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11 WAYS IN WHICH DESIGN(ING) AND RESEARCH(ING) ARE ALIKE: A SET OF REFLECTIONS::

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Abstract

Touching on subjects and elements of practice such as problem determination, aim for ideals, aesthetic agency and ethical action, the following paper addresses common forms between practices in which designers and researchers engage. It is hoped that ideas broached in the following pages will induce, at least, some readers to explore those, similar and other issues within their own practice and will facilitate combining values from each one of the domains explored in order to enhance problem solving in either one.

Introduction

Designing and researching share some characteristics. It is possible to argue, of course, that a great deal of each one is to be found in the other. Yet, lucidity is not dis-privileged by starting with each as a separate practice and then pinpointing elements of both practices that share a common form. This academic, forensic approach, to its credit, affords articulating commonalities while maintaining genetic distinction. There is less risk of corrupting, too much, concepts and esoterica embedded within each practice. We add a caveat: The design field is far too broad and varied for everything that will be said to apply with equal immediacy to every design or design-related discipline.

Concatenated Beginnings

Compelled Engagement

The first observation that we will make is that designing and conducting research involve the *actor* in some ways that are less manifest than others. Obviously, the designer or researcher is the agent and so, conspicuous, outward actions such as writing, building, engaging in communication, and so on are expected. Of further interest, however, are some not-so-patent, intellectual acts. Due to the fact that such transactions are inseparable from the way the design or research question is constructed and how its interrogation is carried

forward, elaboration will be provided in the next sub-section which addresses the design or research problem. The necessary point to be made in this sub-section is that the designer or researcher is *compelled* to engagement--in quiet, yet crucial, ways.

One further clarification must be made. Here, we are considering *doing research* in a rather particular way. We are specifically addressing the practice of constructing formalized questions about the world and interrogating those questions by applying certain methods. We take, for example, a person who regards two ostensibly different entities, observes certain peculiarities about their practices and essays to find out if the two are truly different or whether they share enough commonalities over certain characteristics of interest that they can essentially be termed the same "type." Furthermore, suppose that person goes about the business of making that decision by following certain established protocols employed in investigating such questions (e.g. carrying out an experiment). That person, in the context of the following discussion, can be said to be doing research.

Questions that Frame the Problem and the Solution

As indicated above, construction of the problem and carrying out solutions to the problem are generally networked with active decision-making. Let us begin with doing research. Suppose a researcher carries out her study by following one prevailing research tradition: a question is raised and then formalized into hypothesis[1] statements, data are collected and analyzed using statistical methods, and finally interpretations and generalizations are made. Even within such an established way-of-doing, the researcher is compelled to make some deliberate decisions that will affect the outcome. For instance, in formalizing the problem statement into a hypothesis, decision as to how relationships within the statement are structured is the researcher's. Then the researcher will have to make judgement about values to which the null and alternative hypotheses are pegged (the null, being the one intended to be tested). Doing significance testing, the researcher will also have to specify the level of significance that will be used for testing. These are decisions that will generally affect, if not absolutely, the temper of the outcome(s). How the hypothesis itself is stated, for instance, dictates directionality or non-directionality in the test (one-tailed, two-tailed) and that, in turn, will influence what kind of conclusion the researcher can draw (e.g. whether the researcher can say anything if results *find* in the other direction). In addition, directionality in the hypothesis statement will affect the power[2] of the study. So, even within an institutionalized model, the researcher's agency takes part in shaping the outcome.

Designers make choices too--choices that affect outcome(s). When, like a researcher who is free to pursue a research question of interest, the designer is equivalently free to invent an object, idea, event or anything else, similar acts of decision-making become generative. The designer must begin by determining what is to be produced. She or he must also decide upon how the artifact that is to be produced is going to enter into and be located within the world. Will the designer, for instance, *build* the artifact, event or idea by self (e.g. write a computer program; hand-stitch a garment; compose a piece, write lyrics *and* perform; etc.) or will somebody else be responsible for or be involved in bringing about its realization? Will a made object be tailored to place or will it be context-free? In some cases, the designer will interject questions about how the artifact will end its existence. Then there is the question of message. The designer is obliged to consider what the artifact is to represent, communicate, mean--or perhaps make the choice that it is to mean nothing at all (if that is possible) or be created such that it will allow itself to be communicated to different people in different ways. Many more such questions and choices to be determined exist, but it is not necessary to continue to list them. Some observers talk about the act of interrogation of the very problem itself as an act of problem setting.

[1] Specific concepts of statistics mentioned in the following pages are, for the most part, ubiquitous. They are available in countless references.
[2] Power is the study's ability to find significance.

Interpretation of Precedents

Before leaving the matter of the problem, we will like to make one more related point about practice. In both designing and researching, actors often draw upon precedents to inform questions, directions and interpretations. A researcher may look at older studies to instruct her or him about the design of an experiment, effect size, unanswered questions, and so on. Taking those, the researcher can replicate, re-design, invent and do a variety of things that will direct the current investigation. A designer engages in the same kind of precedent study. Within precedents, a designer may find a formal prototype, learn about signs and their symbolisms, discover solutions to stubborn operational problems, learn about production methods, and so on. Precedents are also capable of revealing dangerous paths down which the designer ought, wisely, not to venture. Intercoursing with precedents tends to become integrated with the sweeping transaction of problem and solution construction within which the designer and researcher are compelled to act.

Abstraction, (Ap)proximation and Representation

(a) We explore two applications of abstraction. The first is a reductive act that occurs early in or before the end of a project. The actor isolates and focuses upon selected parts or characteristics of the problem in order to control noise. Here, abstracting is primarily facilitative--a means to an end. (The second application of abstracting, presented in "b" below, is about finality.) Abstracting, as presented in this first application, truly belongs to problem definition (see above). It is part of the process of structuring the problem, based on an understanding of its character--how it is, how it works - in order to be able to solve the questions we isolate and construct out of the possible problem space. In researching, that problem space might be delimited by, for instance, a population or a sampling frame. In designing, it might be defined by the functional or aesthetic range (or possibilities) afforded by the problem in focus.

In conducting research on a data set, we could list or take into direct account every individual member of the group. On the other hand, we could use a single "average" descriptor such as mean/median (to concentrate to a "typical" middle) or standard deviation (to represent a "typical" character of variability). Thus, description becomes a strategy of control and, in the final analysis, also a means towards estimating or predicting value. Designing is similar. There are two generic ways we make things: we can either tailor-make a thing or we can make an "average," a typical version. In the former, we take into account each, individual, member of the group. In the latter, we will have collected data/information to enable us to make an informed judgement about a solution that will work for the "average" target (e.g. person). Of course, averages embed inevitable *errors*, but there are ranges of such errors that are tolerable. (The question of error is addressed below.) Abstracting by so reducing quantities, while it invites some degree of error, is practically sensible. It curtails tax on valuable resources and makes pursuing solutions feasible. In addition, it facilitates asking questions in a different language such that pragmatic actions are possible. For instance, rather than make a nearly impossible set of comparisons (in pairs, triplets, quadruplets, etc.) of cases in a group of, say three-hundred, we could simply assign members into a few groups based on characteristics of interest, represent each group with one "average" and proceed with necessary problem solving. Then it is convenient, for instance, to design one engine and insert it into a variety of automobiles that look different on the outside – so long as they all possess certain common characteristics (within a tolerable range) such as weight, speed function, space to contain the engine, and so on.

For designer and researcher, abstracting's vigor moves beyond mere representation by a "typical." Abstracting also grants the potency of representation in other languages that either facilitate problem solving or are appropriate for the stage of solution exploration. The researcher can create a mathematical model that makes problem solving manageable. The designer can translate the problem-solution compact, for example, from design statement to schematic drawing, then to detailed drawing or physical model, and so on.

(b) There is another understanding of the idea of abstraction that is, in essence, highly potent. This is the case of abstracting as an impulse towards finality. Here, abstraction is aimed at concentrating innate force. Excesses are removed. Superfluousness is suspended. Functionality is neatly packaged into the minimum-optimum of efficiency and effectiveness. The kind of purity signalled by such abstraction becomes, in itself, something beautiful. A transcendent, innate clarity is granted - even so, that constitutive elements/components are not crudely broadcast. In research, the notion of *parsimony* is invoked. In designing, order is reinforced in such a way that *form* (not shape, but form in its deeper meaning related to typology) gains presence and ascendancy. As a simple example, a spoon is no longer merely a utility object constituted of stem and bowl. Instead, it is a total object of desire: stem, bowl, lustre, fit in hand, fit in mouth, weight, supreme smoothness of edges and material, and so on - all these, no longer so separately considered, but apprehended/encountered as one integrated, forceful, manifest "moment." The spoon becomes a concentrated poem, a lyric moment. The case regarding perfection is considered below, but it is worthy of mention here that the highly-abstracted idea or object - that is, one no longer apprehended as a collection of interacting parts, but as one distilled whole - is considered to be superior and is intellectually considered to be closer to the ideal.

Ethical Action

It is imperative that researchers operate under a code of ethics. Some articles within the body of a code of ethics exist to benefit, primarily, the profession. For example, findings of research studies should be disseminated in order that other researchers in the same field might learn from them. Secondarily, of course, non-members of the profession can also learn from such findings. Other articles are intended to consider select groups to which they are applicable. Many codes of ethics are designed to be ecumenical. Let us consider one example: codes by which researchers dealing with human subjects must abide. The researcher must be careful not to cause, among others, undue physical or mental pain for the subject.[3] There are numerous histories and variants of codes and declarations that pertain to research with human subjects at local, national and international levels (the Nuremberg Code, the Declaration of Helsinki, etc.). Generally, they share a common ideal about how the human subject of research is to be treated. There are varieties of types of codes, articles and statements: some are directed at animals used in research, others are focussed on cultures as supra-individual orders, and so on.

Designers also operate under various professional, state, community or self-imposed codes. Some of them are obligatory. For instance, proper disposal of hazardous by-products is a question of ethics regarding the environment, but violation of rules of practice can also draw a criminal charge. Some others are of a more philosophical nature. One example is embodied in the position that, as many designers believe, the designer must consider her role and responsibility in bringing an artifact into the world. It is a complicated question. Some artifacts end up serving functions for which they were not intended. If the designer was remotely prescient of that possibility, does that finally make the designer complicit? Should the designer have desisted--and denied the world of an otherwise valuable piece of knowledge or means - or did the designer do the right thing by *causing* realization of the artifact? Numerous other such complicated questions probably exist for designers in general. There are production questions with which some designers must wrestle. Should they allow their designs to be brought to manufacture in "sweat shops"? In a world increasingly concerned about the environment, some designers confront questions such as those of sustainability, preservation, embodied energy, degradation, and so on. As with the researcher, the designer must also face questions about preserving wholeness of the human who (or animal that) will use her or his artifact. The researcher and the designer share the burden of ethical action.

[3] In certain cases, there are criteria that guide what may be acceptable in some circumstances, but not others.

Aesthetic Agency

Some design professions recognize that the designer's agency in creating new forms is so central to the practice of designing (and, arguably, the essence of it) that they build protection of outcomes or products that emerge from the designer's exercise of that agency into contract documents. For instance, a statement from one standard owner-architect contract states that "the Architect's decisions on matters relating to aesthetic effect shall be final" as long as those are consistent with the contract as intended.[4] The designer is expected to exhibit skill in the general deployment of parts of an entity in such a way that the outcome is an integrated whole. Often, innovation is the rule, rather than the exception--innovation in arrangement, fabrication process, interpretation, or other ways. All are means directed at attaining an intended end which is demonstrated in the *presence* embodied or precipitated by the artifact. The essential dimension of aesthetic innovation is recognized even beyond the limits of professional design groups alone. Copyright law of the United States, for instance, grants the designer (of an architectural work) rights which cover not only drawings, but also "the overall form as well as the arrangement and composition of spaces and elements in the design," excluding standard features.[5] Furthermore, and in the same vein, the document recognizes a "compilation" as "a work formed by the collection and assembling of preexisting materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship."

Researchers recombine or rearrange elements of their study as well. Some studies, of course, are intended to replicate past ones, one of the goals being that an extant outcome will be granted greater stability through reaffirmation. On the other hand, a researcher might choose to extend the scope of exploration of an existing question or, in a more extreme case, set out on a quest to find out the answer to a new question. In the latter, variables of interest are isolated by the researcher and are linked to one another (in an informed way) in such a way as to specify the nature of their relationships. In the former, the researcher chooses to introduce new criteria into the study in order to extend its possibilities for instigating discovery. In both scenarios, while the question of interest generally guides the process of investigation, a researcher often has opportunity to arrange, reconfigure or juxtapose methodological components such as object groups, demographic groups, physical contexts, time durations, and so on. Inasmuch as the researcher is engaged in the creation of ideas tastefully (informedly) constructed, she or he is involved in a project of aesthetic worth. In the end, the researcher is much like the designer, capitalizing on her or his agency to invent for the purpose of creating new insights, things and outcomes.

Perfection as Inspiration

Aspiration towards an ideal condition is evident in researching and that is demonstrable in one way by considering how certain research practices are grounded. A parameter is a characteristic of a population. Since a population is conceptually considered to be the whole, then the parameter is a description of its universal state. It is, conceptually, complete. Certain foundational research principles are founded upon the value of the parameter. For instance, the ubiquitous *normal distribution* becomes the target towards which many goals are directed. The distribution itself is an image of classical indefectibility: symmetry; coincidence of mean, median and mode; and, on a z-scale, value of the mean as null (0) and standard deviation as unity (1)--numbers which, metaphorically, are transcendental. The *central limit theorem* proposes that bias in estimating the parameter (e.g. the population mean) decreases as repeated random sampling is used to plot a [sampling] distribution, and that distribution itself tends towards normality (i.e. a normal distribution, as mentioned above). Inferential statistics rests on this understanding. In plain language, ability to do inferential statistics is made workable in light of an ideal: the parameter. Hence, in formally setting a testable research question, we *hypothesize towards a parameter*.

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[4] American Institute of Architects. (1997). *AIA document B151-1997: Abbreviated standard form of agreement between owner and architect* (Subparagraph 2.6.17). Washington, D.C. American Institute of Architects.

[5] *Copyright law of the United States*. [On-line]. (2007, December 26). Available: http://www.copyright.gov/title17/92chapl.html

In designing, we equally seek the ideal. We construct rational and working models that have potential to instruct us about coming close to or even attaining the ideals we seek. We hypothesize about a golden section and superpose its structure on existing and intended design models and solutions. We are riveted by magical numbers and systems such as *pi* and the Fibonacci sequence and cuddle with them. Platonic forms enthrall us and we draw upon them as schemas for design solutions. In digital space, the so-called ideal profile is sought by layering many, many different human faces. The question of *type* is elemental and when models that conform closely to *types* are found, the designer studies them diligently and draws upon them for instruction.

Recognition of Error

We would like to invite the reader to consider the admission of error into what we do in three ways. First, error can result from simply getting and using the wrong information. An instrument we are using to construct a solution or record information may simply not be *whole* (i.e. as in wholesome) or appropriate. On the other hand, when we have a whole instrument, an *invented process* we employ in using it may allow room for error. Error may also be the result of our own carelessness, slips in using good information or our incapacity to understand or interpret a situation or attendant information correctly.

Second, error can result from using information which, though correct, is only a part of all of the information that captures a whole. When this is due to our carelessness[6] in not knowing about the range of all the information that should necessarily be of interest, then it can be considered a form of mistake on our part and this kind of error should be bundled with the first category above. In the case where we are aware of the extra relevant information, but are unable to acquire all of it, there are two possibilities: 1) Our information is defective to the extent that it is our intent to apply it to the whole, if its character is not representative of the whole, and whether we realize that situation or not. This condition should be consigned to the first category above. 2) Usage of our information may be considered tenable if we apply it only to the portions of the whole to which it is directly applicable - i.e. not to the whole. There is a special case when we might be able to use such partial information for the whole, and that can be seen in item (2) of the third category directly below. We have, however, separated them for conceptual clarity; below, we deal with synthetics and representation.

Third, error can be regarded conceptually as a question of representation. Sometimes, even though we have access to accurate information, we are required to create a synthetic indicator out of that information. Here, the scenario bifurcates: 1) We have all the information, but it is overwhelming and, pragmatically, we are compelled to create a synthetic that is more manageable. This synthetic, though, contains or involves the whole.[7] 2) We create a different kind of synthetic that does not involve the whole (population), but we know enough about related or relevant characteristics of the whole that we can create this new synthetic from a carefully carved-out part-of-whole in such a way that it will fairly (or reasonably) represent the information we would get if we used the whole.[8]

We continue with the third error scenario directly above. We are potential victims. To illustrate, let us examine only one example of the case of a created synthetic. We mentioned earlier, for instance, the case of the mean used to represent scores of members of a group[9]:

a) That mean pastes over some information: individual variabilities in scores or information are eclipsed, not made evident. This is true in both cases 1 and 2 (of the third error category) directly above.

[6] The reader is urged to understand the unfortunate use of this word here. Sometimes, one is simply not aware that there is other relevant information. In the end, however, the outcome is the same: not being aware of extra relevant information and not taking care to find out if there is need to search for extra information both result in the information's being missing as a result of the action (or inaction) of the data collector.

[7] The reader may recognize this as a parameter.

[8] This, the reader may recognize as a statistic.

[9] Please refer to the section titled "Abstraction, (Ap)proximation and Representation."

b) For case 2 directly above: The mean of any smaller group (sample) that we use will, in great likelihood, not be a perfect estimate of the mean of the whole (population) and different samples--even of the same size and from the same population - are likely to yield different values. At this point, we will more appropriately refer to the phenomenon described in the current case, not as a mistake as such, but as *imprecision*.
Given (a) and (b), we realize that our synthetic information will always not represent every member evenly. We should pause to make an important note: Here, we are talking about a whole (population) that is not homogeneous (i.e. its members are not identical). The reader is encouraged to keep in mind that *that* is much like the world of objects and things in which we live.

The world in which doing research and designing take place is the kind of world where mistakes are imminent and where we often do not have the capacity to find or use all possible or necessary information. In spite of our notion of a perfect condition discussed in the preceding major sub-section of this paper, the most likely events are ones in which our solutions will embody some degree of deviation from the perfect state of things. Just above, we presented three error source categories. It is now time to distinguish the character (and implications) of the third category introduced above. The rest of this section will focus on that category alone. The fact that we possess all information or a part of it that is very reasonably representative of the whole means that we have the capacity to control to some degree what we do henceforth.

In the preceding major section of this paper, we talked about the perfect state. In the current major section, we are extending the idea to include the *possibility* of a perfect artifact in a world of variabilities. One more thing should now be said about how that "perfect" condition may be conceptualized. We may consider the notion of perfection in two respects. First, the "perfect" may be considered as a permanent, steadfast ideal. Second, it may be considered as a condition that fits its context (hence, necessities) at each moment in time. For instance, a shoe that fit a young man "perfectly" (simplistically, of course) at sixteen years will, in many cases, have to be replaced by a different shoe-ideal at twenty-four years.[10] Both conceptions of the "perfect" are relevant for designing and researching. If we could attain the first, application in a variable world becomes a new problem. If the second, the mechanics of displacement, successive change and adaptation present a challenge. We can reason this way: One thing seems constant in both non-prevailing[11] verdicts: variability. In the first, a steadfast ideal does not always fit the world because the environment and its contents are *variable*. In the second, the ideal is construed to fit the environment always, but that ideal has to take *variability* into account. Perhaps, then, variability is an existential force that we also must take into account, if we will be pragmatic, while focusing on the ideal as a goal and for inspiration. That is exactly what has been recognized in researching and designing and which both enterprises embed into practices in an attempt to optimize solutions.

In research, we understand errors exist and have instituted protocols for managing some of them the best that we can. We consider, for example, such notions as random error (error that will occur just by chance and is not emergent from any particular known bias, or is not systematic) or sampling error (that emerges from our inability to consider the entire population of cases involved in our problem). Recognizing such conditions, we compute appropriate error estimates and input them into analyses and into interpretations as we generate solutions. We end up using, again for instance, terms like *confidence interval* (which is a range of values with known probability of "capturing" the ideal value) and *margin of error*. A parallel form of practice is to be found in working towards solutions for design problems. For instance, the eye into which a bolt is passed might be made necessarily larger than the diameter of the bolt in order to capture imperfections in lining up components to be bolted together or

[10] Philosophically (or idealistically, at risk of being redundant), the parameter is steadfast. Somehow, scientifically, we need to reason that way. In a world of practicalities, the story is somewhat different and there is a place for that argument. For now, suffice it to say that in a humanist world--where human activity is central and survival is teleological--it is questionable whether so-called perceived "perfection" that does not facilitate or that contradicts human actions towards survival can, itself, persist or persevere.
[11] Meaning intended here is "non-winning."

even in accounting for context-necessitated variations in the future (e.g. movement due to changing temperatures). In doing so, we embrace a term such as *tolerance*. We design a hole punch to have one or two slightly adjustable "punches." We design some dresses to accommodate changes in the characteristics of the material or of the user. Systems are created to adapt to the environment. *Fault tolerance*, for one, becomes a part of design problems.

In design, a sophisticated metamorphosis may be introduced - particularly within the post-modern discourse. It is the notion of *ambiguity*. Ambiguity accords latitude. In post-modern architecture, for instance, multiple meanings can become legitimized. In prose, another example, Bakhtin can talk about "double voicedness" and "[refracting]...one's own fresh intentions" within any symbol. "In the space between the word and its object," Bakhtin can write, "another's word, another's accent intrudes" (p. 268).[12] Ambiguity and tolerance, margin of error and confidence interval are, all things considered, opportunities whispered to us that our well-formed solutions are not all wrong but possible, given environment. Recognition of *error* is pragmatic. It is, as so, practical because it is about recognition of the realities of being.

Investigating the Question of Difference

To a great extent, designers create new things. Those may be things that are completely new because each one is radically different from anything else that is in existence. Alternatively, they may be things that are new by virtue of the fact that each one involves modification of some part, great or small, of something already in existence. Typically, copying something in existence is not considered designing. That raises the question: Can one thing be determined to be different from another? Is a 2008 car model, for instance, different from a 2007 model? Is a sedan different from a truck, after all? In terms of processes, are there commonalities between fashion design and aircraft design or do they exist in non-overlapping worlds? Similarly, can management planning be seen as having nothing to share with designing-producing a bridge or computer architecture?[13] These are not empty questions. Determining if and how two things are different or how a thing to be created is to differ from something else is not only practical, it is didactic as well. In order to be able to answer such questions, the designer has to engage in careful study of things that are or/and are to be and then array them against one another. Careful isolation or definition of criteria is essential.

A researcher also identifies criteria in anticipation of asking questions about difference. She or he asks, for instance: Are two or more groups different, certain things considered? The researcher isolates certain criteria to enable the question to be answered and re-phrases the question to one like this: Are the means (or variances) of the groups different? The researcher does not usually stop at simply determining that these two or more things are different. The designer generally tends to articulate implications for the observed difference(s). Those implications carry force, for it is in them that the new knowledge is converted into practical value. For instance, when no difference is found, then users of the information (i.e. the result of no difference) can treat the groups compared as the same on the criteria of comparison and, thus, have the chance of controlling situations involving the groups more efficiently. When the groups compared are found to be different, a new state of things is demonstrated and innovation follows in order to be able to create different conditions that fit the groups now seen to be different. These outcomes are parallel to what happens in the case of designing. When the designer finds no difference (in compared criteria about existing or intended artifacts), practical outcomes can follow. For example, cross-platform functions become possible. In another manifestation, *redundancy* in artifact utility becomes a point of interest. Redundancy, of course, is two-sided. When it creates inefficiency, it needs to be curtailed. On the other hand, planned redundancy is a healthy artifact use management strategy. It is, to put it crudely, a back-up strategy. In the event that a designer determines that compared artifacts (existing or

[12] Bakhtin, M. (2001). Discourse in the novel. In R. Kearney, & D. Rasmussen (Eds.), *Continental aesthetics: Romanticism to postmodernism: An anthology* (pp. 254-270). Malden, MA: Blackwell.

[13] An insightful reference is Simon, H. A. (2001). The sciences of the artificial (3rd ed.). Cambridge, MA: MIT Press.

intended) are, indeed, different, innovation gets a spurt. Each different line (group) becomes an opportunity to develop a distinctive trajectory of formal and utilitarian problems.

Critical Evaluation of the Work: **Is it worthy? Where is the worth?**

Evaluation of the work is as much a part of research activity as answering the question that created the study. Evaluation can take place within a study itself or outside the study. Let us look within the activity itself first. A researcher must check against biases so that results are not grossly invalidated. When possible also, a researcher will assess her or his degree of error and embed it as consideration into the study. In some situations, a *post-hoc* analysis is carried out. Post-hoc means after-the-fact, but it is here placed in the "evaluation within the activity" group because, technically, it can be considered to be part of the research design. Post-hoc is indicated here as *evaluation* because it is about questioning results that are obtained - to determine exactly where significance arises.[14] Critical moves like determination of level of *practical significance* or *effect size* grant other evaluative possibilities. Also as part of a reported study, a researcher tends to include a *discussion* section which typically contains, among other things, a reflexive aspect where one's own strategies and interpretations are candidly interrogated. Outside the specific research study, evaluation actions also take place. One example is comparison of the study against others through meta-analytic work. Another is critical analysis of the work (method, theory, etc.) by other researchers.

Design works are also subjected to evaluation of worth. In the process of building an artifact (a painting, a computer program, etc.), the designer will often stop at points in the process to test, consider or check what has been done. Feedback received is generally used to make appropriate adjustments. Bench-testing can be considered as occupying the negotiated zone (as with post-hoc testing above) between the work in progress and the completed work. Bench-testing can be used to give feedback while building the artifact, but it can also be carried out at the end of production (of the prototype) to determine functional suitability or simply to record data on characteristics. A parallel example might be a *dress-rehearsal*. Lessons learned can be used to make modifications, but the dress-rehearsal can also be seen as a post-design action because it is consumed (and commented upon; sometimes, critics are invited) by outsiders to the project. Post-work evaluation definitely includes judgments by critics (art, film, theatre, etc.) and other consumers. Depending on the design profession/discipline, different evaluative practices can be carried out (e.g. *post-occupancy evaluation* in building and architecture).

One with a Bit of Explanation

Multiple Methods

Multiple methods are used in both designing and researching. Here, however, an explanation is in order. Traditional (positivistic) science favours a monastic monism where the empirical method (including adequate amounts of rationalistic effort) is the modus operandi. Researchers operating within the grand qualitative paradigm admit other methods of pursuing an understanding of our world. It must be remembered, however, that qualitative research (as worthy of the term) is also often carried out in a *scientific* way: with attendant treatments and schedules of systematicness, rigour, healthy skepticism, etc. So, the practice of *scientific* research does exist within the domain of multiple strategies directed towards solving problems. Although much of the foregoing conversation has been grounded within the quantitative model, the point should be made that the choice is one of convenience. As stated explicitly immediately above, we hold to the position that "scientific research" is a question of application of a systematic method and so both prevailing paradigms (qualitative and so-called

[14] The reader should be aware that these characterizations of "post-hoc" are presented to facilitate the current discussion and are voluntary.

quantitative) are circumscribed. Besides, many researchers employ a mix of elements of both paradigms and so the notion of “multiple methods” is even more discussable.

In designing, multiple methods of practice are well-established. From problem investigation to end of production, different systems are possessed. Mimesis is a mode of investigation but can also be used to generate a kernel, a point of departure upon which the new is built. Physical models can be constructed; digital models can be fashioned. Collaborative or participatory designing can be used with inside-teams or outside groups. Processes like reverse engineering and forward engineering can be engaged. Finally, as research “behaviors” are grounded *in* philosophical provinces, so are design processes, methods for practice and general worldviews also shaped by philosophical underpinnings: e.g. dadaism, deconstruction, social responsibility, purism, etc.

Conclusion

Designing and researching are certainly different words and are thus intended to communicate different things. When considered as practices, the picture shifts a bit. As suggested at the outset, it can be argued that they are not necessarily practices that inhabit mutually-exclusive worlds. This paper has considered the *structures* of both practices and identified some ways in which they are concurrently informed. Commonalities identified and points raised in this paper are, of course, not exhaustive. It is hoped, however, that designer-readers (or researcher-readers) will see crossing over (or back-and-forth) from one practice to another as an intellectually-viable and a practically - desirable act.