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A systems theory perspective on the relationship between practice and research in the making disciplines

Abstract

This article discusses the relationship between practice and research in the making disciplines. The discussion is based on a systems theory with reference to the German sociologist Niklas Luhmann (2007) and the way Rasmussen, Kruse and Holm (2007) use Luhmann´s theory. This article constructs and emphasizes the fundamental difference between the practice system and the scientific system. Furthermore, it highlights the distinctions between practice as the development of knowledge and research as the generation of knowledge. In addition to these boundaries, the following four different forms of knowledge are classified and described: 1) practical knowledge and 2) professional knowledge, which are both associated with the practice system, and 3) research knowledge and 4) philosophy of science knowledge, which are associated with the scientific system. While emphasizing a fundamental difference between the practice system and the scientific system, this article assumes that art and design research should deal with aspects from both systems. The systems theory term 'structural coupling' offers a way to enable the two systems to influence each other while maintaining their own boundaries. Insider research is a structural coupling between the practice system and the scientific system. By exploring art and design processes from within as both the practitioner and the researcher, it is possible to generate knowledge both about and for practice. This article considers art and design research as a subsystem of the scientific system and argues that this approach may strengthen the further development of art and design research.

Keywords: art and design research, making disciplines, insider research, systems theory, structural coupling, knowledge development, knowledge generation.

Introduction

This article discusses the relationship between art and design practice and art and design research. The phrase *field of art and design* is used in this article as an umbrella term for art, arts and crafts, design and architecture, as well as the research and educational explorations of these areas. This article considers the *making discipline* as a key aspect of *art and design research.* The concept covers a wide range of areas in relation to its 'branches' and concepts, including, for instance, art-based research, artistic research, research through design and research by design. Within making disciplines, the practitioner is emphasized as the one who both develops and generates 'making knowledge' of the creative activity. The word 'making' covers the design of a wide range of objects, 'from the spoon to the city' (Dunin-Woyseth & Nielsen, 2004, p. 5).

A systems theory perspective with reference to the German sociologist Niklas Luhmann (2007) is used as a departure for an analysis of the relationship between practice and research in the making disciplines. The intention is to describe and discuss art and design research, including the meta-discussion about it. Over the last 40 years, this discussion has been dominated by the relationship between practice and research (Biggs & Karlsson, 2010; Grand & Jonas, 2012). Within the making discipline, it is agreed upon that professional art practice is a knowledge-producing activity. Whether one characterizes this knowledge production as practice or research seems more ambiguous. Furthermore, if practice is performed and understood as research – for instance, as design research, it still seems to be a

part of a complex discussion concerning the relationship between practice and research (Friedman, 2011; Grand & Jonas, 2012).

Based on Luhmann´s (2007) theory regarding the functionally differentiated society, a distinction is constructed between the *practice system* and the *scientific system*. The analysis and the approach in applying Luhmann's systems theory refer to the Danish pedagogues Rasmussen, Kruse and Holm (2007) and their way of discussing the relationship between theory and practice in the context of pedagogy. From a systems theory perspective, it can be problematic if art and design research is understood as both practice and research within the same system. Each system is constructed by marking the difference between itself and its environment by defining a binary code. Since the practice system and the scientific system operate according to their own binary codes, it is destructive for both systems if, for instance, one sees art and design practice *as* research. The system distinction illustrates the danger of one system being destroyed when it attempts to adapt to the other. In the first part of this article, these boundaries between the systems and their surroundings are explained through Luhmann's (2007) concepts of *self-organization* and *autopoiesis*. In addition to the distinction between the practice system and the scientific system, the difference between *knowledge development* and *knowledge generation* is addressed. In order to clarify the type of knowledge attached to each of the various systems, the following four different forms of knowledge are described: *practical knowledge*, *professional knowledge*, *research knowledge* and *philosophy of science knowledge*.

The second part of this article starts by describing the relationship between practice and research in the making disciplines. This discussion suggests that art and design research should be characterized as a subsystem of the scientific system and argues that doing so will help art and design research to adopt a 'both/and' approach instead of an 'either/or' approach. To facilitate this approach, *insider research* is presented as a *structural coupling* between the two systems. Exploring art and design processes from an insider's perspective, as both the executive practitioner and the researcher, enables aspects of art and design practice to inspire and influence the research process, while simultaneously maintaining the boundaries of both systems. Using *insider research* as the structural coupling will thus provide the two systems with the ability to 'irritate' each other towards development, but on the terms of each individual system. Instead of destroying each other, the two systems could thus reinforce each other. Art and design research will thus potentially be both about and for practice.

Based on some observations both before and during the 2012 Making Conference in Notodden, Norway, this paper discusses an apparent tendency in the making disciplines to describe art and design research as a subsystem of the scientific system.

Distinction and subdivision

Luhmann and the system theory

Luhmann's (2007) main thesis is that modern society is characterized by functional differentiation. In other words, society is divided into a number of systems, such as the economic system, the political system, the legal system, the educational system, the scientific system, the artistic system and so on, all of which have separate functions (Luhmann, 2007; Rasmussen, Kruse, & Holm, 2007). These systems can then be further divided into subsystems.

Luhmann bases his theory on a paradox, which he expresses as *the unity of difference.* The unity of difference can be created between the system and the environment, where the system as a complexity of operations has the ability to mark a difference between itself and the environment. According to Luhmann, 'The system draws boundaries through its own operations, it distinguishes between itself and the environment, and only then, and only thus,

it can be considered a system' (2007, p. 88). A system is thus defined as a form concept, not a substance concept, where the system always operates inside the form.

The system's operations are only available to the system and take place within its boundaries. This means that systems are operationally closed in relation to their surroundings. For instance, there are no cells outside a living organism and no thoughts outside consciousness. Luhmann (2007) also considers the matter of *self-organization* and *autopoiesis*. The system's own operations have two intentions. First, self-organization is the formation of structures through operations. There are no structural imports from the environment into the system (Luhmann, 2007, p. 95). Second, autopoiesis is concerned with the operations of the system. Here, Luhmann is inspired by the Chilean biologist Humberto Maturana and his work on the organization of living systems. According to Maturana's definition, autopoiesis states that a system can only produce its own operations through the interconnection of its own operations (Luhmann, 2007, p. 103).

How is it possible for a system to operate in an environment, if it is autopoietic? (Luhmann, 2007, p. 246). The operationally closed systems form relations with the environment through a so-called *structural coupling*. Structural coupling is the term for the structure-determined (and structure-determining) engagement of a given system with either its environment or another system. Luhmann also borrows the concept of structural coupling from Maturana, who describes it as standing 'orthogonal' in relation to the system's autopoiesis (Luhmann, 2007, pp. 112, 246, 250). Structural coupling does not interfere with the system's autopoiesis, that is, there is no causal transmission from the structural connection to autopoiesis. The environment cannot contribute directly to the system's maintenance, per the concept of autopoiesis. As long as the autopoiesis functions, that is, as long as the system is able to continually reproduce itself, its structures can be developed. Luhmann observes that 'The connection between system and environment concerns only the structures and everything that may be relevant to structures in the environment' (2007, p. 112).

Thus, although there is no structural determination from the environment to the system, structural coupling provides the system with 'interruptions'. The term 'interruptions' also comes from Maturana. Luhmann, however, prefers the terms 'irritation', 'sense influence' and 'resonance ability' to describe the process of information editing, which can be handled operationally in a system. The individual system decides whether or not the irritation will result in changes in its structure. Causalities between the system and the surroundings are only in the area of structural coupling. All structural couplings are compatible with the autonomy and the autopoiesis of the system (2007, p. 113).

The practice system and the scientific system

Rasmussen, Kruse and Holm (2007) problematize the term 'pedagogy', which often refers simultaneously to pedagogical practice, reflections on pedagogical practice and pedagogical research. The writers consider such a broad definition impractical. With reference to Luhmann (2007) and his theory about a functionally differentiated society, they emphasize the distinctions between the *scientific system* and the *education system*. The function of the scientific system is to produce new knowledge; furthermore, it has the symbolically generalized medium of 'truth'. This system observes itself by using the code 'true/false'. Codes are supplied by programmes, which are rules concerning ways the system can act. In the scientific system, these programmes consist of theories and research methods (Rasmussen, Kruse, & Holm, 2007, p. 30). On the other hand, the function of the education system is 'educating'. It has the symbolically generalized medium of 'course of life' with the primary code 'communicative/non-communicative'. In addition, Rasmussen, Kruse and Holm (2007)

describe the secondary code 'better/worse'. The programmes for the education systems are pedagogical and involve didactical theory and curricula (Rasmussen, Kruse, & Holm, 2007).

A system distinction such as that between the scientific system and the education system illustrates the complications that arise when the two systems are regarded as one. Rasmussen, Kruse and Holm (2007) call attention to the challenge that educational research faces when it is supposed to develop generalizable knowledge which is simultaneously regarded as useful in practice (in their case, pedagogical practice and the teachers). The two systems will easily be able to 'talk transversely to each other' (Rasmussen, Kruse, & Holm, 2007, p. 89). In an attempt to clarify the differences between the two systems and to explain the different kinds of knowledge, the authors distinguish between pedagogical knowledge produced according to scientific criteria in the scientific system and pedagogical knowledge produced as a reflection of knowledge in the education system. Thus, they describe three different kinds of knowledge: pedagogical practice, pedagogical professional and scientific pedagogical knowledge. They argue that these distinctions will facilitate the opportunities for coupling scientifically generated knowledge and knowledge from practice (p. 24).

Instead of identifying the distinctions between the *scientific system* and the *education system*, the terms *the scientific system* and *the practice system* are here used as basic distinctions. The current interest in the practice system is *art and design practice*. The term *practice system* is thus supposed to be a parallel to Rasmussen, Kruse and Holms´ (2007) notion of the *education system* (Whether [design] practice can be described as a functionally differentiated system in Luhmann´s (2007) sense is questionable. I will not argue further for the system characterization used here, but instead describe this as an analytical experiment). Design practice as a similar practice system can be described with the 'function' to produce new, functional and aesthetic products. This system´s symbolically generalized medium comprises 'design products'. The precise design, functionality and aesthetic concern will depend on the different directions and branches in the field and their various definitions of the term *design*. With my own practice as an example, the function will be to make usable, aesthetic clothing. The code with which this kind of practice system describes itself is 'productive/non-productive' with the criteria 'functional and aesthetic'/non-functional and 'non-aesthetic' as a kind of secondary code. The programme for design practice consists of 'practice-specific working methods'. For instance, in my own work, this programme will be patternmaking, techniques for sewing, knowledge about materials, and different design and product development methods.

Different kinds of knowledge and knowledge production

The basic distinction between the practice system and the scientific system constitutes the *art and design practice* as a subsystem of the practice system and the *art and design research* as a subsystem of the scientific system. This is emphasized further by distinguishing between the *development of knowledge,* which is associated with the practice system, and the *generation of knowledge,* which is associated with the scientific system. To qualify as research, there must be generated knowledge of the product- and knowledge-developing process. Thus, this article associates the term *generation of knowledge* with research and the scientific system; the generation of knowledge in the field of art and design has its beginnings in the creative process and possesses a knowledge-developing and explorative character.

Thus, art and design research is carried out with the intention to generate knowledge of a scientific nature. For instance, when a designer is developing knowledge about a certain textile to create the desired expression, this explorative result will have a direct consequence on the design process and further development of the product. The research results are nevertheless the knowledge generated through the design processes. The design process and

the research process will influence each other, but they have different explorative, methodological and analytical natures. Despite several methodological similarities, there will be more methodological control, critical reflection and meta-reflection in the generation of research knowledge, compared to the explorative nature of practice. The term *production of knowledge* is used to describe both the development and the generation of knowledge.

To clarify how the term *knowledge* is used in relation to the different kinds of knowledge production, I have distinguished the four kinds of knowledge as follows: 1) *practical knowledge* and 2) *professional knowledge*, which are both associated with the practice system; and 3) *research knowledge* and 4) *philosophy of science knowledge*, which are associated with the scientific system. These four kinds of knowledge are described below:

Practical knowledge

Practical knowledge concerns the knowledge developed in practice, which is a result of learning processes. Practical knowledge is a system of methods oriented to a certain goal and a product of practical training, learning of skills, personal experiences and education (Dale, 2001, p. 76). According to Dewey (2008), the value of this kind of knowledge lies in its problem-solving abilities. This knowledge is mainly instrumental and is described as a process of experience consisting of three stages: it begins in practice, proceeds to reflection and then returns to practice to use the newly constructed knowledge. According to Dewey, we do not achieve knowledge; instead, we create an experience. This process is a combination of experience and reflection. Experience then becomes a product of action, and is not reduced to something primarily intellectual (Dewey, 2008; Gustavsson, 2001, pp. 134, 149; Løvlie, 1992). Regarding practical processes in the making disciplines, practical knowledge is the kind created during the product development stage. This is a sort of knowledge built on experiences from the making process.

Professional knowledge

Professional knowledge improves practice and the practitioner. On the one hand, it involves the nature of ideas and ideals for successful practice, and on the other hand, it involves knowledge based on a systematic experience of practice (Rasmussen, Holm, & Kruse, 2007, pp. 111–112). Professional knowledge is developed for practice. At this level, the practice-related reflections have a meta-character. Here, the practitioner is able to use reflections to evaluate the value of actions. In the field of art and design, professional knowledge involves reflections on how different experiences and developed knowledge can be used constructively in product development (Schön 2001). In an educational context, reflections on one's own learning and knowledge development will also be included. These kinds of knowledge-developing processes will result in understanding how to develop knowledge and how to use it in the current situation.

Research knowledge

Research knowledge concerns knowledge generated through investigation. The results generated will be considered research knowledge if the investigation meets the criteria for research activity, that is, when it is carried out systematically, methodologically and critically, and where the current results and conclusions are discussed. In the making disciplines, this kind of knowledge concerns art and design practice and can be both about and for practice. In this kind of knowledge production, the relationship between practice and theory can vary. For instance, a practice-concerned investigation can involve the generation of knowledge about a specific material. Within a more theoretical research project, it can, for example, entail the generation of knowledge about the design processes. In art and design research, these aspects

are influenced by the object of investigation, namely, the art and design processes. Moreover, the research knowledge will often be generated from practice, or from within by the practitioner himself or herself. This can be described as an *insider researcher* perspective. As such, practice and research should influence each other in order to qualify as 'art and design research'. I will explain this further in the second part of this article.

Philosophy of science knowledge

Philosophy of science knowledge involves the theory of reflection in the scientific system. The essential elements here are philosophy of science, epistemology and methodology, where one works with questions concerning scientific knowledge and understanding. Seen as a whole, it can be characterized as a meta-scientific knowledge, which means the ability to generate true knowledge. Philosophy of science knowledge is concerned with the understanding of the research results by evaluating them according to the criteria of truth, that is, by reflecting the conditions and circumstances (which method and in which context) from which the results can be seen as true knowledge (Rasmussen, Kruse, & Holm, 2007, p. 85). According to Luhmann (2007) and the systems theory, one always indicates something on the basis of a distinction. In other words, one points at 'something' instead of something else. By changing between first- and second-order observations/descriptions, that is, by describing what one is watching and the way one is watching, others are afforded the possibility of making their own constructions of the research. Philosophy of science knowledge is needed to plan and complete empirical explorations and investigations. As an insider researcher who is supposed to investigate practical, aesthetic activity, one becomes a researcher with a double role, that is, one is both the creator of the empirical data and the one who analyzes it. Art and design research has a recent tradition and no established methodology. Therefore, conducting this kind of knowledge generation demands broad scientific learning and openness, as well as an ability to focus, argue and substantiate the research.

Table 1 represents a summary of the distinctions between the practice and the scientific systems, as well as the different kinds of knowledge.

Table 1. The distinction between the practice system and the scientific system and the different kinds of knowledge and knowledge production related to this distinction.

The practice system		**The scientific system**	
Practical knowledge	Professional knowledge	Research knowledge	Philosophy of science knowledge
Development of knowledge		Generation of knowledge	
Knowledge production			

Art and design research as a subsystem of the scientific system

Production of knowledge in the making disciplines

From the systems theory perspective, one can say that the making disciplines are in a process of observing themselves. Each discipline attempts to establish art and design research as an

independent system by distinguishing between itself and its surroundings. Within the making disciplines are different opinions about knowledge production in art and design processes, as well as the relationship to research and the scientific system. The discussions often turn to the distinctions between practice in itself and practice as research (Borgdorff, 2010, p. 54). Several influential voices in the field have tried to clarify the relationship between design and science, between practice and research, and between practice and academia (Biggs & Büchler, 2010; Cross, 2006; Grand & Jonas, 2012; Kjørup, 2010; Krippendorff, 2007; Sevaldson, 2010). These meta-discussions very often refer to Frayling´s (1993) categories of art and design research – research *into*, *through* and *for* art and design – derived from Herbert Read and his ideas about art education. Jonas (2007) have sketched similar design research concepts based on Frayling´s terminology from 1993 (e.g., the concepts of Frayling and Jonas (as well as Findeli) are summarized in Jonas, 2012 p. 22).

The long-running discussion about art and design research can – through a systems theory perspective – be explained by the tendency to reconcile the two and to consider them as one unified system. Art and design processes have characteristics that elude research. Apparently, this quality evokes the need to legitimize these processes as knowledge-producing activities in the making disciplines. Unpredictability and non-linearity characterize both society and contemporary science, and are often emphasized as characteristics when design processes are described as knowledge and product-developing processes (Dyrssen, 2010; Nowotny, Scott, & Gibbons, 2001). Thus, the development of science and research methodology in general has influenced the discussion of art and design research. Dunin-Woyseth and Nilsson state that the development of a 'post-academic science' supports the possibility of considering this kind of knowledge production as equal to other kinds (2008, p. 142). In several fields in the making disciplines, art and design processes are characterized *as* research (Grand & Jonas, 2012). Citing Borgdorff's definition, 'artistic research – embedded in artistic and academic contexts – is the articulation of the unreflective, non-conceptual content enclosed in aesthetic experiences, enacted in creative practices and embodied in artistic products' (2010, p. 47). In some concepts, the products made in a design process can be characterized as scientific results. However, other perspectives emphasize the difference between practical and professional knowledge and research knowledge. For example, Ken Friedman opposes the way of characterizing practice as research: 'Instead of developing theory from practice through articulation and inductive inquiry, some designers simply argue that practice is research and practice-based research is, in itself, a form of theory construction' (2011, p. 20). Friedman argues that even though the practice of design is a foundation of design knowledge and that design knowledge and research overlap, it is the action of systematic and methodical inquiry that constitutes research (2011, p. 12).

Jonas (2012) describes these kinds of differing perspectives within the field as a 'designerly' strand and a 'scientific' strand. However, he acknowledges 'a plurality of schemes in peaceful co-existence' (p. 26) with references to, among others, Love (2002). Grand and Jonas (2012) represent the 'designerly' strand, arguing that design practice can be interpreted as research practice. Jonas identifies different criteria of the design research to ensure that it is the generic design process and not the scientific process that guides design research:

> The scientific paradigm must be embedded in the design paradigm:
> - design research is guided through design process logic,
> - design research is supported by phases of scientific research and inquiry, and
> - complexity must not be unduly reduced, or the subject matter of design research is destroyed (2012, p. 31).

Jonas places Friedman in the 'scientific' strand, and describes this as 'attempts to re-align design research with scientific research, or to re-establish a clear distinction between (reflective) practice and "proper" research' (2012, p. 24). From a systems theory perspective, one can say that these 'strands' differ in the way they acknowledge art and design research as being a subsystem of the scientific system. As such, it seems as if Jonas (2012) categorizes design research as a subsystem of the practice system, while Friedman considers it as a subsystem of the scientific system.

Regardless of the different 'strands' concerning art and design research, it seems to be of a general interest in the making disciplines to emphasize art and design practice as the object of investigation, and the epistemology of practice that is implicit in the artistic, intuitive processes (Cross, 2001; Dyrssen, 2010; Grand & Jonas, 2012). Attempts to legitimize art and design research as academic research by using research methods that are inapplicable to the object of investigation are often criticized. The professional activities should not be pushed into an academic context at the expense of the 'stuff itself' (Biggs & Büchler, 2010, p. 82). There also seems to be agreement regarding the interest in moving beyond discussing what design research is to how it should be conducted. According to Sevaldson, 'The main challenge is now to move forward from describing and understanding what is design research towards a position where we start to actively model design research: *designing design research*'(2010, p. 30). Grand and Jonas also express such an intention: 'Ours is a contribution to the design of design research […]' (2012, p. 13).

Methodological development, both generally and specifically in the making disciplines, together with a growing number of research projects and art and design research courses, is contributing to the process of constructing art and design research as its own independent system. Despite methodological development in process today, it is still difficult to legitimize this kind of knowledge production as research knowledge and to characterize art and design research as a subsystem of the scientific system. From a systems theory perspective, art and design research can thus not yet be seen as a closed and independent system. By using Luhmann's (2007) systems theory, it is not possible to talk about art and design research as a 'both/and' without turning it into an 'either/or' approach. If one intends to develop and establish art and design research as a subsystem of both practice and scientific systems, the two systems will directly influence each other's inner structures and break down the borders between them. Consequently, each system's autopoiesis will be destroyed, which means the destruction of both systems. The result will be either practice or research. Art and design research as a subsystem must therefore be associated with either the scientific system or the practice system. This article argues that art and design research should be considered as a subsystem of the scientific system.

The researcher is bound to the generation of 'true' knowledge, and the designer is bound to the demand for creating products. An art and design researcher should satisfy these two functions. This means that communication has to refer to two opposing codes: true/false and productive/non-productive, respectively. If this kind of research is to be conducted successfully as a 'both/and', it demands development of the methodological premises of art and design research, where both practice and research influence each other constructively. Various possibilities to support this development are discussed in the following section.

Insider research as structural coupling

It might seem contradictory, but while arguing for a distinction between the practical system and the scientific system, this paper makes a case for the two systems to influence each other. For a theoretical argument, Luhmann's (2007) term *structural coupling* is used. A structural coupling can support the development and expansion of the two systems – art and design

practice and art and design research – without infecting the autopoiesis of each system. A structural coupling can create links between the system and its surroundings (Luhmann, 2007, p. 113). The systems will stay closed, self-organized and self-creative. Instead of transferring structures from the environment into the system, structural coupling can help one system to 'interfere' with the other. In this way, art and design research, for instance, can 'resonate' internally in the practical system. The author´s work on a reflection-stimulating method for design processes provides an example (Riis, 2008). In this method, the stimulation of the conscious and distanced reflection on experiments from a design process is inspired by research methodology. This approach can make the system change its inner structures. Conversely, the scientific system can be 'irritated' by practice, for instance, design processes, which can inspire change within the system's structures. This can affect the development of research methodology with inspiration from non-linearity, which characterizes design processes. A structural coupling makes it possible for the closed system to be 'irritated' by its surroundings, but at the same time maintain its differentiation and system boundaries (Luhmann, 2007, p. 114; Rasmussen, Kruse, & Holm, 2007, pp. 40, 41). The system is then able to decide whether or not it will let its inner structures be 'irritated' to change.

Insider research, where one assumes the role of both practising designer and investigator of this practice, *is* the structural coupling between the two systems. Initially, the two systems are not structurally coupled; however, the 'insider perspective' offers this. Under this condition, it is possible to affect both systems, albeit on their individual premises so that they will maintain their autopoiesis. An important aspect when generating research knowledge from art and design processes is that it should happen from *within*. This method will produce practice-internal observations rather than the practice-external observations generated by a traditional research perspective. This approach also emphasizes that the practical process should not be conducted too long before the research is carried out. Even though the reflection regarding the generation of research knowledge has to be distanced from the pre-reflective aspects in the creative process, it is unfavourable to carry out a traditional retrospective study.

To succeed in the development of methodological premises for art and design research, it is important to protect the balance between the research-legitimizing aspects and the uniqueness of art and design practice. The distinctive process should not be undermined because of scientific demands on intersubjectivity. To generate generalizable and useful knowledge is less valuable for the field of art and design if one excludes the possibility of maintaining and emphasizing the expressivity, uniqueness and originality that often characterize art and design activity. This is a discussion based upon the basic distinctions between natural science and the humanities, and between nomothetic and ideographic scientific thinking. To the natural scientific researcher, individual concurrency is primarily relevant if it is an example of something universal and generalizable. Intersubjectivity is here often connected with repetitiveness. To the researcher in the humanities, the study of the unique case promotes meaning with an essential expressive quality. According to Kjørup, '[…] The individual concurrency is a part of the whole because of its unique character, not by abstracting from it' (2008, p. 86).

As such, carrying out a theoretical conviction that releases the art and design process from banality must be balanced with not generalizing to an extent where it becomes commonplace and unimportant. In this consideration, intersubjectivity means openness regarding the methodological and theoretical circumstances on which the current investigation is based. This approach demands philosophy of science knowledge. If the insider researcher is supposed to generate knowledge of, for instance, a design process that is meaningful for others, practice has to be 'irritated' by the scientific system. By shifting between the first and

second order of observation, according to Luhmann (2007), one offers others the opportunity to understand the generation of knowledge and to make their own constructions in this light. This method concerns research in general, but art and design research – with its basis in the unique, creative aesthetic processes – demands a lot from both the researcher and the surroundings to decide if the research can be generalized.

Making disciplines and generation of knowledge

There has been a tendency in the field of art and design to refer to established disciplines and academia as 'threads'. Since Gibbons et al. (1994) introduced their theory about Mode 1 and Mode 2, the latter is often used to legitimize art and design activity as knowledge producing. Mode 1 is connected to the traditional research disciplines, where research is determined by the 'rules' of the current field (Gibbons et al., 1994, p. 3). Mode 1 knowledge production is characterized by homogeneity, disciplinarity and faithfulness to the established methods. Mode 2 knowledge production is described as being focused on application and is characterized by 'transdisciplinarity; heterogeneity; organizational hierarchy and transience; social accountability and reflexivity; and quality control, which emphasizes context and use-dependence. It results from the parallel expansion of knowledge producers and users in society' (Gibbons et al., 1994, p. 167).

Since making disciplines do not have a clear disciplinary designation, Mode 1 knowledge production is often presented as a kind of 'thread' to art and design research (Dunin-Woyseth 2010). There seems to be a tendency today to moderate this antagonism. However, several influential people in the field currently point to the *interaction* between Mode 1 and Mode 2. In his keynote speech 'Knowledge in the Making. On Architecture as material practice and making discipline' at the 2012 Making Conference, Professor Fredrik Nilsson emphasized the importance of this very interaction. This interaction will strengthen both the development and the generation of field-specific knowledge and the development of field-specific research methods in the making disciplines. Mode 1 and Mode 2 will thus complement each other (Dunin-Woyseth & Nilsson, 2008, p. 145). In their keynote speeches, Kristina Niedderer and Professor Pirita Seitamaa-Hakkareinen also exemplified this interaction with a basis in their own research projects. Seitamaa-Hakkareinen presented different methods for exploring the 'handling mind' and 'embodied thinking' in her keynote speech 'Embodiment and Materiality in Making'. In her keynote speech, 'Explorative Materiality and Knowledge: The Role of Creative Exploration and Artefacts in Design Research', Niedderer discussed the relationships among the concrete object, the design process and the research process, and how the creative practice can be integrated into the research process. During both his lesson at the pre-conference and his summary at the main panel debate at the Making Conference, Professor Mikkel Tin emphasized the need for developing a methodology and a theoretical framework with the same standards as those of established disciplines. He based his contributions on the aspects of the sensuous, creating, skilled body which can only be partly conceptualized, recognizing the challenges posed to research. Practice (or 'primary practice', Tin's term based on the phenomenology) implicitly involves meaning making. However, Tin cited the necessity to observe, reflect and conceptualize practice in order to qualify as research knowledge.

Based on the Making Conference, the pre-conference and current literature from the field of art and design, there seems to be a new tendency to stress the importance of scientific legitimization and quality. The need to develop methods for conducting research on the same level as established disciplinary research has been highlighted. From a systems theory perspective, one now strives to study and to treat practice and research as two different

systems; furthermore, art and design research is being developed with the understanding that it is a subsystem of the scientific system.

Conclusion

Both practice (including the development of practical and professional knowledge) and research (including the generation of research knowledge and philosophy of science knowledge) are essential to qualify, develop and establish the field of art and design. In other words, it is vital to develop new products, materials, expressions, etc. The knowledge developed from practice is useful in practice. Generating research knowledge from practice is equally important; it ought to nurture ambitions to do so both about and for practice.

From a systems theory perspective, it seems as if the development of art and design research is strengthened by the basic distinction between practice and research. While this article argues for art and design research as a subsystem of the scientific system, it does not necessarily have to be at the expense of the complexity of the art and design processes. The art and design research should be carried out according to the premises of the object of investigation, that is, the art and design processes or the 'the stuff itself' (Biggs & Büchler, 2010, p. 82).

The researcher is bound to the generation of 'true' knowledge and the artist or the designer is bound to the demand for creating products. Therefore, an art and design researcher needs to satisfy these functions and refer to the two opposing codes of true/false and productive/non-productive, respectively (and functional and aesthetic/non-functional and non-aesthetic). This requirement demands development of the methodological premises of art and design research, where both practice and research influence each other constructively. This is possible by researching from within art and design practice. Insider research is thus a structural coupling between the practice system and the research system. As an insider researcher, one can thus increase the chances of the two systems influencing each other, while maintaining the autopoiesis of each system. The insider researcher's position makes it possible to generate research knowledge legitimized in the scientific system, while simultaneously considering the complexity and uniqueness in the art and design processes. The art and design processes and the research processes can, will and must 'irritate' each other. Emphasizing art and design research as a subsystem of the scientific system will minimize the danger of 'either-or' and help the researcher to efficiently generate knowledge both about and for practice.

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