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(Un)Frayling design research in design education for the 21Cth

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ABSTRACT

This paper will focus on redefining design research education for the 21st Century. In this context, we will contextualize critical issues emerging from analyzing Christopher Frayling's seminal paper *Research in Art and Design* by reviewing seminal theoretical work in the field of design by Archer (1968), Cross (1983), Jones (1970), and contemporary critiques such as Herriott (2019), and the authors (2019). By implementing an historical account into previous work, we will deconstruct Frayling's structuring and why he articulated his framework leading to our critique of the fundamental problems arising from it. In the process, we build from previous work by the authors to reposition the ontological nature of design knowledge around notions of prospectivity, abductivity, and probabilism. This positioning emancipates design from the present, thus overcoming the scientific/tacit paradigms liberating design to operate in its true future-led prospective and transformational nature.

KEYWORDS

Abductive reasoning, prospective, probabilistic knowledge, theory

Introduction

As stated in a recent call for papers from the Art History network;

The Debates surrounding and inquiring into the nature of Artistic and Design Research have been in progress since the early 90's ... and still constitute a live interesting area of interest, however, research on design and art continues to constitute a contested academic field. (Guerra 2021)

This statement positions the origin of artistic and design research with Christopher Frayling seminal paper *Research in art and design*; however, previous research by Archer (1968), or Cross (1983) seems to be absent in Guerra's account. Our paper will focus on design research evolution to review what happened before Frayling's seminal paper to contextualize why Frayling did what he did, why he articulated his framework in the way that he did, and the potential problems emerging from his account.

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From this point, we will review contemporary critiques (Herriott 2019; Galdon and Hall 2019) to underpin the problems that Frayling's model creates for today's research in Design. This process supports a different perspective on the ontological nature of design knowledge (Galdon and Hall 2019), which aims to clarify practice-based research projects in which experimentation, reflection, critical practices, and analysis are taking place simultaneously. This clarification aims to facilitate cross-cultural collaboration by proposing a distinctive model that can be understood across the three domains of thinking (Archer 1978) by designers, arts and humanities, and scientists.

Transformational processes embodied around the notion of World-making involve this generative interweaving between practices and forms, methodologies and phenomena, doing and knowledge. However, the missing ontological acknowledgement positions design research as a contested academic field creating confusion among researchers and practitioner. The institutional paradigm of linear, arborescent, cataloguing of research is now challenged by a clear model where practices shape fragmented territories, in dialogue, in solidarity, and collectively constituted.

Bruce Archer

Historically, design approaches in research have been compared to and categorized within the sciences, arts and humanities. For instance, C.P. Snow (1959) defined the separation of the domains of knowledge into the sciences and the arts and humanities. He also speculated on a third (a vacant plot) as being something in the social sciences that Archer took up in 'Time for a revolution in art and design education'(Archer 1978) as design.

It is probably too early to speak of a third culture already in existence. But I am now convinced that this is coming. When it comes some of the difficulties of communication will be softened: for such a culture has, just to do its job, to be on speaking terms with the scientific one. (Snow 1959, 71)

However, the design discipline can be seen as having its own distinct way of understanding the world. Its fundamental approach based on planning, solution-based problem solving, problem shaping, synthesis and preparedness, readiness and appropriateness in the built environment which determines a different manner of knowing. Therefore, prospective disciplines such as design can be positioned as their own specific practices, distinct from the aforementioned sciences, arts and humanities. In this context, Bruce Archer (1978) went some way towards proposing design as the third culture of thinking, fulfilling Snow's challenge to fill the vacant plot (Snow 1959). Archer positioned the third mode of intellectual enquiry for education as 'design thinking'. In this process he rejected names such as 'technology' or 'technics' and 'aesthetics' for the new constituted domain. It seems that he

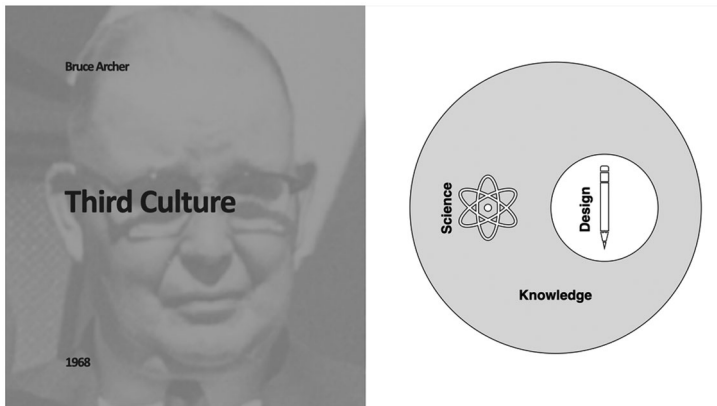


Figure 1. Bruce Archer's doctorate attempted to explain design as a special branch of science.

looked for variables to distinguish the association with one of the other two domains. He also described the route of the three 'R's' (Reading, Writing and 'Rithmetic) emanating from Sir William Curtis MP in 1807 (Limbird and Byerley 1825) representing the monopoly the church at that time had on education. Archer's recalls his great aunt fiercely protesting the three 'Rs' and counter-proposing; (a) reading and writing (b) reckoning and figuring (c) 'Wroughting' and 'wrighting'. By 'wroughting', she meant knowing how things are brought about - technology. By 'wrighting', she meant how to do it - craftsmanship (Archer 1978, 4). This model around 'R's seem as attempts to encapsulate core domain level practices. However, they seem to have a rather neat relationship to the humanities (reading and writing), the sciences (reckoning and figuring) and design thinking ('wroughting' and 'wrighting') as the practices and modes of intellectual enquiry. Whilst the first two modes of enquiry and knowledge gathering may be familiar the last set may seem less so. In applied design thinking terms, a closer definition could be that 'wroughting' can be thought of as shaping, forging, moulding, and producing parts or components whereas 'wrighting' is the assembling, testing, adjusting, and refining of the collective parts or assembly of the project. However, Archer's earlier doctoral work attempted to explain design as a special branch of science, though usefully, it failed to do so (Boyd Davis and Gristwood 2016).

Archer's model enters into a contradiction; if design is a different thinking culture from the sciences, then it follows that the output cannot be scientific in its nature (Figure 1). It draws a distinction between knowledge of fundamental building blocks and processes that have been observed in the world around us versus the 'world to become' conjecture of design knowledge. We characterize this paradox as; **the factuality problem**. Science builds on

reproducible experiments that prove theories and establish facts of the given world.

Nigel Cross

Some years later, Nigel Cross, in his seminal paper *Designerly Ways of Knowing* (Cross 1982) (Cross 2001), built on Archer's work at the Royal College of Art, and describes this third culture as:

[...] the collected experience of the material culture, and the collected body of experience, skill and understanding embodied in the arts of planning, inventing, making, and doing. (Cross 1982, 221)

In the process, Cross also differentiated design from the sciences and humanities by comparing the terms of the kind of phenomenon that is studied in the three cultures; the sciences focus on the natural world, the humanities on human experience, and design on the human-made world. He also differentiated between the appropriate methods with which to approach each 'culture'. The sciences use controlled experiments, classification and analysis, while the humanities use analogies, metaphors, criticism, and evaluation. Finally, design uses modelling, pattern-formation and synthesis. In terms of the values of each culture, the sciences aim for objectivity, rationality, neutrality, and concern for 'truth', whereas the humanities aim for subjectivity, imagination, commitment, and concern for 'justice'. Finally, in design, practitioners aim for practicality, ingenuity, empathy, and concern for 'appropriateness' which he termed a 'designerly' way of knowing (Cross 1982, 221–222) (Figure 2).

Cross addressed the issue of factuality (scientific empiricism) by introducing tacit knowledge as an alternative. For Polanyi (1958, 1966), who coined the term, this type of knowledge cannot be adequately articulated by verbal



Figure 2. Nigel Cross differentiated design from the sciences and humanities by comparing terms for the kind of phenomenon that is studied in the three cultures.

or written means. The notion of tacit knowledge aligns perfectly with the practice of design, however, it presents a fundamental paradox in the context of research, as research practice and function revolve around transferability. This type of implicit knowledge creates a problem around how we can be sure that tacit knowledge is communicated and acted upon in a manner consistent with its generation. This is an issue that had bedevilled design research, education and practice and we characterize this as; ***the transferability problem***.

Christopher Frayling

In the three cultures context Christopher Frayling introduced his seminal paper *Research in art and design* (Frayling 1993). Consciously or unconsciously, he built from Archer by stating that design is different from science (art and design is by no means identical with science (3)) and aligned with Nigel Cross in establishing its practices as fundamentally internal by building from Picasso's uncomfortable verbalization of his work (tacit knowledge rather than propositional (3)). On the other hand, Frayling acknowledges later in the paper, that the tacit element may not be sufficient. In fact, he proposes a report (documentation) to complement tacit knowledge (5). As a result, the final output may be a combination of internal and external knowledge (the Cognitive art tradition (5)). In order to explain this conundrum, he proposed three modes of research in design by building from Herbert Read (1944) (Figure 3).

Research ***into*** art and design – This model refers to traditional models of research. Historical research, Aesthetic research, and Theoretical research. The expected output is a thesis, or dissertation. This approach is focused and more related to history. This model is archive based and is an external perspective.

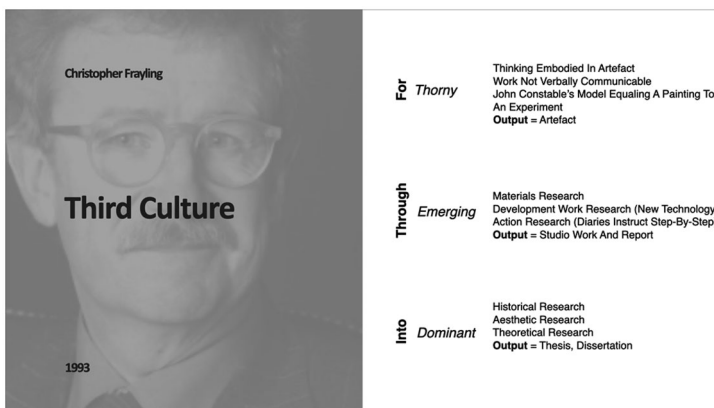


Figure 3. Christopher Frayling three modes of research in design.

Research **through** art and design – Frayling points towards materials research, development work research, and action research (diaries instructing step-by-step processes). The main outputs are studio work and a report to communicate the results. This approach is focused on exploring through the process of creating and making.

Design **for** art and design – In this model thinking is embodied in the artefact, therefore, work is not verbally communicable. The intention is inspirational or experimental and the main output is an Artefact. This model represents the embodiment of tacit knowledge. He refers to Picasso's work and points that this model would entail granting PhD's to the entire history of art. Frayling defines design **for** as thorny due to the trickiness of verifying knowledge exchange and intent on behalf of the creator. This approach is internal to the artist or designer.

Frayling built his argument from Herbert Read (1944). However, it is interesting that Herbert Read proposed two types of action; teaching through art, and teaching to art. As noted by Friedman, Frayling reports in a 1997 discussion that his proposal was 'distantly derived from Herbert Read's famous teaching through art and teaching to art'. (Friedman 2008, 155). Nevertheless, from the three categories Frayling presents, research **into** design is more related to history, and research **for** design embodies practise but falls into the untransferable. Only research **through** design seems to be operational in the context of design. In this context its implementation is more related to process and documentation.

The notion of diaries instructing a step-by-step way of a practical experiment in the studio seems contradictory to earlier differentiation of design to scientific enquiry (3). In fact, this method seems to suggest repeatability of some kind in the reported process.

The notion of documentation is very interesting, insofar as it is supporting the novel generation of knowledge. The problem occurs when knowledge is substituted by collection. The act of collecting does not imply *per se* any contribution to knowledge except if it is a novel method in itself. This however is a contribution to archival research practices, not to design.

The John Constable's model reported by Frayling equating a painting to an experiment is very interesting, but as pointed out by Picasso, you still need to find something through enquiry. This approach is relevant in design research insofar as the experiment leads to a contribution to knowledge, otherwise it is piece of design practice. This aspect of a novel contribution to knowledge is missing in the argument. This and the transferability of knowledge are fundamental notions to the nature of academic research.

Into seems to be more related to history and something that already exists to be studied externally (closer to the humanities than Frayling may suggest). **For** seems to be aimed at providing examples or case studies for

improving methods for design practitioners, and **through** seems to be the most commonly adopted model. **For** is not operational in the context of research due to **the transferability problem** (as Frayling acknowledges, describing it as thorny), and the latest arguments reduce research **through** design to a reflective documenting process. We characterize this latest problem as; **the procedural problem**. These elements question Frayling's model as a constitutive and differentiated field or culture, as suggested by Archer and Frayling themselves.

Richard Herriott

In *What Kind of Design is Research Through Design?* Herriott (2019) questions precisely the distinction between 'standard' design research and Research through Design. He asks whether research through design is actually different from existing methods of scientific research, and if this assumption is justified. This position is also shared by Findeli (2008)

In conducting a comparative study, Herriott underpins how research through design and research in design make objects/processes their object of study. In his account, the main difference is that 'in the case of research through design the object is made for the purpose' (Herriott 2019, 8). However, the methods of observation and analysis are the same as science. For the author the main similarity between the modes of research being studied is that both research in design and research through design conduct experiments. In his account the experiment may vary in position but both are artificial situations.

This analogy extends to design accounts into the natural sciences or social sciences (or a hybrid of both). In both cases, he suggests 'a reading of the background theory leads to a research question which is testable by experiment. The difference lies in the extent of and effect of the designer/researcher's role in the design work' (Herriott 2019, 8).

In his conclusion, he states that 'Research through design is part of a well-established tradition in science of using an experiment of some type to test a hypothesis about X. This procedure is, after all, exactly what practicing designers do too: make some observations about the world, make a hypothesis that the user needs object X and then test the hypothesis by making a prototype of X' (Herriott 2019, 8). Here is worth arguing that the motivation for design and science experiments differs greatly. Scientists know what they are looking for and where to find it while designers experiment when the way forwards are unclear. They both share a similar motivation in removing obscurity (Hall 2011).

He also Challenges Gaver (2011) transient nature of design outputs – The idea that Research through design is possibly about the process and the type of object produced and concludes:

Once the designer has created the new object (e.g. an iFloor) they still have to switch hats, so speak, and observe and report as a form of scientist. They make accurate observations, record the data, analyse it and then propose what are hopefully falsifiable claims about the world e.g. a particular way of designing will achieve particular results. (Herriott 2019, 9)

He also struggles with the notion of tacit knowledge in the context of research ‘Unless tacit knowledge is elevated to the same level as explicit or communicable knowledge, the idea that there is a designerly way of knowing is either an unsupported or a weak claim’ (Herriott 2019, 9). The tacit knowledge problematic has also been challenged recently by Meyer and Norman (2020)

The fundamental problem with Archer, Cross, Frayling, and to some extent of Herriott and Findeli propositions is that all of them appear to have missed one fundamental variable; time. This is surprising, as this variable was introduced earlier by design researchers including John Chris Jones in 1970.

John Chris Jones

John Chris Jones, in his seminal book *Design Methods*, postulated that design was different from the arts, sciences, and mathematics. In response to the question ‘Is designing an art, a science or a form of mathematics?’ Jones responded:

The main point of difference is that of timing. Both artists and scientists operate on the physical world as it exists in the present (whether it is real or symbolic), while mathematicians operate on abstract relationships that are independent of historical time. Designers, on the other hand, are forever bound to treat as real that which exists only in an imagined future and have to specify ways in which the foreseen thing can be made to exist. (Jones 1992, 10)

Fernando Galdon and Ashley Hall

From this perspective, the authors (2019) have positioned design as a prospective activity in the context of abductive reasoning ((making decisions without having all the information) (Douven 2011)). In this area, research by Dorst (2010), and more recently Cramer-Petersen, Christensen, and Ahmed-Kristensen (2019), have concluded that design combines deductive and abductive reasoning – imagining alternative future outcomes; however, in both cases abductive reasoning plays a fundamental role as an initiator of the design activity.

This intrinsic prospective approach of design, based on abductive reasoning, planning, solution-based problem solving, problem shaping, synthesis,

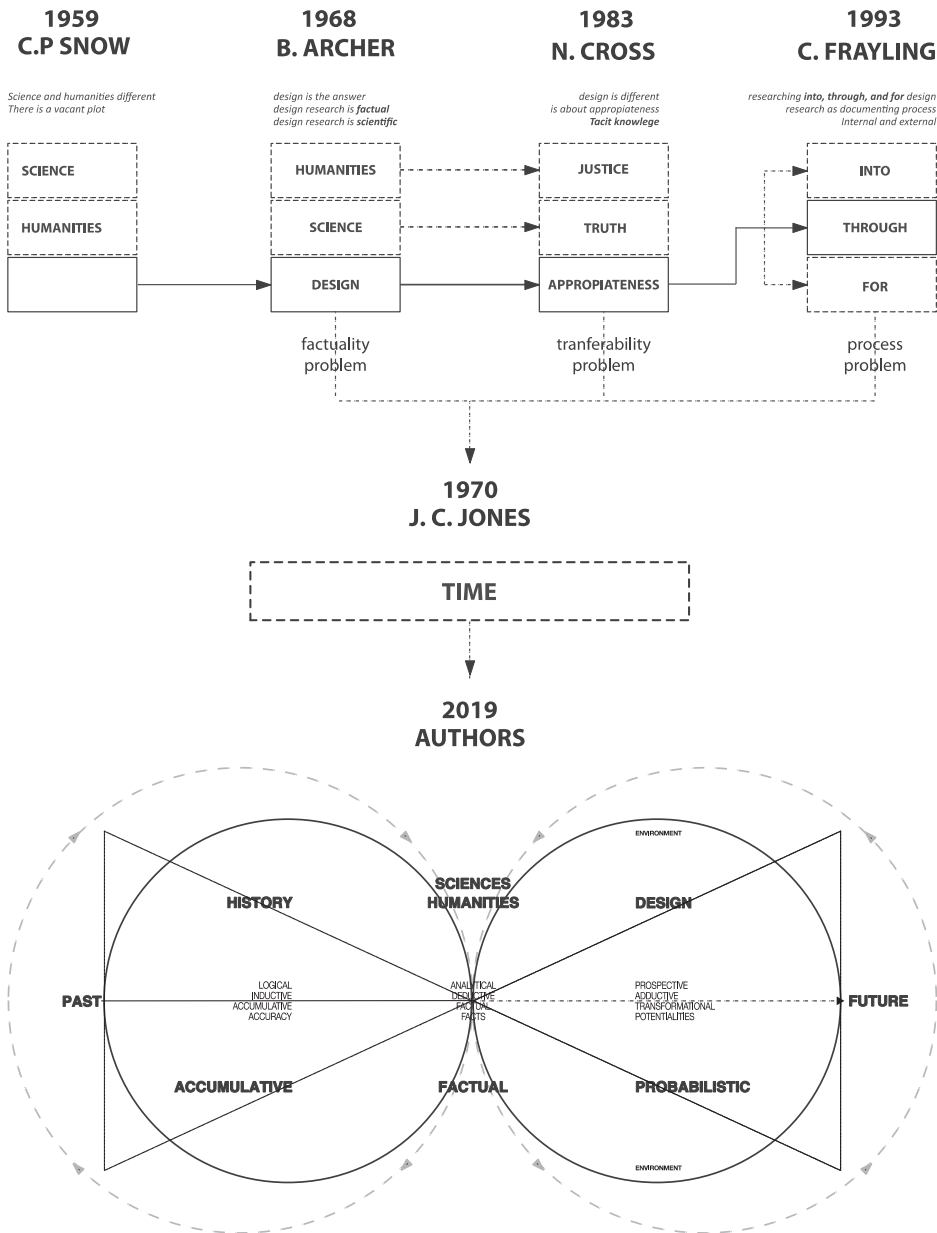


Figure 4. Repositioning design research in design education for the 21 Cth.

preparedness, readiness and appropriateness in the built environment, determines a different model of knowing. In this scenario, the designer is dealing with wicked problems by accessing areas yet-to-be or not-fully-formed (Rittel and Webber 1973; Buchanan 1992; Conklin 2006). Consequently, its output is based on potentialities, not certainties. We trade some degree of accuracy for access to areas that are partial and yet-to-be or not-fully-formed.

Therefore, our output is probabilistic, and research is always preliminary in its nature. Moreover, in exchange we provide guiding knowledge – as Glanville (2005) proposed, ‘knowledge for’ future action and possibilities rather than ‘knowledge of’ past actions and events.

Design research is directional and transformational at its core. In this context, we are more abductively concerned with how things ‘ought to be’ (Simon 1996, 111–167) instead of how things actually are.

In the prospective framework (Figure 4) we have proposed that design research can access the future. However, current models of research are limited by the present, both by observation and/or measurement. In order to address this fundamental aspect, we introduced the concept of probabilistic knowledge by building on new approaches in design and economics. Probabilistic knowledge in the context of design research could be defined as the potential impact of transformational initiatives (see Galdon and Hall 2019 for an extended explanation).

In this context, probabilistic knowledge emerges as an ontological reality to address the intrinsically prospective and abductive nature of design research. Ultimately this approach implies a different form of knowing and aims to position design research as the field best prepared for addressing the future.

At this point it’s worth highlighting that Archer published a much more developed concept than his 1960s PhD in a 1992 paper: The nature of research into Design and Technology education. This paper shares some of the elements positioned in our argument. In his argument time emerges within the category of ‘envisioning’. He seems to start to acknowledge a range of elements that are intrinsic to design and this dimension of time, however, he seems to be attached to a set of elements from the past. Consequently, these new elements (complexity, contextually, ambiguity, uncertainty) and their ontological nature are not translated into an operational design framework to keep its integrity in research. That is abductivity, prospectivity, contextuality, and probabilism (probabilistic knowledge).

Design research in design education for the 21Cth

In *Towards Relational Design* (2008), Andrew Blauvelt proposed that we are moving towards a type of design that is relationally based and contextually specific. In his account, he structures the evolution of design into three main epochs: modern design, post-modern design and relational design. Modern design ranges from 1900 to 1950, and focused on forms, which were disseminated rationally and potentially universally. Post-modern design ranged from 1960 to mid-90s, and focused on design’s meaning-making potential, symbolic value, semantic dimension and narrative potential. Finally, relational design ranges from the mid 90s to the present, and focuses on effects on

users, pragmatic and programmatic constraints, rhetorical impact, and the ability to facilitate social interactions. He presents IDEO and Anthony Dunne and Fiona Raby as primary practitioners in this new evolution. In his account, he describes relational design as including performative, pragmatic, programmatic, process-oriented, open-ended, experiential, and participatory elements, moving away from designing discrete objects 'to the creation of systems and more open-ended frameworks for engagement: designs for making designs' (Blauvelt 2008).

If the first wave of design offered us a multiplicity of forms, and the second a multiplicity of meanings and interpretations, the third wave presented a multiplicity of contingent, bounded, or conditional solutions: open-ended rather than closed systems; real-world constraints and contexts over idealized utopias; relational connections instead of reflexive imbrication; 'the end of discrete objects, hermetic meanings, and the beginning of connected ecologies' (Blauvelt 2008, 6). In this context, the nature, intentionality and implications of the system of interaction demands a different kind of design and time intervention. In this scenario, design research must address complex systems and unintended consequences via prospectivity and emancipation, while dealing with uncertainty, not-fully-knowing, reparation, accountability, and the ubiquity of fluid cyber-blended and hyper-connected ecologies.

This analysis can also be found in *L'eclipse de L'object* by Findeli and Bousbaci (2005). They structure the evolution of design in three stages; up to mid-20 Century; the material object or product has long been the main focus of the theories. After the Second World War; the object tends to disappear from the concerns of the theoreticians. And in a more contemporary period a shift took place away from the product in the preoccupations of the theoreticians. Theoretical models, for the authors, are now interested in either the actors of the design process or the experiences of the user as a 'whole' human being.

In this context, this paper claims to advance knowledge by making a fundamental contribution to contextualizing Glanville's 'knowledge for' future action and possibilities rather than 'knowledge of' past actions and events (Glanville 2005).

Implications for design research education

In this final section we will review the conclusions presented by Frayling's seminal paper research in art and design (Frayling 1993) to update its relevance in today context.

Frayling's original paper represented a revolution for design research as it provided an operational framework differentiating researcher positions in relation to designing by building on earlier work by Archer.

In evolutionary terms, on reviewing several of Archer's work, Boyd Davis and Gristwood (2016) points that, he went to the opposite end of the scale by the end of his career and was investigating highly qualitative ideas from semantics and semiology. His thesis and his later work on 1978 contradict each other, or more accurately, his ideas are more well formed by 1978. However, they still operate temporally in a present-based capacity.

The evolution of Cross's ideas by Frayling are critical by adding documentation as part of the process of conducting academic design research – We need to emphasize that Frayling's conclusions refers to obtaining a PhD. The distinction we are making here is fundamental, as there remains confusion between practice-based design research and other forms of academic design research. In the latest, transferability of knowledge, and a contribution to knowledge are quintessential parts of its constitutive practice.

Frayling's paper was historical and set the foundation for a debate in 1997 to define the model for PhDs in Design in the UK (UK Council for Graduate Education 1997). However, Frayling's 1993 paper is a tentative paper on intentions, rather than based on empirical studies; It proposes how a PhD may be conducted in the context of art and design. Now, 30 years later, we can review to which extend these initial intuitions were accurate.

Before Frayling's into-through-for model, and with the exception of Archer's PhD, theses tended to be more related to **into**. As he acknowledges in his paper;

Research into art and design is the most straightforward, and, according to the Allison index of research in art and design - as well as CNA lists of the 1980s and early 1990s plus my own experience at the Royal College of Art - by far the most common (Frayling 1993, 5)

During Frayling's tenure as a vice-chancellor of the Royal College of Art, PhDs built on his model. Two relevant examples of this period are Anthony Dunne's Critical design and James Auger's Speculative Design. These theses are examples of deploying research **through** design and both theses are articulated around iterative cases studies. In the case of Anthony Dunne evaluation was conducted via feedback collected at exhibitions, and this feedback informed the subsequent case. It is pure research **through** design model. In the case of James Auger, it differs slightly as he used two cases study to iterate, but included a workshop to test the validity of the proposition. Here, although research **through** design is the dominant feature, we can see a preliminary evolution towards research **for** design.

After Frayling's tenure, RCA theses started to evolve towards research **for** design. Examples such as van Ditmar (2016), Galdon (2021), or Iulia Ionescu

(Current 2022) presents a combination of **through** and **for**. However, this combination is diametrically opposed to Auger. These theses started with a range of preliminary exploratory projects to inform the main area of intervention and can be characterized as practice led scoping or experimenting to concretize methodological evolution and theoretical specificity. The main investigation therefore was implemented to devise an output focused on research **for** design(ing). In all these cases, researchers used mixed methods combining qualitative and quantitative research in the form of surveys, or statistical analyses to inform decisions. Research **through** design is not the dominant feature of this approach, and we see an evolution of a hybridized research practice where the practice itself becomes research for designing practice conducted through designing research. It becomes a '**research-for**' approach where the practices observed are not those of a design studio or a classic designer, and neither are they conventional academic approaches. One of the factors that may support this evolution is the (un)disciplinary hybridity emerging in design research with the researchers above having backgrounds in Biotechnology, Social Science and Digital technology, or Architecture and Design Engineering. The core practice becomes a designing research approach which is neither industrially led nor conventionally academic but seeks to leverage the designerly permissions to embrace new forms of design research knowing.

This transitional period was concluded with the articulation of the ontological nature of design by the authors (2019). In which a full operational model is presented for modified research **for** design. Therefore, the 'thorny' nature of this approach, as described by Frayling (5), is demystified and articulated. This is of significance as Frayling himself noted that this model is the future of research in design;

The thorny one is Research for art and design, research with a small 'r' in the dictionary - what Picasso considered was the gathering of reference materials rather than research proper. Research where the end product is an artefact - where the thinking is, so to speak, embodied in the artefact, where the goal is not primarily communicable knowledge in the sense of verbal communication, but in the sense of visual or iconic or imagistic communication. I've mentioned the cognitive tradition in fine art, and that seems to me to be a tradition out of which much future research could grow: a tradition which stands outside the artefact at the same time as standing within it. (Frayling 1993, 5)

He Concludes;

I can only add, that research for art, craft and design needs a great deal of further research. Once we get used to the idea that we don't need to be scared of 'research' - or in some strange way protected from it - the debate can really begin. (Frayling 1993, 5)

The fundamental problems for Frayling, but also for Archer, Cross, and to some extent for Harriot is the variable of time. This variable introduced among others by John Chris Jones in the 1970s, was unconsidered in these models and forced them to operate in the present, which fundamentally prevented an understanding of design as a future-led activity focused on transformations operating around notions of prospectivity, abductivity, contextuality, and probabilism. This repositioning emancipates design research from the present, thus overcoming the scientific/tacit paradigms, and liberates design research to operate independently in its future-led prospective and transformational nature focused of future world-making.

However, this recontextualization around these notions of prospectivity, abductivity, presents a question in the way we consolidate knowledge. If design is preliminary in its nature and contextually operating with uncertainty using and abductively approach, then how do we consolidate knowledge? How can we rely on design knowledge for as future to be and what forms of trust allow us to proceed with confidence?

In the context of trust building and the consolidation of knowledge we consider the rationale to implement this strategy building from a Parmenidean perspective of truth as a process (alétheia), and a Socratic perspective of multi-perspective dialectic ontology (ti estin). Parmenides built from Heraclitus's notion of reason (logos) to present the notion of truth (alétheia). Alétheia builds from ἀληθής (alēthēs, 'true'), and is composed by two elements ἀ- (a negative particle meaning, 'not'), and λήθω (Lēthē, 'oblivion', 'forgetfulness', or 'concealment' (Liddell and Scott 1940). Alétheia (ἀλήθεια), through its privative alpha (ἀ-) means 'un-forgetfulness' and/or 'un-concealment'. This proposition positions truth as a process of uncovering or discovering and unforgetting or remembering and is akin to both prospective and abductive design reasoning. Socrates built from this notion but challenged the idea of writing as it entailed conclusiveness. Instead, his dialectal ontology brought the public sphere and conversation as a method to establish the truth and positioned knowledge as an open-ended process in which knowledge could be recursively altered aligning with 'designing for' notions of prospectivity, abductivity, contextuality, and probabilism. By testing his arguments with a multiplicity of wise men he could refine and test the robustness of his arguments. However, it violates the second rule proposed by Parmenides; unforgetting. The fundamental problem with conversation is that you tend to forget things. Writing, on the other hand, consolidates knowledge in its original form, hence the contention between 'designing through' and 'designing for' and how we can build on different types of knowledge including the tacit.

Building from these notions we acknowledged the potential of the multi-perspectival evaluation of Socrates, but challenge his opposition to writing

by publishing papers, so they can be scrutinized in its original form. In this context, we introduce preliminary as a category to operate as a register which also leaves the possibility of the knowledge generated to be challenged, evolved, modified, or falsified. In this way, we can reconcile and integrate the notions presented by Socrates and Parmenides. This strategy included diversity, transversality, impact, relevance and responsibility as fundamental variables to address. This approach to practice aims to enhance scrutiny by diverse audiences to maximize its transversality and therefore, its robustness. This process enables cross-disciplinary scrutiny to enhance robustness in the context of established models of research. This is through the reason why we write preliminary papers to achieve these things (in design), instead of fixing blocks of knowledge (Sciences). In other words, we view these published outputs as probabilistic in nature.

Going back to Archer's *The Nature of Research into Design and Technology education* (Archer, Baynes, Roberts 1992), his model also uses evaluation at different stages, but his operationalized model works with a belief in completeness and with the idea that the process ends when the project is concluded.

We don't. By introducing the dimension of time, we acknowledge that product development only accounts for 50% of the story, and that there is another 50% that can only be known a posteriori, is determined by context and the unfolding future levels of exchange, and that knowledge is not complete but transient, therefore open for refutation, and modification. Which has to be this way because we are dealing with complexity, contextually, ambiguity, and uncertainty.

With the introduction of time comes accountability (the executed past), and responsibility (the constructed future). If we believe that design has unlimited capacity for change, then it follows, we have infinite responsibility for changes in an ongoing permanent future.

Conclusions

Frayling's paper was historical and set the foundation for a debate in 1997 to define the model for PhDs in Design in the UK (UK Council for Graduate Education 1997). However, Frayling's paper was a tentative set of ideas based on intentions, rather than based on empirical studies; It proposed how a PhD may be conducted in the context of art and design. Now, 30 years later, we can review to which extent these initial intuitions were accurate.

In the early part of our discussion, we reviewed Archer's doctoral work and his attempt to explain design as a special branch of science and the argument that it usefully failed to do so (Boyd Davis and Gristwood 2016).

Nigel Cross's evolution framed the three cultures in terms of output and presented an evolution to Archer's ideas in terms of the type of knowledge generated which he framed as tacit knowledge and designerly ways of knowing. This allowed us to identify the emergence of an issue we characterized as ***the problem of factuality***.

Polanyi's tacit knowledge was then used by Christopher Frayling to frame an evolution to Nigel Cross's work by introducing three new possibilities; Research into Design, Research through design, and Research for design. Frayling's model offered a way-out of the 'tacit conundrum' in the form of Research through design combining internal and external perspectives. This category allowed us to integrate design research into established models of academic research while maintaining its integrity which he positions around process. This reframing aimed to address the implications of tacit knowledge in what we characterize as ***the problem of transferability***.

Research through design, as described by Frayling, focuses on development work and documentation. These elements create a final problem; ***the problem of process***, where design becomes a process/tool/method to develop and document research. If design is a tool/process/method, then this challenges its view as a field of enquiry and thinking culture. This approach is a *de facto* dissolution of design as a constitutive culture.

Furthermore, any acknowledgement of research as a contribution to knowledge in the field is missing from Frayling account. What constitute the act of academic research is a double-side process of searching and finding. You need to search, but you need to find, and what you find needs to be novel and make a contribution beyond established knowledge.

The fundamental problem with Archer, Cross, Frayling, and to some extend of Herriott, and Findeli propositions is that all of them missed the value of considering the temporal relations of knowledge creation. This is surprising, as this variable was introduced amongst others by John Chris Jones since the 1970. This aspect forced them to operate in the present, and fundamentally, prevented an understanding of design as a future-led activity operating around notions of prospectivity, abductivity, contextuality, and probabilism. The liberation of these notions enables Archer's third culture to be fully operational in the context of research as it does not aim to reject or prevent researchers from implementing research into or through design, it clarifies how future-prospective research for design can operate.

The model presented by Galdon and Hall (2019) aligns with Cross's aforementioned functional claim (appropriateness) and consolidates Archer's design distinctive position as different from the sciences and humanities. It positions the ontological nature of design knowledge as probabilistic. This repositioning emancipates design research from the present, thus overcoming the scientific/tacit paradigms, and liberates design research to operate

independently in its future-led prospective and transformational nature focused on world-making. However, this independence, which is capital in constituting cultural distinctiveness, does not indicate insolation, quite the contrary. It facilitates interdependences and collaborations by clarifying what we do to others. This aims to facilitate explainability in preliminary and basic terms to other fields and cultures – exactly as when a sociologist and a scientist sit in front of each other and explain to each other the scientific method, or field work. Designers are prospective thinkers using abductive reasoning to generate potentialities to transform society and the build environment by prototyping objects, services and actions for future world-making.

In the past, our core research practices were enclosed in workshops and studios. They have now been liberated via the evolution of design thinking towards transformational future impact. In this context, our practices have expanded beyond the artifact to integrate with other thinking domains and cultures. In this process our expertise has shifted towards a distinctiveness and culture aiming to lead cross domain collaboration. Design research is directional and transformational at its core, and the prospective preliminary nature of our abductively led knowledge for future transformation leads the manner in which we approach research practice.

We see an evolution towards a hybridized research practice where the practice itself becomes research for designing practice conducted through designing research. It becomes a '**research-for**' approach where the practices observed are not those of a design studio or a classic designer, and neither are they conventional academic approaches. The core practice becomes a designing research approach which is neither industrially-led nor conventionally academic but seeks to leverage the designerly permissions to embrace new forms of design research knowing.

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