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Designed Epistemology

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Abstract:
The reliance on linear, rational, Enlightenment philosophy to guide pedagogy and practice in knowledge creation, specifically in education and design, can sometimes lead to problems. This paper calls on Gödel's incompleteness results to justify the use of design principles in building epistemology. An example of course design is examined using Jonas' Research through Design framework (2014) and compared to Deleuze and Guattari's idea of the rhizome. The question is raised whether philosophical and psychoanalytic theory can provide the framework for design theory.

Keywords: Design theory; Philosophy; Scientific method; Research through Design

1. **Introduction**

The scientific method is a tool widely used for reasoning about the truth and validity of theorised knowledge. Aside from the deductive logic of mathematics, philosophy, or computer science, the scientific method may be the only other epistemological tool accepted by the academy. The algorithm of the method that is presented to students as young as elementary school is an inductive process; particular experimental results are extrapolated to apply universally. Variations of the method have been applied widely to almost all fields within the academy since the Renaissance. The traditional design process is a form of the scientific method (Funk and Wagnall, 2018). The traditional approach to design of research, prototype, test, iterate, and production correlate well with the process of the scientific method.

In this paper, we argue that the definition of rigor within the academy is based on the judged success of the application of the scientific method by the fields and disciplines that comprise academia. We believe that this reliance upon the scientific method to legitimize knowledge contributes to design being relegated to a position of perceived lack of academic rigor.

We present the work of Kurt Gödel on the nature of deduction within axiomatic systems as central to our criticism of the academy's reliance on inductive reasoning to justify rigor, and key to understanding how knowledge creation can be further supported through the use of design principles. For example, the development of educational theory and practice both utilize the type of reasoning Gödel highlights. Therefore, we examine below the application of Wolfgang Jonas' analysis of situation of inquiry to the practice of course development in education. This discussion identifies where design thinking can succeed when Enlightening thinking may fall short. Finally, we demonstrate how this example of design thinking is in line with the idea from philosophy of Deleuze and Guattari's rhizome.

Thus, we conclude that design thinking could be used to further support the knowledge creation of many of the fields that make up the academy. We propose that supporting the design theory and research that informs this design thinking with the framework of philosophical and psychoanalytic theory could essentially give us "permission" to pursue knowledge in this fashion when it proves necessary to do so.

2. Definitions

School children and hard scientists understand that, due to its inductive nature, any results arising from application of the scientific method are subject to change upon the discovery of new evidence (Britannica School, n.d.). This is why electromagnetic theory is just that, a theory, even though the phenomenon of electric light upon the flipping of a switch seems like established fact.

The process that children learn proceeds as follows: given a problem or question research is performed to inform a hypothesis; an experiment is devised to test the hypothesis; if the hypothesis fails a new hypothesis is formed and tested with a new experiment; if the results are successful the experiment is repeated to verify validity. Scientists then deem their conclusions theory because they are aware, and children are taught this as well, that these results could eventually be overturned by new discoveries (Britannica School, n.d.).

Alongside this summary of the scientific method, let us consider Richard Buchanan's (2001) formal definition of design. "Design is the human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes" (p. 9). If we understand Buchanan's use of "purposes" as analogous to the problem, his use of "conceiving and planning" as analogous to research and hypothesis, and his "making of a product" as analogous to the experiment, then it becomes clear how closely his definition echoes the scientific method.

As a slight aside, we argue that this manner of thinking about problems and developing solutions is fundamental to human existence and extends much further back than the ideas related to academic rigor that arise out of the Enlightenment and the emergence of the scientific method.

The scientific method and the linear design practice that echoes it can both be highly effective. Together, they are largely responsible for facilitating the technical and social advancement of society thus far. However, either due to greater awareness on humanity's part or due to the cumulative effect of advancement, more and more wicked problems have emerged in recent history. Terry Irwin (2019/2020, p. 28) sums up wicked problems nicely:

> 1) they involve multiple stakeholders with conflicting agendas(Dentoni & Bitzer, 2015, p. 68); 2) straddle disciplinary boundaries; 3) are ill defined and stakeholders rarely share an understanding of the problem; 4) the problem is continually changing and evolving; 5) problems exist at multiple levels of scale and are interdependent and interconnected; 6) any intervention (attempted solution) in one part of the system, ramifies elsewhere in unpredictable ways; 7) interventions

take a long time to evaluate, and problems, a long time to resolve (Rittel & Webber, 1973, Buchanan, 1995; Coyne 2005; Author, 2011a, 2011b, 2015).

3. The Wicked Problems of Epistemology

In this section, we explain how epistemology itself is a wicked problem. To be clear, we do not intend to argue for causality between the wicked problems of logic and ways of knowing and the problems of human advancement. We believe that many of the problems that have risen through our "progress" are a natural result of the spatio-temporal framework we advance within. For example, "Problems such as climate change, water security, poverty, crime, forced migration, and loss of biodiversity are "systems problems"" (Irwin, 2019/2020, p. 28) or wicked problems that have come about due to human advancement. But we also believe that having an understanding of how dominant ways of thinking can fail us will open the door for realizing more comprehensive solutions to the problems that face us.

Let us examine induction first. Above we explain that induction attempts to extend results about the particular to the universal in order to make a claim about reality. Within mathematics this linear extrapolation is not accepted as sufficient for proof. Mathematics *does* allow something called mathematical induction, but this is actually a form of deductive reasoning (Dolciani et al., 1974, p. 72).

Statistical analysis is an example of induction in action. An experiment is devised in which a data is gathered about a sample of the population. Claims are then made about the more general population from which the sample was drawn. Sometimes the data and theories generated are passed on to one bureaucracy or another and policy is generated.

There can be several problems with this practice. As Carl Jung (1957, p. 7) pointed out, statistics only shows us some theoretical average that does not actually exist. In the cases where the average is not being considered, but the data is analysed in other ways, sample size is a problem. The sample size is never the entire population, that is the point of using statistical analysis. In most cases, the sample size is significantly smaller than the population. Lasty, even if a total sample is taken, temporality causes problems with future extrapolation. Granted, most competent and ethical researchers are aware of the problems with this method. However, it can be easy to lose sight of the reality of this process when pursuing a solution to some problem.

This method of approaching inquiry and knowledge became prevalent during the Enlightenment. Modernity (Barker, Modernity, 2004) in epistemology started with the Enlightenment. Thinkers wanted a departure from superstition and religion. Scientists, philosophers, and educators wanted to be able to explain reality in a rational logical way (Barker, Enlightenment (the), 2004). Characteristics of this way of approaching epistemology and ontology are "positivistic, objectivistic, deterministic, individualistic, dualistic, and reductionistic in character" (Jörg et al., 2007, p. 147). This kind of thinking is linear, wants to simplify topics as far as it can, and is always searching for some unifying theory or metanarrative. This epistemology "strives for the closing of a … system and tends to think that the established theoretical system completes the knowledge" (Chen, 2004, p.423) of whatever discipline or field the thinker is working in.

This culminated in the Logical Positivists in the early Twentieth century. They believed that if a proposition was not verifiable through logic or the senses that the statement or idea made no sense to even consider as having any meaning (Nickles, 2013).

Many of this school of philosophy believed that Wittgenstein's first work, The *Tracatus Logico-Philosophicus* corroborated their philosophy (Burbules, 2014). One of Wittgenstein's early ideas is that language and reality are logically interconnected. The boundaries of language define the boundaries of reality. This idea appeals to the logical positivists because their world view requires reality to be completely defined by logical and empirical facts. They ignore Wittgenstein's statements that there are mystical facts that cannot be put into words, or his later thinking that language is a variety of contextual activities, each with its own internal rules or logic (Burbules, 2014).

Wittgenstein's ideas arose from the work of Bertrand Russell and others on the philosophy of mathematics. Russell and his peers were interested in defining the nature of mathematics. Russell defines mathematics, at its essence, as logic (Cooke, 2009). Then the question becomes what is logic? Wittgenstein puts forth the idea that logic is embodied in the language that defines our reality.

Naturally, then, mathematicians would like to be able to prove that their field, which, according to Russel equates to logic, unassailable. Hilbert wanted to prove the consistency of all mathematical systems (Rundle 2006). Kurt Gödel became interested in this proposition, but his results proved the inconsistency of axiomatic systems (Linton, 2009). Axiomatic systems are those that take a few assumptions that everyone agrees are obvious as a starting point and then proves as much as they can about the system. Gödel's incompleteness theorems tell us two important things about these systems: there are true statements, that can be understood intuitively, that cannot be proved and that an axiomatic system cannot prove its own consistency (Linton, 2009).

The reason that this is important for epistemology is that deductive logic is the pinnacle of academic rigor. Being able to make a statement and prove it solely through logic is, according to Enlightenment thinking, the most epistemologically reliable practice. The next level down from mathematics in academic rigor is the induction of the scientific method which has been examined above.

The result of this examination is that the epistemology that is the foundation of rigor is not sufficient to justify the importance placed on it. Thus, we argue that there is opportunity for improvement in humanity's problem-solving endeavors. We believe that design thinking is worthy of contributing to this improvement.

One of the problems the academy has with design epistemology is that there is often an element of intuition that guides knowledge creation. However, an aspect of Gödel's proof is that intuition plays a role in truth, even in mathematics, and which *cannot* be verified. Therefore, we argue that use of intuition in problem solving should not be evidence non-rigorous knowledge creation.

Buchanan (2001, p. 5) pointed out that another problem the academy has with design is that a designer cannot articulate their results in the same way a scientist can. Designers often lack an understanding of the theoretical explanations that underly their thinking and practice. Jonas (2001, p. 65) talks about philosophy already having developed the theory about design, but that philosophy does not consider design's practical application. We argue against this idea, as does Ryan Engley. Engley asserts that "theory's project is to articulate that which would cause…" (Engley & McGowan, 2018, 1:09:00 in). In our analysis of Buchanan's definition of design above, we explain design as "that which would cause".

Some of the design theorists at the forefront of searching for a design theory in the last few decades are Richard Buchanan, Wolfgang Jonas, Rosan Chow, Terry Irwin, and other thinkers that they refer to. Their various articles developing design theory all have recognizable bases in philosophy and psychoanalysis.

In the next section we wish to work through an example of instructional design and use Jonas' synthesis of 1st and 2nd order observation in research with the design project to illustrate approaches to course design. This example highlights the similarities between a design theory and a philosophical theory. Working through the different approaches to course development also shows how intuitive design thinking can complement the linear approach to education that educational psychology often embodies.

4. Research Through Design as Rhizome

Cybernetics is the science of communications and automatic control systems. Within cybernetics, classical detached inquiry and situated inquiry correspond to 1st and 2nd order observation. In 1st order cybernetics the observer (designer) is situation outside of the system (product). 2nd order cybernetics places the designer inside the product. A matrix can be set up with four cells. The variables concern the project, the observer or designer, the direction of their attention relative to the project, and the direction of the product of their thinking or work. In research *for* design the designer is outside the project researching in the external world, and the product of that research is directed at the project. In research *about* design what changes is that the designer is researching the project; their research attention is directed at the project. When the jump is made to 2nd order cybernetics, the designer is situated within the project. Research *through* design examines the external world from within the system of the project. Lastly, research *as* design happens when the designer researches the problem from within the problem and the product exits the system into the world (Jonas, 2014, p. 5).

A good example that illustrates the first three positions is the design of a course in a career or technical college by an instructional designer. This approach to course design commonly involves surveying employers to determine the skills and abilities the students need to come away with. This process informs the objectives that get included in the syllabus of the course, taught, and assessed during class. After the course has been delivered, the instructional designer may look at the outcomes of the course with the course instructor to determine whether anything needs to be changed in the content and delivery. They may investigate the grades and level of competency of the students and, if they are lacking, try to determine what needs to change in the course. In the situation that corresponds to research *through* design, the instructor and course designer are the same person, and they have a high level of real-world expertise in their field. Since they are situated within the course as it is being delivered, they know immediately if a design move produces the competency in the student that will hold up to real-world application. When a move proves unsuccessful, the instructor can change course immediately and try something else. There is no need to loop back to the start as in a traditional design iteration.

There is a philosophical idea that corresponds to this internal branching iteration as opposed to linear or circular iteration. This is Deleuze and Guattari's idea of the rhizome. Teal (2010) argues for Deleuze and Guattari's rhizome idea as a more complete visualization of the design process. This idea is "non-hierarchical, non-dualistic, and a-causal" (Teal, 2010, p. 295). The rhizome paradigm does not suggest an overturning of existing systems, but a redefinition of theory and practice. It asks that we balance the rational and a-rational as we experience the complexity of the world. The rhizome approach is more pragmatic than the complexity paradigm, although very similar, in that it offers order and linearity combined as well as the feature that any point of a rhizome can be connected to any other point.

Deleuze's thinking is important to design because throughout his career he worked against the limitations of binary thinking; "'there is no dualism…we invoke one dualism only to challenge another." (Deleuze & Guattari, 1987, p. 20 as cited by Teal, 2010, p. 296). We believe that binary thinking can significantly impede the effectiveness of a design practice. This includes drawing the conclusion that this rhizome idea is now the best and/or only way to approach design. We recognize the array of problem types and contexts, and acknowledge the value that can be brought through linear and procedural design education and practices. The conclusions of Hatchuel, et al. (2013) related to developing an ontology of design arrives at a similar conclusion. "Design has a specific ontology, anchored in subtle and difficult cognitive mechanisms…design corresponds to a type of rationality that cannot be reduced to standard learning or problem solving" (p. 162).

Deleuze says the designer (or student or teacher) should reinvigorate the neglected side of our thinking atrophied under Western rationalism, but in a both-and manner. Not an alternative, but an allowance of abilities disallowed by hierarchical dualism. Nonlinear, complex, and enmeshed knowledge can be given equal footing with logical and rational processes. "There is no wrong way to proceed, except not to proceed. Everything is connected to everything else." (Teal, 2010, p. 297). We believe that this statement, if truly considered in light of one's thought and knowledge, is most often true. But we also believe that many experts in their fields take for granted the complexity of their knowledge. Concepts are part of a chain or system in which concepts refer to each other in their interplay of differences. Concepts articulate problems. "Thinking rhizomatically does not define a problem so that one can address it instrumentally; rather one makes things to understand problems. The only way to develop the familiarity necessary to understand a problem is to attempt to respond to an understanding of what the problem is" (Teal, 2010, p. 301).

Echoes of the rhizome idea can also be found in Terry Irwin's Emerging Transition approach Wolfgang Jonas' Scenario approach, Jonas and Chow's Case Transfer, and many other ideas in design. This is but one example of a case in which philosophy has already done the thinking for the designer. What remains is for the design field to translate the discourse of philosophy and psychoanalysis into the field of design in a way that makes the theoretical also practical.

5. Lines of Flight; Opportunities for Further Research

Rosan Chow (2015) urged the design community to improve our culture of inquiry. She expressed that "The habit of knowing, correcting, and building on existing research/knowledge is at its weakest in the cultural practice of design research" (p. 31). We recognize that our argument above has only scratched the surface of several topics contained within. We do not contend to have represented a complete picture of the current state of design research, nor a complete explanation of the range of associated philosophical and psychoanalytic theories. But we present this argument to further the discussion of the connections we have perceived between design theory and research and those already existing in philosophy and psychoanalytic theory, as well as those addressed by Theory writ large. We believe that this discussion has the potential to be useful in further thinking about design theory and practice.

We believe that sometimes we, as human beings, need to give ourselves permission to think in different ways. To facilitate this, we have often felt the need to find the justification outside of our own thinking that allows us to break with the cognitive paths that we sometimes think we must follow. Jonas and Buchanan both talk about long term theory building for design and the issues that have arisen in that. We believe that there is rich potential in a future project that engages in translation of philosophical and psychoanalytic theory into a framework that unites those theories with design theory in a collective community of inquiry.

One idea for further research that we find particularly intriguing is to study the links between Gödel's further work about intuition in logic and mathematics and the role of intuition in art and design.

Jacques Lacan's theory of the three registers of being, the imaginary, the symbolic, and the real, can be explored through the lens of design. Lacan's theory could add to understandings of motivation for design, the role of design in our interactions with the external world, how the collective assessment of the success of a design occurs, and much more.

Slavoj Žižek's work on ideology could contribute to an understanding of the commodification of design practice into commercial marketing ploys.

Investigating these lines of thinking, and many others, in addition to those discussed above may further support those in the design field to articulate the principles that guides their work (Buchanan, 2001).

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