled wants and desires, and outcomes that have serious unintended consequences. The attempts to improve designing are therefore both understandable and reasonable. And it is also understandable why many design researchers have the ambition of improving the design process by making it more reliable, less risky, and more predictable.

Design research, in this article understood as research *about* and *for* designing, has commonly as one of its primary goals the development of knowledge, methods, and tools that can improve professional design practice. The purpose of this kind of research is to support design practices so it will produce outcomes that are *better* and more *suitable* than otherwise. This form of design research is often driven by a strong ambition to serve the professional practice in the field (Dalsgaard & Dindler, 2014; Goodman et al., 2011; Gray et al.; 2014, Gray 2016; Norman 1988; Roedl & Stolterman, 2013).

Professional practice can be supported in many ways, and we can identify at least three ways that design researchers make this happen. The *first way* is to design and create new artifacts, systems, and solutions that in some way can function as examples and templates of good design with the purpose to move us towards a *better* future. These examples then work as inspiration and models for practicing designers and can guide them in their design efforts. Many design conferences have exhibitions of different kinds that showcase new designs.

The *second way* is to develop methods, tools, and techniques that are meant to be used during the design process by professional practitioners. Design research has over the years been successful in influencing practice by introducing new techniques and tools aimed at supporting designers in dealing with certain aspects of design, for instance, usability, user experience, accessibility, sustainability, user research (Stolterman & Pierce, 2012).

The *third way* is to produce knowledge in the form of theories, concepts, and ideas that can intellectually inspire and challenge professionals (and researchers) in their thinking and development of future artifacts and systems.

In this paper, this desire of improving the design process, will be analyzed and discussed. The analysis will primarily be done in relation to the concept of *predictability*. The reason for this is that process improvement is often understood and measured by how predictable the outcome of a process may be. Research aimed

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at improving the design process is therefore, as most process improvement attempts, trying to achieve a higher predictability by reducing uncertainty and risk. Of course, not all design research is striving for this goal. We will come back to that later.

There has been a surprising growth of interest in designing as a valid and valuable human approach to intentional change. Designing has become recognized and valued in a broad range of disciplines and professional practices and is by many today seen as a unique approach that can lead to creative and innovative new solutions (Buchanan, 1992; Cross, 2007; Dorst, 2003; Goel & Pirolli, 1992; Krippendorff, 2006; Lawson & Dorst, 2009; Nelson & Stolterman, 2012; Pye, 1969; Stolterman, 2008). However, even though the process of designing has become broadly recognized, the efforts by design researchers to improve designing shows that it is not (yet) a dependable process. We can imagine that behind some of these improvement efforts are questions such as: Why is it so difficult even for experienced designers to repeat their successes? Why can't the process be more predictable? Why can't design methods deliver the same (predictable) outcome if used by different designers? In relation to questions like this, the notion of predictability in designing naturally becomes attractive. Therefore, it is not surprising to find in most design research journals and conferences attempts at making designing a more well-defined process that can reliably produce expected outcomes. Design researchers (and practitioners) produce a constant stream of proposals of new techniques and methods that are intended to support professional designers in improving their design process. An assumption in this article is that often these improvement attempts are done by trying to increase the predictability of the process.

There exists a substantial body of design research that has deeply enriched our understanding of the nature of designing in all its complexity and richness, just to mention a few: Schön (1984), Alexander (1977); Cross (2007); Gero and Kannengiesser (2014); Hatchuel and Weil (2009); Krippendorff (2006); Lawson and Dorst (2009); Nelson and Stolterman (2012). Most of this literature theorizes designing as a process with its own logic and rationality that emphasizes creativity, imagination, iteration, sketching and testing, and as a process that is highly person and context dependent. Designing is not described as a process of well-defined steps that has to be followed in detail to reach a desired outcome. It is instead presented as a process that is greatly dependent on the knowledge, skill, and judgment of the individual designer, and of the circumstances of the context and environment. This foundational literature, in its diversity, does not support the idea that designing can be improved by increasing predictability. Instead, the literature presents an understanding of designing that sees unpredictability as an essential and intrinsic property of designing. The fact that it is not possible for the design process to be fully controlled—that it is not possible to guarantee a desired result—is not seen as a problem. Instead, it is seen as a consequence of the nature of designing as a human activity aimed at producing solutions that do not yet exist. Unpredictability is therefore both unavoidable and wanted. This body of literature constitute a foundational understanding of designing that the rest of this article is built on.

This leads to the basic assumption in this article, namely that design research faces serious challenges if it takes on the task of improving design practice by increasing predictability without fully understanding the nature of designing. As a consequence, we need to carefully reflect on how design research aimed at improving designing takes on this task and what the risks are and to what extent it is successful.

But first, we need to look a bit closer at the notion of predictability, what designing is, and at why predictability is problematic when it comes to designing. It is important to note that examining the task of improving designing through the notion of predictability is only one possibility, and there are, of course, many other perspectives that might produce other results.

Everyday Predictability

In many areas of life, humans strive toward predictability. Most of us appreciate some kind of stability and control. Life would probably be unbearable if all our actions were completely unpredictable. Living in a world where everything happens randomly and where the outcomes of our actions cannot be predicted sounds both frightening and exhausting. Luckily for us, most of our daily activities are, to a high degree, predictable, which means that we can repeat them over and over without spending too much cognitive effort in figuring out what to do and how to do it. For instance, most mornings we are able to get up, make breakfast, and arrive at work more or less on time. We can predict when we must get up so that we will arrive on time.

This does not mean that we are always satisfied with the level of predictability. Many of us are constantly trying to find ways by which we can increase our control of these activities, so they become even more predictable. This ambition to increase predictability can be seen everywhere. We want to know that our actions, with some certainty, will lead to intended outcomes. We buy new tools, or we learn and apply new knowledge and techniques that promise to deliver a specific and intended outcome every time with some kind of guarantee.

At the same time, not all human activities are suitable for this ambition of increasing predictability. There are many activities where humans appreciate unpredictability in different ways and for different reasons. For instance, unpredictability in its most extreme form, randomness, is accepted when it comes to such obvious things as lotteries, casinos, and certain games. In these cases, predictability exists within a given system that sets the boundaries for randomness. For instance, when it comes to lotteries, randomness is only related

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to the drawing of winning numbers. Apart from that, the lottery is an extremely predictable process. We know that a number will be drawn, and someone will win. Unpredictability only has to do with who has the winning lottery ticket.

Experiencing nature is another activity where predictability is complemented with a desire of unpredictability. We may, in our quest to appreciate nature, engage in preparations that allow us to experience the unpredictable (watching wild animals) while making the experience predictable (wearing weatherproof clothes). We might like to control the weather, but we would not like to fully control our encounter with wild animals, such as our experience at a zoo. In the same way, people may visit public spaces (such as a bar) with the hope of some unpredictable encounters that can lead to new friendships while at the same time hoping for predictability in that these new encounters will only lead to good relationships. The same goes for visiting the movies or reading a book. We want the experience to be predictably enjoyable while also being surprised and excited by events and aspects we did not expect.

In other situations, unpredictability is less desired. When we drive a car, we predict that most other drivers will behave in accordance with traffic rules, norms, and regulations. When it comes to traffic safety, we, as a society, are constantly trying to improve predictability by creating new rules, tweaking existing rules, adding new technologies, and fostering new habits and norms. We do not usually see creativity and innovativeness on the part of individual drivers as a potential improvement since it would lead to unpredictable actions. In traffic, predictability of human activities is crucial.

Given these examples, it seems obvious that unpredictability and predictability are neither inherently good nor bad. Their value can only be measured in relation to particular purposes, desires, and goals. This means that when it comes to designing aimed at creating the not-yet-existing, some form of unpredictability is unavoidable.

Another conclusion, relevant for the argument of this text, is that people are in many areas of life engaged in improving their actions and processes to achieve better results. It seems to be a human habit. It is also clear that when people engage in improving human actions and processes it is both normal and common to do that through the lens of predictability. Based on this reasoning, it is not strange that design researchers want to improve designing as a process and that they sometimes approach it through the lens of predictability. However, that does not mean that it is unproblematic.

The following will be an analysis of some of the reasons why design research in many cases use predictability as a measure of success of the attempts to improve design practice, even though designing is understood as unpredictable at its core.

Framing Predictability

The notion of predictability can be understood in many different ways as discussed above. The way we frame it is crucial and has consequences for how we can think about it. The most common and maybe natural way to think about it has been shaped by an everyday understanding of what science is and how it works.

Most people, even people with no knowledge of research, understand predictability as a corner stone in the foundation of science. Of course, predictability is a concept that is heavily debated and a concept that takes on many disguises in the world of science and research. However, in the everyday understanding of science, the notion of predictability is mainly seen as a measure or criteria of success. The typical and ideal research process consists of someone making a claim in the form of a theory (broadly understood) about how some particular aspect of reality *works*. The way to measure the correctness of the claim is to use the theory as a predictive tool. The theory predicts certain outcomes given certain conditions. If the theory correctly predicts the outcome, then the theory is seen as proven, true, supported, or at least, not falsified. This is, of course, an idealized version of the scientific process or what Ziman (2000) calls the *legend of science*, but it is still part of an everyday understanding of what science is, and it is a way of thinking that has spread far outside of academic practice (Strevens, 2020).

The idea of predictability in science is foundational when the purpose is to develop knowledge that is claimed to be universal and absolute, but it is also instrumental when it comes to tentative ideas and preliminary theories. However, we know that there are very few areas where predictability can be applied in any strict and definite way (Cowles, 2020; Strevens, 2020; Van De Ven, 2007; Ziman, 2000). For instance, humanistic research is usually not at all concerned with the notion of predictability. The same goes for many qualitative and interpretative research approaches and methodologies. This means that predictability is not the only criteria for determining the quality of knowledge. But still, the scientific understanding and use of predictability is deeply rooted in academia and in everyday practice, for good reasons.

Predictability can, when it comes to human activities, be understood as the (simplistic) idea that a specific process, with its steps, phases, activities, and tools, will—independent of who is performing the process—lead to an expected (or same/similar) result. For instance, most people are in favor of such predictability (seen as fairness) when it comes to how they are treated by societal institutions, and therefore we, as a society, strive to make societal decision processes so predictable that the individual civil servant responsible for the process becomes irrelevant.

At the same time, when some societal processes are fully predictable, they are sometimes accused of being bureaucratic or technocratic and insensitive of contextual richness and complexity. But on the other hand, when judgment and sensitivity to individual circumstances influence the process, it is accused of not being fair and/or predictable. Sometimes an ideal process is understood as one where there is no influence from the person conducting the process, and sometimes it seems as if the ideal is when the outcome is fully in the hands of the person that conducts the process. These are two broad but distinct approaches, one that aims at making the process independent of the person and one that aims at increasing the influence of the person.

We can find both these approaches when it comes to research aimed at improving designing. One that is driven by the desire of a person-independent process and the other driven by an

ambition to increase the influence of the individual designer. Of course, it is seldom that we find a statement that expresses these desires. We do not see design researchers claiming that *if our design method is used, it does not matter who the designer is*, but at the same time, the underlying idea is often that the new design method will influence (improve) the design process to become more predictable (improved). In some cases, that is achieved by (intentionally) reducing the role and influence of the designer.

A conclusion from this reasoning is that predictability often becomes a measure of success even when it is about processes that are not suitable for prediction. Predictability may even be used when the process in question is intrinsically unpredictable, such as with designing.

Designing as Intentional Change

It is impossible to, in a concise and brief way, fully examine the nature of designing and why it is not a process that can easily be made predictable. It is not the purpose of this article to make such an argument, it has been done convincingly by many design researchers already. For the purpose of this examination, only a few of the major arguments will be outlined, therefore, this section should not be seen as a full explication of the nature of designing. Instead, it serves as a sketch that makes it possible to move to the next step in this examination.

In this examination, the discussion will primarily be about aspects of designing that clearly *relate to predictability* which means that many aspects are left out. If the reader is not convinced by this brief argument, then of course the rest of the paper will be less valuable. However, hopefully this will at least be enough to set the stage.

Designing is about changing the world. Changing the world is easy and unavoidable. Every action taken by humans lead to changes in the existing world, no matter how small and insignificant they are or may seem to be. Any change has an infinite space of consequences. This does not mean that all change made by humans are examples of designing in the way discussed above or of interest to our examination. Designing is here seen as an activity aimed at *intentional change*. That is, an activity that is expected to lead to an intended new state of reality.

Many of our everyday activities that change our world are intentional in some way. We are trying to achieve something, and we make intentional and appropriate changes to our reality. In most cases, however, to figure out and decide about these changes are not intellectually challenging nor do they require a well-developed process (or at least we think so). They are just part of what we consider to be our tweaking of everyday habits and routines. These everyday forms of designing are not our primary concern here. Our focus is instead on *professional intentional* designing.

So, what is so unique about designing that makes it difficult to improve and predict? Even though designing does not have a definition that is accepted by all, there is in some communities and on a philosophical level some agreement on what constitute designing as a process of intentional change. During the last decades, we have seen an impressive development of theory about designing. Within this field, designing is commonly seen as a human activity of inquiry and action aimed at changing the state of the world (Dorst, 2003; Galle, 2018; Gero et al., 2014; Hatchuel et al., 2009; Krippendorff, 2006; Lawson, 2005; Nelson et al., 2012; Norman, 1988; Pye, 1969; Schön, 1984). This means that designing involves both finding out something about reality (inquiry) and about making change happen (action). Another aspect of designing is that it is usually considered to be a process that leads to something new, something not-yet-existing (term from Nelson & Stolterman, 2012). If the outcome of a design process is just a copy of something already in existence, it is rarely seen as a product of designing.

Designing is driven by a *desire* for change or *desiderata*, that is, the desire for something not existing that either pulls or pushes design forward. Desiderata, as defined by (Nelson & Stolterman, 2012), is a term that can be seen as the all-encompassing combined wants, needs, and desires that all stakeholders together have in a particular situation. Of course, these needs and desires do not have the same weight or importance to all stakeholders, so discovering the desiderata for a particular situation is a complex and extraordinarily difficult task for a designer. This fact is why design research (understood as user research or market research) is central to many designers as a way to find out as much as possible about the context and people, and about their wants and needs, and about limitations and opportunities. Ideas about change emanates and emerge from a deep understanding of desiderata. A well developed understanding of desiderata can then ignite and initiate a design process and fuel it to its realization.

However, one complexity with designing is that any design idea or even implemented design can influence the desiderata. This means that what was initially desired, may, when a new design is implemented, lead to new considerations and revelations of what is desired. There is no stable state when it comes to what humans want and desire—it is constantly changing. Desiderata is not *given* or *existing*. It is, in most cases, a human reaction toward a situation that in some way does not provide the outcome or experience that someone would like to see. This means that desiderata can only be understood in relation to what already exists, that is, in relation to a specific context and reality. When the existing reality changes—for instance, with the implementation of a new design—the desiderata also change. What is desired is not the same as before the implementation of the new design. A perfect design can change what constitutes a perfect design. This has been developed and theorized in some detail by, for instance, Schön (1990) with his idea about *figural complexity* as the co-dependence of *problem* and *solution*, and by Hatchuel and & Weil (2009) in the CK theory, and Gero and Kannengiesser (2014) in the FBS theory. It is also possible see the emphasis on iteration in design practice as a way of dealing with this co-dependance in a practical way.

There are several other distinct aspects of designing when compared to other approaches of inquiry and action. One of the most important aspects is that designing engages in a particular way with *imagination*. A designer must imagine a non-existing reality both as a whole and in detail. This means that designing leads to a suggestion of a new reality that resonates with someone's desire or desiderata while at the same time resonates or fits with what already exists. Since designing is about the not-yet-existing, it is

logically impossible to test in advance to what extent a particular situation with an added new design fulfills or lives up to the intended qualities. The only situation when that would be possible is if the proposed and imagined new state is only and completely a consequence of natural laws that in a complete sense determine the outcome in a way that fully comply with desiderata. This can, however, only happen if the proposed change takes place in a world that will not in any sense be affected by the new design except in intended ways. This form of *isolation* of a change is not possible in our everyday world and therefore complete prediction or exhaustive advance examination of a design's consequences is not possible. This is known and experienced by practicing designers and is why, among them, the notion of *unintended consequences* is commonly used as well as the understanding that designing will many times fail, and that it is a process that takes courage due to its inherent inability to provide any guarantees.

A design is not fully realized until it becomes part of the existing reality. It must be manifested in the specific context where it is supposed to exist. Even if a design, as an idea, a concept, or even a finished artifact is developed, it is the realization of the design into an existing reality that determines to what extent the desiderata that triggered and guided the design process is fulfilled.

So, designing is, in this context, the intentional professional process of creating something new and not-yet-existing aimed at satisfying desiderata. There is no way to understand all the consequences of a design since it is an addition of something new into an already existing complex reality. The complexity of the composition of new and existing is infinite, even with a small design. Given this definition, complete predictability, when it comes to the design process, is not possible.

This understanding of design has been developed by a number of design theorists and can be seen as an accepted broad inclusive theory of designing even though there are many variations when it comes to details. One theory, among others, that aligns with this broad picture of designing as an unpredictable enterprise and can serve as an example is developed by Donald Schön in his writing about *figural complexity*.

Figural Complexity and the Un-predictability of Designing

Schön (1971) stated famously that there is no such thing as a stable state when it comes to our reality. Schön argued that we can never rely on our reality as given and to stay the same over time. Instead, our environment constantly changes. Schön also argued that there is no way we can develop methods or approaches for intentional change that can be proven to always deliver the best result. When a new design is added to the world, the initial state changes, and earlier understandings of the previous reality do not apply any more (similar to the discussion of desiderata above). This means that the method that worked in a previous situation does not necessarily work in the new state of reality.

Schön describes this impossibility of complete prediction with his theory of *figural complexity*. In this text, Schön defines designing as: "In the very broadest sense, designing is the process by which things are made." (p.111) To be able to explain this process of designing, Schön develops a number of concepts and their relationships. It is possible to read his proposal as a fundamental theory of designing. As such, it is a theory that explains some core aspects of designing and why these aspects make designing an unpredictable process.

Schön introduces the notion of *design structure*. He writes, "By design structure, I mean the designer's representation of a problem together with the rule-governed procedures that guide his transformations of it" (p. 111). This means that a design structure is the designer's representation and understanding of an existing situation. (As a side note, Schön uses *designer* as a concept that includes anyone involved in the design process).

The next concept that Schön introduces is *design proposal.* A design proposal is the imagined design that, if manifested, would satisfy the desires that would constitute a response to the design structure.

The core concept of Schön's theory is *figural complexity.* Schön argues that all design proposals are dynamic constructs that constantly change during the process of design. And as soon as one aspect or element of the design proposal changes, the whole proposal changes. Schön's notion of figural complexity refers to the overall *shape* or *gestalt* of the design proposal, its *figural* composition. The notion of complexity refers to the infinitely complex relationships between the elements of a proposal. This means that "In actual designing, successive trials are not independent of one another, …The designer's choice of a new color or pattern is likely to be influenced by previous judgments of fit or misfit, that is, by learning from previous trials, and paths of influence may differ depending on one's view of the actual learning process" (pp. 124). This, in turn, means that "actual design proposals are generated and selected through processes of learning that involve appreciations of figural complexity. When they are enacted, they change design structures in ways that set new conditions for the judgment of fit or misfit." (p.125)

Schön's theory clearly advocates an understanding of designing as a process of constant learning and change, which also means a process that is logically impossible to not only predict but to prescribe in any detail. His theory of figural complexity also leads to the revelation that design is *irreversible.* No iteration or going back in the process will return to the same place where the process was earlier. The learning and figural changes mean that the earlier place, in light of new insights, does not exist.

In summary, Schön's theory of figural complexity explains how designing is a non-reversible, time dependent learning process where all aspects are interrelated and interdependent. There is no way to fully understand this process in advance or to know what the best possible design action or decision is in each step of the process. Each decision and action influence the next decision and action. They even influence and change what the designer sees as valuable, needed, and desired throughout the process.

It is important to recognize why the nature of designing has these qualities. It is because a process such as the one Schön describes has the potential of being extraordinary sensible to the richness and complexity of reality. It would not be possible to achieve this by capturing comprehensive data about reality that through a logical process is manipulated into a future desired state. Instead, it is a process that relies on the involved designers'

judgement and sensibility to, in an intuitive and imaginative way, deal with infinite richness and complexity with limited resources and time. This means that certain situations and problems are suitable for a designerly approach (while, of course, others are not). The approach is also, as a consequence of being unpredictable, able to produce not-yet-existing creative and surprising outcomes.

The purpose of the last two sections has been to show that there exists a quite established consensus in contemporary design theory that designing as a process is not possible to fully predict and that designing is a process that gains its strength from its nature of being partially unpredictable. Our next step is to examine how design research, aiming at improving designing, use different forms of predictability as a tool or measure of success.

The Structure and Logic of Improving Designing

Design research aimed at improving designing is a highly diverse field and it is not possible to portray it fully or in any way that would be fair to all. This means we should be careful in drawing conclusions about what contemporary design research is doing, its purpose, and means. However, for the purpose of this text we need some way of describing what design researchers do when they try to improve designing.

Let us start by painting a picture of a typical process that a design researcher might use when they try to improve designing. First, the researcher proposes a new approach that they have invented, created, and developed (tool, method, technique, etc.) The researcher then argue that the approach will lead to certain design outcomes or qualities. Then the researcher tests the approach by letting some designers use the approach in real situations. After that the researcher will analyze the outcome to see if the design outcome shows the expected and predicted improved outcomes and qualities. If they do, it is seen as *evidence* that the approach works. Based on the results, the argument is made that if designers will use the new approach, it will with some predictability and certainty lead to desired outcomes.

There are at least two ways we can interpret the researcher's claim in an example like this. One strict and one cautious. The strict interpretation would be that the claim is that if the approach is used it will always and with certainty lead to expected outcomes. This very strict interpretation is probably one that very few researchers want to subscribe to, and we do not often see this as an explicit claim.

Instead, commonly we see a more cautious interpretation that can be exemplified with statements as *the study indicates that our method has potential* or that *the findings are promising but more research is needed.* These types of statements are quite confusing if we read them from the perspective of predictability. Do the researchers mean that the findings support some predictability with the approach or not? Will more research lead to some clear findings that the approach is proven to work or not? In many cases, the researchers actually do not mean that there is any strict predictability in their approach or in their study, but they cling to a language that implies such scientific measures and causality.

Both the strict and cautious interpretation seems to be influenced by an understanding of the scientific process and its methodology and a willingness or desire to hold on to its language, while it is applied to a process that by definition is not aimed at creating highly particular outcomes with some certainty. It could be the case that design researchers, even though they understand the problematic aspects of these kinds of arguments, feel forced by the academic culture to dress their research in a language of *claims* and *evidence.* We will later come back to this issue.

Design research aiming at improving designing can take very different approaches. In order to have a way of discussing possible approaches, a simple model that categorizes approaches based on how they intend to influence the design process (Table 1) might be useful. This Table is created for the purpose of this article and does not represent or depict actual design research approaches and it does not say anything about how common they are. The Table should instead be understood as a conceptual map of some possible design research approaches. The categories are based on the idea that a design researcher has some basic assumptions about (1) how the process is possible to influence, and (2) how to achieve that influence. The Table describes a set of possible ways to influence the design process and how to do that.

Table 1. Some possible approaches for improving designing.

Improving the design outcome by *increasing* or *decreasing*…
• The influence of the **designer**
• The size or shape of the **design space**
• The impact of the **design situation (context)**
• The influence of **tools, methods, and techniques**
• The influence of established **knowledge**
• Notions of **good design**

A researcher (or practitioner) who wants to improve designing can, as Table 1 shows, focus on a certain element or aspect of designing. In the Table, the elements listed are the designer, the design space, the context, the methods, tool and techniques, established knowledge, and the notion of good design. We can, of course, imagine several other elements. These elements should be understood as broad and inclusive. For instance, the element the designer should be understood to include everyone who is actively involved in a design process. The context should be understood as including any aspect of a situation where a design is meant to be implemented, from the local to the most inclusive global aspects. And the same goes for the other elements.

Any approach to improve designing can now, based on Table 1, be seen as trying to *increase* or *decrease* the influence of a particular element, following the pattern: improving the design outcome by increasing or decreasing X.

For instance, a new design tool is often introduced based on the idea that the influence of the tool AB on the design process will improve the outcome, as in improving the design outcome by increasing the influence of tool AB.

The reasoning behind this is that by increasing the influence of the tool, the process will, with higher predictability, lead to a desired outcome. Of course, we can imagine that someone else would argue for the need of decreasing the influence of the same tool, based on the idea that the tool is harming the process. In both cases, the idea is that by either increasing or decreasing the influence of the tool, the design process will be improved in some way that will lead to a desired design outcome.

For each of the elements in Table 1, it is possible to imagine what possible improvement approaches might be. For instance, if the focus is on the designer, the approach would be to either increase or decrease the influence of the designer. This can be seen as trying to make the design process more or less person dependent.

With the element of the design space, the idea would be to develop support that could increase or decrease the design space. Increasing the design space might be based on an assumption that there is a need for methods that expands the space, that is, increases creativity in the process. On the other hand, we can imagine the idea that designing does not reach its full potential if the design space is too large, so there is need for a support that can help reduce the design space.

The same goes for the other aspects in Table 1. And, of course, the notion of predictability comes into play when an advocate for a specific approach tries to prove that the approach with some certainty will lead to improved design outcomes.

If we assume that Table 1 only shows some of the possible approaches that design researchers can engage with to improve designing, it becomes clear that there is a plethora of possible approaches. And if we consider combination approaches, the number of potential approaches becomes even larger. It is not uncommon to see approaches that, for instance, argue for reducing the impact of the designer by implementing a new tool together with criteria that would define a desired design space. In such a case, we are dealing with changes that relate to three elements. The combinatorial aspects of such an approach becomes highly complex and, therefore, almost impossible to test in any empirical way. However, it is not unusual to find examples of combination approaches in contemporary design research. This is not strange in any way. To seriously influence the design process may require changes in several elements, not only one. However, if we want to empirically test these proposals, it becomes extraordinary difficult, if not impossible.

At the same time as these complexities emerge, we have to remind ourselves that it *is* possible to develop design support (methods, tools, techniques) that can lead to a design with particular qualities. For instance, in the extreme, we can imagine a method aimed at supporting the design of the physical size of a designed artifact. A method based on this purpose can then be developed in such a way that it, without any exception, will only allow designs that are within the size limit. This kind of predictability, when it comes to specific qualities, can be useful for designers in certain situations. But it is not the kind of overall improvement of designing that we generally see in the design research community.

If we go back to Table 1, it seems probable that most attempts to improve designing rests on the assumption that the influence of the designer should be reduced. This is quite natural since the designer is possibly the most uncontrollable but most powerful element in the process. The idea is to make sure that this *uncontrollable element* will not in any negative way influence the outcome. This kind of thinking is probably behind much development of new design methods and tools. The argument goes that since an individual designer is not able to have all the necessary competencies and skills for all kinds of design projects, we have to develop methods and tools that can compensate for that lack of knowledge and skill. This approach can be quite successful in supporting a designer, but it also has some interesting consequences. For instance, reducing the influence of the designer means that any form of (good or bad) professional experience, personality, and character of the designer will not in the same way influence the outcome of the process. This means that methods and tools that reduce the designers' influence will lead to some form of standardization or commodification of the process. In some cases, such a commodification might be desired and useful (efficiency, branding, safety, etc.), but in others it leads to conservation of existing solutions and not to creative and innovative designs. Of course, prescriptive approaches that may lead to standardization and commodification have their place as a support for beginner designers, as scaffolding for learning and training.

No approach to improve designing have a natural end or limit. Every approach can be made even more detailed, even more carefully developed so that each and every minute step of the process is fully prescribed. In the most extreme case, reducing the influence of the designer means that we can completely get rid of the designer, and we end up with a fully automated process. (For instance, we are today seeing a strong interest in different forms of generative design approaches. These approaches, in their extreme versions, reduce the designer's role to only evaluate presented alternatives). Again, this is not necessarily a negative outcome, there are situations when this is a desired outcome since it would lead to more predictable outcomes, often in the sense of being standardized and safe.

This examination has hopefully showed that even though some approaches will lead to changes in the design process and potentially influence the final outcomes, it seems impossible to produce evidence that a specific approach will, with some predictability, lead to some promised expected outcome. So, how can design researchers engage in improving designing without depending on predictability?

Ways of Improving Designing

As argued above, predictability is sometimes used as a way to verify that a suggested approach will, with some certainty, positively influence designing. We have argued that using predictability to measure the success of designing is highly problematic, if used in any strict sense. Does that mean that it is not possible for a researcher to do research that can improve designing? Not necessarily. There are many things that design researchers can do, and have done

successfully, to influence and also to improve designing without, or by being careful with, invoking predictable outcomes as an argument. We will briefly discuss a few possible approaches: the *inspirational approach*, and the *preparation approach* (there are of course others). But before we do so, let's stay with predictability and explore the notion of *soft predictability*.

Soft predictability. After having scrutinized and criticized the idea of using predictability as a measure of success it might be time to look at the idea with a less critical eye. If instead of a strict interpretation we would approach predictability more pragmatically, we may identify something that we might label *soft* or *cautious predictability*. The term *soft* would imply a form of predictability that does not invoke a strict scientific understanding of the notion. In many everyday situations people apply some form of soft predictability when they advocate for certain ways of doing things. For instance, we may say something like *I always use X when I do Y, and for me, it often works*. This statement mean that the person is not claiming that using X is the best way for everyone to achieve Y, but that for some, in certain situations, it may work. This way of invoking predictability is also quite common when it comes to design research. Often studies make arguments such as *we found that when designers used X they achieved Y better that without X.* This type of statement is often complemented with disclaimers about the testing, size of participants, cultural differences, or other aspects that might reduce the strength of the claim, ending with a statement that more research is needed.

This form of soft predictability makes it possible for researchers and practitioners to share their experiences and insights that are grounded on careful studies but not adhering to a strict scientific method. For this form of predictability to work, the *claim has to be reasonable in relation to the level of predictability invoked.* This means that soft predictability may work in a case where, for instance, a design researcher argues that their study suggests that tool X might help designers to do their work more efficiently but that there are many aspects and variables that need to be in place and that it is still not guaranteed that it will work. But if the same design researcher takes a strict predictability approach and argues that their study has proven that X will improve the design outcome without any disclaimers, then there is a problem. So, soft predictability is an approach that from a pragmatic point of view seems to be reasonable for certain studies aimed at transforming and improving design practice. However, it is an approach that, when presented, requires careful attention and sensibility in relation to claims and predictability.

After having looked at the soft predictability approach, let's look at two examples of approaches that do not invoke predictability at all.

The inspiration approach. In many design fields, a common approach is to help designers by *inspiring* them. The idea is that examples of artifacts or knowledge can inspire a designer to think and act in new ways. This approach does not include predictability when it comes to the outcome as any form of evidence. On the contrary, an inspirational approach cannot promise anything with any certainty. With a lot of work, it might be possible to *prove* that the influence of an inspirational method will lead to some desired outcome, but it can only be done by engaging a large number of designers with the same design problem under some controlled circumstances, but that requires very different research methods than what are commonly used in design research. It would require methods that are commonly found in large clinical studies, such as highly complex, long-term, controlled experiments with real people in real situations where the outcomes actually lead to real consequences. Predictability as a way of measuring the effectiveness of this approach seems quite futile. However, that does not dimmish the potential benefit of the approach.

Inspiration can be supported in many ways. For instance, designers can be inspired by seeing and experiencing concrete designs. This is an approach that many practicing designers constantly engage in. They collect examples of designs or details of designs, they develop collections of artifacts or photos, they take notes, and save sketches. The idea is that when engaged in a design process, previous designs, solutions, details, etc., will inspire new ideas, new designs, and new solutions. The way this happens is in the *collision* between the collections of concrete designs with the complexity and richness of the new design situation. It is of course not possible to predict *what kind of influence* or *inspiration* existing concrete designs will lead to. It is completely dependent on who the designer is and on the situation. One collection of designs can in one situation lead to ideas in one direction while in another situation lead to completely different ideas.

Traditionally, this approach has been used in education in architecture and other design disciplines. Architecture students are constantly being exposed to buildings, as models, in books, by visits, by traveling. It is expected that the stream of encounters with buildings of all kinds, shapes, forms, and styles will support and inspire the students to create their own designs when facing their own design situation.

Similar to how concrete artifacts can inspire designing, so can abstract ideas, concepts, theories, and metaphors. New ideas can strongly influence the way a designer will imagine future designs. New metaphors can inspire designers to radically shift their way of understanding a situation and a solution. This inspirational ability of abstract ideas and concepts is not easily tested. Of course, it would be possible to set up experiments where different metaphors or ideas are compared by how they influence designers, but again, to do this in a way that satisfies scientific requirements of predictability is extraordinary difficult.

Design research has been quite involved in the inspirational approach. A large amount of research in the field leads to new, creative artifacts and systems that are meant to show new aspects or qualities, or new ways of dealing with real problems. Conferences have special areas and sessions designated to the presentation of new designs. There is also a large amount of research aimed at producing new ideas, new metaphors, and new concepts that designers can use as inspirations.

The preparation approach. The idea of preparation means that instead of *prescribing action*, efforts are made to *prepare for action.* The idea of preparing instead of prescribing leads to a radically different approach when it comes to how to influence and improve designing (even though it partially overlaps with the inspiration approach). It commonly means that the focus is to increase the influence of the designer *in advance* of designing.

Any approach aimed at supporting a designer's ability to make judgments, to evaluate alternatives, and to develop innovative ideas without imposing a prescriptive process can be understood as a non-predictive way of supporting the overall design outcome. The preparing approach is about educating and training. To prepare for designing means that designers are engaged in activities that will help them to do the right thing and to do them well when they face a real design situation. Some of the more recognized theories on design practice argue for a preparation approach (Lawson, 2005; Nelson & Stolterman, 2012; Schön, 1984).

However, even with this approach it is not uncommon to see the use of predictability. It can take the form of *if you train people in X way, their designs will be more Y.* Using predictability in this way, with this approach becomes almost impossible. When the idea is to prepare a designer for design and have the designer act individually based on their own thinking and judgment, the breadth of variables (knowledge, experience, skills, personality, beliefs, etc.) potentially influencing the final design outcome becomes vast and not possible to control and measure. Preparation is an approach that, without any doubt, can influence designing but cannot verify improvement using predictability as a measure.

If we now, after looking at these different approaches, go back to Table 1, we can see how an inspirational or a preparing approach can (as probably any approach) be applied to each row in the Table. For instance, there are many design methods and tools that are aimed at inspiring the expansion of the design space. Many of these are labeled as creativity methods. The idea is that the method can inspire the designer to expand the design space in some way using a structured or random process. In a similar way, it is possible to find design methods that follow the preparing approach for all rows in the Table, primarily by supporting a designer to be able to make good judgements.

It seems as if all these approaches can, if done right with care and sensibility, lead to improved designing. But since they do not increase predictability they cannot promise anything, instead they commonly lead to increased risk. This aligns with what many design theorists and practitioners claim, namely the idea that design is always risky and that there is no guarantee of good outcomes. Improving designing should lead to (unpredictable) unexpected and exceptional (risky) outcomes. This is one of the core reasons why designing is used as an overall approach in the first place. Many of the successful influences that design research has achieved when it comes to transforming design practice has been through the use of either the inspiration or preparation approach, and much less by prescription and promises based on predictability (however, to substantiate this argument empirically would take some work).

There are probably other approaches, not mentioned here, that could be seen as aiming to transform design practice. Even though we have focused on certain approaches and how they relate to each other and to predictability, the main message is not the approaches themselves but the insight that every attempt to improve designing is affiliated with one of the mentioned approaches (or an approach not mentioned), and that each choice of approach has consequences.

Protecting the Core of Designing

One overall insight based on the analysis above is that it is essential to protect the core of designing. The ability of the design approach to support people to develop creative and innovative solutions to complex situations and problems is its unique strength and something that has evolved over time. It has led to an approach that has a strong core of knowledge, principles, processes, and activities. Any improvement of the process has to be done with due respect to what makes the design approach able to produce unique outcomes. There are limits to how much you can influence and change the process before it no longer will produce the kind of outcomes that was the reason to choose the process from the start.

It is possible and quite easy to break the core of the design approach. This is something that can happen with any approach. For instance, if the scientific approach is *improved* by increasing the influence of who is conducting the research and less guided by the scientific research method, it will no longer produce outcomes that people will recognize and respect as *true* knowledge. We usually do not consider research findings that are based on the judgment of an individual as reliable. We expect the outcome of the process to be person independent. Replicability is a key principle of research. That means that we cannot really improve science by increasing the influence of the individual researcher. The opposite goes for the artistic approach. If you attempt to make the artistic process faster and more streamlined by making it less person dependent and more automatic, it is probable that you will end up with outcomes that people in general will not accept as art. The reason is that most people see art as a process based on the core principle that the individual artist is fully responsible for the outcome. This is one reason why handmade artistic objects are usually seen as more valued and as real artistic expressions compared to mass produced objects.

Every approach of inquiry and change (design, art, science) has a core that over time has been *designed* (evolved) to produce certain outcomes. This core cannot be changed or tweaked without consequences. Of course, the core is not eternal or sacred, it keeps changing over time, and sometimes in radical ways. These approaches should, of course, not be seen as given or untouchable, they need to be constantly challenged and refined based on the changes of our needs of outcomes, but every time we intentionally try to improve or transform these approaches, we need to carefully reflect on what the consequences will be. We do not want to, with good intentions, break the ability of designing to produce the kind of outcomes we expect.

All this have implications for design research. Any research aimed at supporting or *improving designing has to be grounded in a deep understanding of the nature of designing,* that is, grounded in an understanding of the aspects that makes it an approach that can deliver a unique type of outcomes. If that is not the case, there is a risk that improvement attempts will lead to detrimental consequences, potentially destroying its core, and the approach will no longer provide desired outcomes.

Consequences for Design Research

What does this examination of improving the design process mean for research about and for designing? First, it is important to remember that even if it is difficult to prescribe and predict

designing, the ambition to improve designing is something that will continue to engage a large number of design researchers and practitioners, for good reasons. Research about designing has been and is today primarily a practice-oriented enterprise. That means that the purpose is to support and hopefully improve practice in some way. It is also important to remember that design research has influenced design practice in many ways already, in many cases for the better, by engaging one of the approaches soft predictability, inspiration, or preparation. But when it comes to using predictability as a way to establish evidence for an improved design process, we have to be careful.

As argued above, predictability is a powerful tool that is fundamental to most scientific research in the quest of universal knowledge. But when it comes to transforming a professional practice that is highly dependent on a unique set up of an individual designer's judgment, a collaborating team, large numbers of stakeholders, and a highly rich context, and a complex environment, it is crucial that the claims are reasonable in relation to the evidence. Design research is not less valuable if the claims are held low or if the evidence for success is not scientifically robust as long as they can support practice in ways that are beneficial to the participating parties.

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