THE VALUE OF DESIGN RESEARCH

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ABSTRACT

To assure the reliability of results, design research has often adopted the methods of other disciplines, reproducing the exterior shape of scientific research rather than its deeper grounds. Design academics often imitate what scientific disciplines do when they do research (i.e. applying codified methods), yet the discussion about why such disciplines behave that way is still limited.

Basing on science studies, we argue that what determines research findings' validity may not just be the application of research methods but the consensus of a community, which lets new knowledge claims enter what we refer to as the Great Archive of Science (GAS). By analysing the dynamics of the GAS, we show that the rules, methods, and models typical of the research environment have as their main purpose to make the reliability of researchers' knowledge claims as durable as possible.

Regarding design research, we thus argue that what turns designers' work into research is not just the application of scientific methods but primarily the participation in the grand game of the GAS, whose dynamics enable a relatively circumscribed corpus of knowledge to be held reliable and durable by a community. Relying on this argument, we seek to explore how design, while remaining a planning endeavour, may at the same time become an activity of knowledge production, which is the essential feature of research itself.

Keywords: design research, research through design, research epistemology, scientific method, design knowledge

1 INTRODUCTION

Several years' debate about design research has brought to light the multiplicity of activities lumped under this umbrella concept (Frayling, 1993; Jonas, 2004; Krippendorff, 2007; Grand and Jonas, 2012; Rodgers and Yee, 2015) [1].

In general, the concept of design research, especially in the case of research through design, implies that it is possible "for designers to produce knowledge based on the skills and capacities of the design field itself" (Bang et al. 2011, 2). Yet in applying that idea, the theory and practice of design research have often simply attempted to reproduce the model of codified scientific research (Crouch and Pearce, 2012; Koskinen et al. 2011; Saikali 2003). The question we want to raise is whether conforming to the model of codified scientific research is an appropriate way for design research to mature into a useful, meaningful, and fully enfranchised discipline.

[1] The debate on design research focused first and foremost on analyzing the many ways in which we can speak of research in the context of design; see Rampino and Colombo (2012) for a thorough reconstruction.

We believe that to answer such question we must delve into the way design makes the model of codified scientific research its own. For, in our view, this bears the risk of taking what has historically been the exterior shape of scientific research – i.e. the form of some standardized methods – instead of its profound social reasons as the model.

Design-research theory often strives to appropriate methods that have been developed and codified in consolidated disciplines so as to then apply them to design activity (Laurel, 2003; Crouch and Pearce, 2012; Krippendorff, 2006). In this approach, there seems to be an attempt to imitate what other scientific fields do when they do research and to understand *how* they behave, without asking *why* they behave that way.

In this work we try to ask the why. And, to do so, we will set off from science as a social activity, as a set of people who act according to established behaviour models, thus starting from science-in-action (Latour, 1987) rather than relying on established epistemological theories. The question is no small matter; for understanding the deep social reasons, underlying the ideals and practices of scientific research helps to focus on how those deep reasons can bear themselves out in the field of design, irrespective of established methods.

2 THE GAS TANK

In order to understand why scientific research employs codified methods, it is helpful to focus on scientists' practice of publishing their research findings. This involves a first shift of focus. When reflecting on a scientist's activity, we suggest to focus not on the knowledge he/she produces, which is something very vague and intangible, impossible to determine in a naturalistic attitude (Bloor 1976), but rather on knowledge claims: statements conveyed through oral (e.g. conferences) or written (e.g. journal articles) communication.

John Ziman (2000, p.34) notes that the scientists' habit to claim knowledge, mainly in written form, has led to a "notional archive" of scientific knowledge that is "absolutely enormous". Paolo Volonté (2012) calls this the Great Archive of Science (GAS). It consists of the entirety of scientific literature: books, journals, and data published online. But the larger an archive, the less accessible it is in practice. The Great Archive of Science therefore has an apparently contradictory feature: on the one hand, it is where knowledge claims are preserved from oblivion and handed down from one generation to the next, as well as the place where new claims are made public; on the other, owing to its immensity, it is also the 'graveyard' of scientific discoveries – or would be, were there not a meticulous system for classifying and retrieving the archive's knowledge claims.

There actually is such a system. It consists of library catalogs, book indexes, Internet search engines, and especially that portion of the GAS known as 'secondary literature,' which makes up the bulk of the GAS. Secondary literature is a body of knowledge claims about other knowledge claims, where the latter are judged, evaluated, selected, and combined. The GAS acts as if it consisted of

two elements, a heavier GAS made up of knowledge claims about 'reality'[2] and a lighter GAS made up of knowledge claims about knowledge claims.

Secondary literature is what prevents the enormity of the GAS from turning into a graveyard for knowledge claims. However, it cannot save all claims. The majority of the knowledge claimed since throughout science began now lies buried and forgotten in the GAS. Only some of it has survived: the knowledge taken up by new knowledge claims. Although it is customary to think that scientific knowledge is known and shared because it is true, this is a naïve simplification. The other way round is valid: knowledge is considered true when it is shared. We believe $E=mc^2$ not because it is 'true' (in fact we believe in a deal of claims that turn out to be false) neither because Einstein said so (few of us have ever read Einstein's papers), but because others have since argued persuasively that Einstein's equation is reliable. As a matter of fact such reliability could rest on a variety of different and inscrutable causes, some of them epistemologically legitimate (personal experience, consistency), others more disputable (prejudice, social convenience), but in all cases it is the web of references and citations that in the end saves a knowledge claim from the oblivion. The secondary literature therefore bears the responsibility of selecting what part of the GAS will continue to be available – because considered reliable - over time.

We can imagine the GAS behaving like in a huge imaginary tank. New claims enter from the top and lie on the surface, at first, but soon begin to sink inexorably to the bottom, where they are submerged by new claims and form a thick layer of inert sediment. Every scientific knowledge claim is fated for oblivion in the dregs of the GAS unless new knowledge claims intervene by declaring it reliable, thus bringing it back to the surface. And these new claims will start to sink, too, their fate hanging on yet more new claims. Thus, the GAS is animated by the knowledge claims scientists constantly advance, not just claims about reality but especially second-order claims. Absent the latter, the former would be destined to lie forever at the bottom of the GAS, which largely consists of claims that have simply been forgotten.

Collective memory, one might say, is the driving principle of science. The *prima facie* validity of research findings is determined not by research methods but by the consensus of a community of scientists. Methods are tools to achieve such consensus. Indeed, the materials deposited in the GAS tank are constantly filtered through those processes of intersubjective communication and evaluation that Robert Merton (1957, p. 560) called "organized skepticism".

Two instruments are widely used in scientific practice to enhance a knowledge claim's chance to survive within the GAS tank: referencing and peer reviewing.

References and citations form a web of knowledge claims that strengthen each other. Individual scientists use them mainly as a heuristic means to avoid constantly having to survey the entire gamut of knowledge on which their own new knowledge claims are based. Citations thus provide knowledge claims admitted to the GAS with specific locations, tying new claims' reliability to the

[2] We use the very general term 'reality' to denote everything that is not a claim: facts, objects, events, natural laws, etc. This simplification is needed to allow a plain exposition of our point.

reliability of their cited sources. Were the theory of relativity eventually to lose favor in the community, it would drag all related knowledge claims toward obscurity at the bottom of the GAS. However, every new citation also reinforces the reliability of the claim being cited. A reference to Einstein means his demonstration was deemed reliable once more, further reinforcing its reliability in the eyes of other scientists and bringing it closer to the surface of the GAS. The citation system is thus not only useful to the individual researcher but also a structural component of the scientific method.

Peer review is a key feature of scientific research too. To gain admittance to the GAS, any knowledge claim must first be scrutinized by 'well-informed colleagues.' The reason is that, to be claimed in public, a piece of scientific knowledge must go through a communication medium. A speech at Speakers' Corner is not enough. Yet any medium has to have gatekeepers. Gatekeepers in media are those entitled to decide what can be published, and how (White, 1950). Science has institutionalized this general rule by making it part of required method: gatekeepers are scientists and make decisions based on scientific criteria while eschewing political, editorial, academic or other such criteria. As a result, the reliability of any new knowledge claim admitted to the GAS has already been somehow vetted. It is in this process that research methods become important. Before submitting a knowledge claim to a gatekeeper, scientists meticulously refine it to forestall any possible criticism from referees. Were there no peer-review process, scientists would probably give much less importance to research methods. The need to withstand informed criticism is a constraint on the upstream phases of research that forces them to rigorously comply with the rules of method.

In sum, we argue that the purpose of all research's characteristic methods and behavior models is basically to solidify knowledge claims to the greatest possible degree (Latour, 1987, p.22-29), i.e. to make them last as long as they can. More precisely, the ability of a piece of knowledge to endure depends on the reliability of the corresponding claim acknowledged by the community. In the precipitating dynamics of the GAS, a knowledge claim can last only thanks to the 'collaboration' of players who see in its re-employment a chance to solidify their own claims, because they acknowledge its potential to last. Therefore, each researcher seeks the willingness of others to place their own trust in what she or he has claimed, to believe in it, and to invest their credibility in it. Scientific research developed all its quirks, obsessions, canons, and precepts in response to the constraints imposed by the GAS as a collective tool for selecting knowledge that promises to endure in the long run.

3 PRODUCING DESIGN KNOWLEDGE

Having highlighted what we consider the foundations of research-in-action in the world of science, we put forward the thesis that the same foundations can justify the idea of a design research, and especially of research through design[3]

[3] Indeed, it is our opinion that scholars who deal with design as an object of study (*research into design*) generally stand on the solid ground of some established, codified discipline: no one calls into question the legitimacy of their hewing an ideal of scientific research, especially that of social science. On the other hand, *research for design*, i.e. research at the service of the design profession (Buchanan 2001), presents a rather more complex case, but is a niche whose focus we can nevertheless say "is

(Frayling 1993). This means that if design research is to exist enfranchised and freed from the risk of science's 'colonization of design discourse' (Krippendorff, 1995, p.7), design research has to avoid a mere reproduction of other disciplines' research methods. Rather, it has to produce an archive of knowledge that is lent a certain reliability by the fact that many believe in it and presumably will do so in the future. In other words, the aim of design research should be to fit certain claims of knowledge into an interplay of claims analogous to the fluid dynamics of the GAS.

But what does it mean, in practice, for the design field to "claim knowledge"? This question has already drawn the attention of several scholars (e.g.: Buchanan, 2001, p.13-17; Friedman, 2001; Friedman 2003; Cross 2007) who noticed the twofold characteristics of design knowledge. On the one hand, it often inhabits a nonverbal dimension (Mareis, 2012, p.63) that makes it a kind of tacit knowledge (Polanyi, 1958). On the other hand, various observers insist on the need for design-research projects to be accompanied and wrapped up by verbal texts, articles, dissertations, and the like (Findeli, 1998; Schneider, 2007; Bonsiepe, 2007). The research-through-design process can thus be seen as characterized by two different forms of output: "a concrete problem framing" and "a series of artefacts – models, prototypes, products" (Zimmerman, Forlizzi and Evenson 2007, p.497). These two kinds of output seem to be intrinsically correlated; for, together, they may represent two complementary facets of the same knowledge outcome.

Zimmerman, Forlizzi and Evenson's "problem framing" may become concrete in a "theory on design" (often in the form of new frameworks) or, more often, in a "theory for design" (Zimmerman, Stolterman and Forlizzi 2010, p.313) in the form of implications, of guidelines, of "design specifications for future products" (Frens 2007, p.140) or of new design processes and methods. But, in research through design, such verbal knowledge claims are typically made possible and validated by the existence of one or more artefacts that embody and exemplify them (Mareis 2012, p.67): knowledge generated thus bases itself on producing "design exemplars" (Zimmerman and Forlizzi 2008) or "epistemic objects" (Mareis 2012), in the form of artefacts that "can be seen as the solid form of knowledge to be disseminated" (Bang et al. 2012, p.7).

The design artefacts' ability of bearing new knowledge becomes clearer when we compare them with art objects. Scrivener (2002) points out that in order to be bearers of new knowledge, art objects lack "consistency of interpretation." In fact, when faced with an objet d'art, each of us feels emotions and sensations that remain personal, that are not necessarily the same as someone else's, whereas what Scrivener calls knowledge artefacts, such as a subway map, for example, can produce congruent interpretations in different people.

This distinction should not be overemphasized, since scientific research can certainly fail to produce consistent interpretations in the community of scientists. However, it does throw light on an essential difference between two archetypes of knowledge embodied in objects. A design artefact, too, in acting as a source

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still on design as a practice and not as a research discipline that makes contributions of knowledge" (Zimmerman, Forlizzi, and Evenson 2007, 496). For this reason, we wish to concentrate on research through design, for it is here that we find the research design produces.

of formal and aesthetic inspiration for other designers, is undoubtedly subject to personal interpretation. Nevertheless, it is not perfectly analogous to an art object. For, while the latter has no cogent relationship to the range of what is technically possible (Ezio Manzini, cited by Verganti 2002, p.14), a design artefact also embodies a new technical possibility. In this regard, a design artefact is similar to an engineering prototype that communicates – implicitly but unequivocally – a possible (technical) solution to a certain problem. Said solution, whose feasibility is proven by the prototype, has a consistency of interpretation from which the art object is precluded. As a result, the prototype generated by research through design, unlike the art object, may be the bearer of "exemplary" (Binder and Redström 2006) knowledge – not only about the technical possibilities but also about possibilities for use – that can be transferred to other designers (professionals or researchers), as well as to researchers from other disciplines. "People working on related research topics", remarks Stappers (2007, 87), "should be exposed to the prototypes, so that they may learn solutions even if these are not made explicit".

As the main point of this discussion we would like to stress that, although the two products of research through design (the artefact and explicit knowledge) may even meet different fates once they have been admitted to the GAS, they must be admitted together. For, on the one hand, no claim of new knowledge generated by this kind of research can stand, unless it is supported and demonstrated by the existence of a design outcome – a model, prototype or concept – since otherwise it would not be a matter of research through design. On the other hand, to be qualified as design research result, the design outcome itself is not sufficient, but it must be accompanied with the designer's reflection on his/her work (Bonsiepe 2007, 29) and a statement of the results of that reflection that can be re-used by someone else.

Once such knowledge has been admitted to the GAS, other researchers will have access to it not only by following Ariadne's clew of verbal claims and citations but also through a 'knowledge bearer' in a class of its own: the artefact, whose existence is witnessed through images (in printed publications), by models (in conferences) or even directly.

Recent years have seen the design-research world moving in precisely this direction, both with the rise of journals dedicated to the findings of research-through-design (the International Journal of Design, for example) and with certain changes in the structure of design conferences. One example that may stand for all is the recent founding of the Research Through Design Conference, where "submissions are taking the form of an artefact (exhibited at the conference) accompanied by a commentary paper." Once again, presenting a research prototype is inseparable from making an explicit claim of knowledge. What we argue is that, without that claim, the gatekeepers would not have the tools required to gauge whether said prototype, as the product of a research process, may actually be admitted to the GAS.

This ushers in a final issue we must deal with: By what criteria can the dual results of research through design (artefacts and knowledge claims) be deemed worthy or unworthy of admittance to the GAS?

4 CRITERIA FOR ENFRANCHISED DESIGN RESEARCH

Several authors have already taken up the issue of design research assessment. From our standpoint, one especially interesting contribution comes from Zimmerman, Forlizzi and Evenson (2007, p.499-500), who propose evaluating research through design by referring to four criteria: process, invention, relevance, and extensibility. This section analyzes these criteria in detail vis-à-vis what we have argued up to now.

To begin with, Zimmerman, Forlizzi and Evenson believe it necessary for the designer-researcher to recount the process through which certain knowledge was generated, the reasons for choosing to employ certain methods, and the rigor they were applied with. Although we have observed that methods are not what primarily determines the soundness of research in general, describing the process through which certain knowledge was generated is a sine qua non for lending the claim reliability in the eyes of others. The reason for this is that reliability of a given claim depends crucially on the trust of people other than the one who originally advanced it that the claim is ripe to be made their own. It must, however, be added that the need of recounting the process is not symmetrically true for the explicit claim of knowledge and the outcome of the designing. The first is produced by the process of inquiry outright, which sets out from a research question whose answer the researcher seeks to define an appropriate research strategy for. As noted, to lend reliability to the knowledge the researcher-designer claims to have generated, said process has to be documented and described in detail. The design outcome, be it a concept or a prototype, is brought forth, on the other hand, from a designing process that, as such, employs not the methods of inquiry but the methods of design-making. For the purposes of enfranchised design research, this second process need not necessarily be described in detail. In this regard, Mattelmäki and Matthews (2009, p.5) cite the following example: "In Matthews et al. (2008), the process of the design of the tiles is entirely absent to the account (and inconsequential to the argument), since products-in-use are all that is required to make the points they argue." When the research question is about the designing process and the tools employed therein, however, describing that process naturally becomes indispensable.

Zimmerman, Forlizzi and Evenson's second criterion is that the research's output be significant invention. This is also a necessary feature for selection inside the GAS, because no one will rely on the uncertain durability of knowledge claims that merely say the same thing as already existing claims. We consider this criterion especially useful to apply to an artefact produced by research through design, because it means that the researcher-designer has to make an argument why the research advances the current state of the art in the research community by specifying what design issue was dealt with and how it was resolved. This is an essential step because, as Stappers (2007, p.87) states, the artefacts "embody solutions, but the problems they solve may not be recognized." Therefore, it is important that the researcher explicitly declare the claimed advance both vis-à-vis solutions already on the market and vis-à-vis solutions that might be proposed by other research. This is prerequisite for allowing the gatekeepers of the GAS tank, first of all, and all the other

researchers who come upon the solution later to gauge the relative significance of the innovation and thus the foreseeable duration of the knowledge claim.

The above holds true if the research through design focuses on the design outcome. When, on the other hand, it focuses on establishing new tools for designing (hence on *how* rather than *what* the designer designs), the invention will amount to a theoretical contribution or a proposal of new design methods. In this regard, we may refer to the newness of the knowledge contribution, just as in other disciplines. Mattelmäki and Matthews (2009, 4) cite a research project whose aim was to evaluate the various facets of design probes as a tool: "The role of designing in the cases appeared in the customizing of the probes experiments, in designing the probes kits and 'communicational' artifacts as design objects. Design skills were also applied in seeking [...] design opportunities and elaborating alternative solutions in several cases." In such a case, the design outcome may actually not represent a significant invention vis-à-vis the state of the art but nevertheless prove useful for explaining how certain solutions emerged through specific design processes or through reliance on particular design methods.

The third criterion is relevance, i.e. the impact a given research outcome is expected to have on the world. In the context of scientific research, the foreseen impact of certain outcomes has increasingly become a key factor in distributing resources (research grants etc.) in recent decades. Anyway, the relevance of a knowledge claim is certainly a factor favouring selection in the GAS, if by 'relevance' we mean it being in the focus of interest of a research community. No matter how clever or innovative a discovery is, it is fated to lie dormant in the silt of the GAS tank if no one takes an *interest* in it. Applying relevance to research through design means that the design process should deal with an actual problem by envisioning a preferred state of affairs. The design outcome and the explicit knowledge generated ought thus to meet a real need on the part of society, users, companies, designers or some such target. This is the reason a lot of design research tackles issues universally considered 'socially relevant,' such as environmental sustainability or healthcare.

The fourth and last criterion applied by Zimmerman, Forlizzi and Evenson is extensibility, which is to say the chance that others may use the knowledge outcome of the research. This corresponds to Merton's imperative of communism (1968, p.610), which is to say the publication of research results, without which Western science could not have begotten the GAS. We may add that extensibility can take place only if knowledge output has been properly conveyed as an explicit claim of knowledge. This is the prerequisite for research results, once they have been admitted to the fluid dynamics of the GAS, to be employed by others. Two suitable examples are Xerox's work on the interaction design of reprographics machines cited by Zimmerman, Forlizzi and Evenson (2007, p.500) and "Vision of the Future" by Philips Design (Lambourne, Feiz and Rigot 1997). These two research through design projects broadly influenced design culture on all levels, and they have been widely cited. The extensibility of results, which partly depends on being distributed through 'scientific' research channels, is a determining factor for research output to be deemed 'knowledge.'

5 CONCLUSION

Design and design research are different frames of activity. We have argued that design research can be truly specific to the design discipline only when designing is one of its tools. For this is the platform on which design, while remaining a planning endeavor, may at the same time become an act of producing new knowledge. This is the case of research through design.

We have considered that, in order to assure the quality of research results, design research has often run the risk of taking up the scientific methods of other disciplines, without stopping to consider why such methods are considered 'scientific' there. This could lead to a kind of 'colonization of design discourse' (Krippendorff).

To fully understand why scientific research employs codified methods, we analyzed scientists' practice of publishing the results of their research. This has served to clarify that what determines whether research findings are valid is not the method in itself but the consensus of a community. Equally, what makes a designer's work research is not just having applied codified methods but also participating in the game of the Great Archive of Science (GAS), whose laws know how to select, from countless claims of knowledge, a relatively circumscribed corpus of durable knowledge. In our view, knowledge claims based on research through design should consist of a design outcome equipped with an explicit declaration of the features that make it a new, valid, and trustworthy piece of knowledge. Indeed, neither a mere design outcome nor purely verbal knowledge claims suffice to qualify a design activity as design research.

Finally, we sought to identify the criteria needed to a design project to legitimately aspire to be deemed design research. Four criteria drawn from literature appeared to be relevant: reliability (by process recounting), originality, relevance and extensibility. According to the dynamics of the GAS, respecting the first three criteria would make it easier for a claim of knowledge obtained during research through design to be admitted to the GAS. Its chances of remaining afloat in the fluid dynamics of the GAS will be directly proportional to the extensibility of the findings, i.e. to the likelihood that others take up as their own the knowledge claims it avers.

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