Transferability vs. Repeatability: Consolidating the Ontological Nature of Design Research

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Abstract

Over time we have begun to build foundations for design ontology moving it away from efforts to align with a scientific rigour model based on reproducibility and generalisability towards a new direction supporting design's emergent and abductive qualities. Two of the key issues that have escaped our grasp has been a better understanding of design ontology and what equates to rigour in constructive design research. Recent work by the authors has positioned transferability as a candidate for a design ontology based on an ontological mirror along with a series of attributes addressing the rigour issues of future-forwards knowledge generation. Here we use two case studies to test the future forwards rigour of a transferability property for design knowing and speculate as to how researchers can build confidence and trust.

Author keywords

Transferability; Design Ontology, Design Futures; Design Research

Introduction

thinking by CP Snow (Snow, 1959) and Archer's claim for design as the third culture, (Archer, 1978) a number of design thinkers have suggested temporal relationships between forms of knowledge production across different domains. Herbert Simon "Design, on the other hand, is concerned with how things ought to be,…" (1969, p.115), John Chris Jones "…that which exists only in an imagined future" (1992, p.10) and finally Ranulph Glanville "…there is a third kind of knowledge that converts knowledge of into knowledge for… (2005, p.112) explored the idea that design has a distinctly different temporal relationship to scientific and Arts & Humanities knowledge building. This culminates in Glanville's proposition of 'design *for* future transformation'. It aligns with work by many others positioning design as an abductive form (Douven, 2011) of thinking imagining new futures.

The issue previously explored by the authors (Hall & Galdon, 2023) concerns rigour and more specifically how knowledge that is being generated for future transformation in a forever-forwards mode can be built upon and at some future stage perceived to be truthful and worthy of acting on. While the authors have explored theoretical avenues leading towards transformation, we also seek to test tangible examples.

Towards a Design Ontology

Several developments have come together for identifying the core foundations of knowledge generation in design research. These are substantially different to those of other domains of thinking and the call for distinct design foundations made most recently by Dixon "…with the potentially special approach to knowledge claiming in design, there is also the possibility that the evolution might take on a different form here too." (2023, p.127). Dixon identified the impossibility of reproducibility and generalizability as foundations for design research and opens the door towards several other approaches.

Gaver et al (2012, 2022) have identified emergence in the context of Human Computer Interaction (HCI) as an essential quality for design research where methodologies are rarely set in advance. This contrasts to the 'preregistration movement' in HCI which seeks to evaluate the outcome of research according to a prior public registration of research aims. Here design and the sciences clearly diverge in their expectation of rigour models where one appears to view divergence as suspect and the latter sees it as essential for investigation. Koskinen and Krough (2015) inspired by Gaver (2001) explore accountability in the context of constructive design research by way of the entanglement of theory and practice. They describe the tensions of design research that builds on practice and must navigate competing interests and multiple concerns. Building on this Krough and Koskinen (2020) consider the implications for moving from a practice based to a knowledge-based discipline and how this affects research outcomes. They explore through four different epistemic traditions using the concept of 'drifting by intention' and emphasise in line with Gaver that context is crucial, and that drifting is conceived within a constructivist design research tradition and would be out of place for example in an engineering context. Binder and Redström (2006) review the three traditions of design research and described how drift can emerge in research cycles as practice uncovers new opportunities and directions. They contrast the inside and outside view of design research programs to illustrate the projected verses the perceived research experience akin to Jacob's research night and day (Jacob, 2001). Zimmerman, Forlizzi & Evenson (2007) propose relevance and extensibility as criteria for reliable knowledge production in design research. Earlier Guba and Lincoln (1985) in the social sciences point towards transformation as one of a series of trustworthiness attributes including credibility, transferability, dependability, and conformability. The context here is producing knowledge of the world via rich and thick descriptions of socio-cultural scenarios rather than knowledge for future transformation. Nowell et al (2017) extended this concept challenging that a researcher cannot know who, how and where their research may be transmitted or extended to hence a question arises as to how design researchers who initiate research can enhance their practice, anticipate transmitted context and extensibility capacity of their work. Interestingly Krough and Koskinen (2015) contend that design researchers build on the ideas, methods, and practices of other researchers rather than the objects that might be outcomes of their work indicating that 'thingness' has less influence in design research for transferability.

We can draw threads of similarity through a special approach to knowledge claiming (Dixon), emergence (Gaver et al), drifting by intent (Krough and Koskinen), extensibility (Zimmerman, Forlizzi and Evanson) and transformation (Guba and Lincoln) leading towards a proposition that if design's purpose is to create knowledge for future transformation, then transferability becomes a contender to underpin ontology. Three of these concepts have spatial relations to research outcomes in terms of direction as illustrated below in Fig.1.
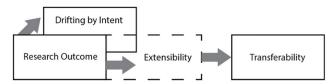

Figure 1. Candidates for core ontology attributes in the context of constructive design research.

Methodology

In order to test transferability in concrete research examples we have reflected on two design research projects undertaken by the authors that deal with design futures and supports thinking that addresses the key issues above: a framework for prospective design (Galdon and Hall, 2019a), and a design for safety foresight review (Anderson, Hall, Ferrarello, Cooper and Ross, 2018). Reflecting across these publications has supported new thinking towards contributing to

the ontological quality of design knowledge production, and a further consideration about what this means in terms of rigour for practice-based design research.

Case studies enable the exploration and investigation of applied research within a defined context by using a variety of data sources (Baxter *et al.*, 2008). This methodology allows design researchers to develop and to enhance:

> "…the capacity of comprehension and analysis of real problems, the capacity to propose and evaluate alternatives for the improvement of the problem considered, to work collaboratively, [and facilitates] their capacity of information management and synthesis of problems" (Herrera *et al*, 2016).

In this context, we will use comparative studies. According to Bukhari (2011) a Comparative Study analyses and compares two or more objects or ideas to examine, compare and contrast them to show how two or more subjects are similar or different.

Transferability Case Studies

We have selected two case studies from the research projects of the co-authors to test diverse transferability motivations, methods, mediums, and audiences for research. Neither of the case studies were created with the express purpose of facilitating transferability or making a case for ontological significance and we have approached the comparison of the cases to operate on a critical basis to develop a preliminary set of criteria for considering transferability factors. Therefore, our approach is retro-speculative.

Case Study 1 – Prospective Design

Prospective Design differs from other forms of future design studies, such as Critical and Speculative Design, in its focus on systematic and relational ideation. Prospective Design aims to design on behalf of the user to shape frameworks and mitigate unintended consequences. Its focus, building on Nigel Cross's work (1983), is on building preparedness, readiness, and appropriateness. This methodology repositions the designer as an expert in future-led technological potentialities aimed at reducing risks and protecting citizens/users. The success of the output is determined by its potential to affect change, which depends on the weight of the actors involved within the system. This future-led, mixed-methodology aims to design trust and incorporates trajectories, probabilistic extrapolation, asymmetries, consequential analysis and counter-fictions to design novel strategies to mitigate unintended consequences in prospective technological developments.

The methodology was developed in the context of artificial intelligence (Galdon, Hall, & Wang, 2019a). Four publications (Galdon and Wang, 2019b: Galdon and Wang, 2019c; Galdon and Wang, 2019d; Galdon and Wang, 2019e) were submitted to the National Data Strategy board for review. The committee accepted all four publications as pieces of evidence to inform the development of the framework which will determine the use of artificial intelligence (AI) in the UK. This framework was synthesised, adapted, transferred, and implemented in the context of publication aimed at future covid-19 type events (Rodgers, Galdon, and Bremner, 2020) to build preparedness, readiness and appropriateness. Building from the work conducted in prospective design, the covid-19 work also made use of time via longitudinal studies, the adaptation of probabilistic extrapolations via evolutive traces, and the execution of a concrete output via the generation of a book supported by the Arts and Humanities Research Council in the UK. This adaptation mirrored the process developed in prospective design. This project is an example of the synthesis, flexibility, contextual adaptation, and transferability process in which design operates. Currently, we are implementing a new case study to further synthesise, adapt, transfer, and implement prospective design in the context of regeneration and sustainability via the development of deep products (Galdon and Hall, 2022).

Case Study 2 – Design for Safety Foresight Review

The Design for Safety (DFS) Foresight review (Anderson, Hall, Ferrarello, Cooper and Ross, 2018) was a strategic design research project commissioned by the Lloyds Register Foundation (LRF)

following the successful design for safety grand challenge that focussed on saving lives at seas working with ship's pilots and the Royal National Lifeboat Institution (RNLI) on the river Thames (Hall, Ferrarello and Kann, 2017). The LRF is a charity funded from profits derived from business operation by the Lloyds Register surveying ships with remit of improving safety and have commissioned and published a series of strategic reports on diverse safety areas from fishing and ferries to robotics and critical infrastructure. The DFS research team at the Royal College of Art were commissioned to develop a DFS foresight review that would identify the top global risks from the perspective of DFS and identify any gaps in knowledge and capability.

The foresight review consisted of an international questionnaire and a two-day symposium with an international representation of geographies and safety critical industries. The review was focussed through a DFS matrix which identified the capability gap. A series of strategic mapping exercises were conducted during the symposium including mapping safety case study examples from each expert to ask where should design operate and what is missing from design; design future scenarios based on future forecasting techniques, which outlined future global risks that cross-sectors experts need to tackle through design; a strategic session where experts prioritise future design risks. Following a second one-day symposium with lead researchers and the Lloyds register foundation an onion diagram was developed to communicate the gap in capability and knowledge related to future global DFS issues. These were a DFS gap in ethics and principles, safety culture and safety practices.

Comparison

Case study 1 (CS1) contains several transfers from the original project into four papers for the UK AI Data Strategy Review Board and separately another strand supports a research publication aiming to improve design systems response to future pandemics. Case Study 2 (CS2) has developed a number of publications including one on emergent methodology (Hall, Ferrarello, Anderson, Cooper, Ross, 2019). The DFS project informed a new research project also in the marine environment seeking to support a new economic model for the world's oceans.

Both case studies take a 'knowledge for' future transformation approach from different directions. The prospective design case study (CS1) develops a philosophical perspective on futures and develops a methodology for prospective design that encourages stronger feedback loops from future projections allowing us to 'design in' preferred futures taking a collaborative directional role rather than a passive anticipatory stance. Design for safety (CS2), on the other hand, takes an applied approach of evidence gathering and collaborative activity in a two-day symposium followed by a second one-day event with a group of around 40 participants transferring knowledge through socially facilitated sessions, foresight and documents.

Comparing the two case studies we have proposed an explorative comparison with criteria selected to identify rigour, type, medium, audience and indicators of transferability in the context of generating knowledge for future transformation. When comparing criteria, we see that the case studies diverge in their aims, building a new approach to design futures and uncovering design for safety issues and limitations of design methods for tackling future global issues. Neither form of knowledge calls for repeatability or a retesting of its findings, yet both place emphasis on forward facing future action for 'knowing what to do next' in the context of knowledge for future transformation. The intended audiences diverge between academics, practitioners, industry and government.

Discussion

The case studies take place in complex dynamic environments tackling wicked or even very wicked problems (Alford & Head, 2017) and hence deal with 'unknowable problems' that prevent repetition. The intricacies of working with systems present a significant challenge for designers. Traditionally, these issues were framed around the concept of wicked problems, developed by Horst Rittel and Melvin Webber in the 1970's to deal with complex social issues (Rittel & Webber, 1973) and led to the challenging of fixed step-by-step models of the design process. Wicked

problems are complex and interconnected, sometimes they are nested or overlapping and often involve conflicting demands from various stakeholders with different perspectives making them impossible to fully solve.

As we look towards the future, we must also consider the critical role of contextuality. The output of a design projects will be subject to contextual forces such as economic, social, and environmental factors, and its value will be determined by *a posteriori* exchange based on these factors. Moreover, the intersection of complexity and contextuality gives rise to two additional variables: ambiguity and uncertainty. These elements prevent repeatability and create an environment in which contextual transferability demands design frameworks with flexibility to adapt to different contexts.

Vectors

Based on the spatial and directional needs of transferability we propose vectors to understand the relationship of the core ontological design research practice and its fundamental differences to the sciences and arts and humanities. We envisage vectors describing the adaptability of knowledge and its transferability as a form of 'future rigour in the making' that could potentially satisfy the challenges that require design's collaborative response to global challenges.

Specifically, we propose vectors for how we might understand the interactions between the future forwards potentials for more successful inter-domain collaborations. We make the case that a vector-based concept improves the potential for inter-domain collaboration. This leads us to the concept of transferability as directionality and a key domain knowledge quality for design which we compare (mirror) to repeatability in the sciences. In terms of rigour, we discuss the qualities of transferability that could address issues for practices which are often validated a posteriori. In our model rigour refers to integrity (collection of original data, material, findings), rather than being disciplined in the implementation of a method (repeatability).

Fig. 2 describes an initial set of vectors emerging from the case studies. We can see internal vectors from within the researcher's projects in CS1 and CS2 moving into knowable transfers. Agreeing with Binder and Redstrom we can see transfer vectors that are internal and external to the project (knowable) and agreeing with Nowell recognise that some may be unknowable hence impossible for the researchers to build on, predict or trigger. We could also speculate that relevance (Zimmerman et al) provides a retro-speculative connection for both knowable and unknowable vectors. Krough and Koskinen's assertion that design researchers tend to follow the ideas, methods and practices of other researchers rather than the objects indicates that we will have to revisit what we view as research outcomes and their influences.
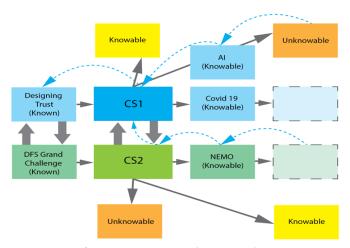

Figure 2. Vectors emerging from case studies.

Vectors that are knowable to the researchers are indicated by grey arrows while blue arrows show reverse retro-speculative trajectories linking to rigour claims. Further vector possibilities are indicated by the additional dashed boxed on the right to infinity. Many more cascading vectors and reciprocal transfers are possible even between indirect contact as in CS1 and CS2 where the authors who were not involved in both case studies yet exchanged other research activities.

Many questions remain and a more extensive analysis of the vectors from other more extensive research projects including knowable and unknowable transfers could provide greater confidence and trust in design research as a constructive special approach to knowledge claiming. Some of these questions include how we can navigate the knowable/unknowable transfer contexts, who decides what success looks like (if success is a consideration in a constructive context)? Are the outcomes traditional research forms (artifacts or the equivalent in practice-based research) or is the researcher practice influence, methods and concepts a 'cultural' research transfer? And how do vectors cascade through knowable, unknowable, external and internal to the researchers? Ultimately the vector network takes on the form of a cultural production.

Although it can sometimes seem like design research is continually flooded by adjacent fields and disciplines these also provide insights for shaping the foundations of design research. Most value seems to be gained for advancing the special approach to claiming knowledge in design research when we 'rub up' against related areas ranging from HCI to design engineering, philosophy, and the social sciences amongst many others.

Conclusions

In comparing our case studies, we have found that diverse approaches to design futures research ranging from rigour, type, methods, audience, output, and indicators offer some potential in supporting an idea of knowledge for future transformation supporting an argument for an ontological design claim for transferability as a key ingredient. The concept of vectors allows us to begin to spatialise these relations of forward knowing whether the relations are past, present or future. In this context, we introduce the factors that make possible transferability; Synthesis, Flexibility, Contextuality, Adaptability, and Comprehensibility.

We offer this as a potential contribution to design ontology as an experiment emerging from a theoretical argument. There are of course alternative, contradictory, and complementary arguments for a design ontology and our thinking here is based on an initial set of comparative criteria applied to a pair of case studies. Other methods may elicit alternative arguments and propositions however we believe the temporal arguments made by Simon, Chris Jones, Glanville still hold and point towards a more radical position of design ontology which we support here. Further research is anticipated towards detailed investigation of the factors for successful transferability and how this can build towards a framework.

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