Beyond Normal Design Thinking: Reflections on the evolution of a paradigm and ideas for the new incommensurable

Philip Ely (PhD, FRSA)
School of Design and the Built Environment
Curtin University
Perth, Australia
philip.ely@curtin.edu.au
ORCID Number: 0000-0002-8718-0010

Abstract Drawing upon the work of Thomas Kuhn and the notion of paradigms and normal science, this chapter takes a closer look at the emergence of Design Thinking (DT) across its diverse community. Here, the DT paradigm is conceptualised as a disciplinary matrix of symbolic representations, metaphysics and models, values and exemplars, identifying the controversies around its origins and its continued development. Design Thinking has become normalised into both everyday practice and research and across its business-oriented and scholarly communities. In this chapter, we argue for more sociologically oriented inquiries which map the controversies, relations and modalities within a paradigm-sharing design community whilst resisting the binary distinctions between scholarly and practice-based inquiry. With a Kuhnian lens, how paradigms are borne from design communities can help us understand future trajectories, for there are signs that a post-Design Thinking period is on the horizon.

Keywords: design thinking, paradigms, design theory, design practice, design research, Thomas Kuhn

Introduction

In 2009, at a catalytical moment in the history of design thinking when Tim Brown's seminal article in the Harvard Business Review was published, design scholar Sharon Poggenpohl wrote 'Design is reaching a transitional moment that requires a critical look at its current and future states…Design's craft origins cannot support the evolving context of design action needed now' (Poggenpohl, 2009, p. 3). Poggenpohl argued that design – as a discipline – was not well organised and required 'a discourse that is responsible to history, uses scholarly apparatus (definitions, references, bibliographies, footnotes etc.), reports research intelligently, supports dialogue between academia and practice, opens issues critically for examination, and builds knowledge, not only for its own purposes, but also to share with others with different disciplinary perspectives' (p.17). Accepting that design deals with the messiness of human behaviour and creation in contrast to the sciences where certainty and truth hold sway, Poggenpohl argued that future design research was critical to its

maturity as a discipline, making the ideas and actions in design more explicit, arguing that such an endeavour was an essential challenge to the traditional (artefactual) approach to design.

The inter-disciplinary practice and critical discourse that Poggenpohl called for was - in some design disciplines - already emergent. For example, design historians have argued not only that 'design history' has become a discipline in its own right - with a concomitant infrastructure of journals, learned societies and a research culture of research degree students – but has experienced an epistemological reorientation beyond merely visual aesthetics and cultural history (Lees-Maffei & Houze, 2010, p. 2). Further, Midral argues that the extent of design's maturity is evident in its ability to 'produce its own discourses and lines of inquiry and to define the conditions for its own existence'(Midal, 2019, p. 396). Even in the most pragmatic of disciplines – graphic design – a discursive, critical, and scholarly research community is evident (Black et al., 2017; Kim, 2017; Teal & Atzmon, 2019) and, as this chapter explores, the discipline of design thinking has also experienced a veritable explosion in discourse amongst professional designers and academics alike.

One aspect of Poggenpohl's invitation for more research activity that is still open to development is around the notion of *future states*. If we are to accept that the broad field of design (and its constituent disciplines and sub-disciplines) is one primarily concerned with *futuring* – of 'changing existing situations into preferred ones' as Herbert Simon is quoted *ad nauseum* – one inevitable question emerges: what, then, does this mean for the field of design itself? What does the future hold for design? Specifically, what future lies ahead for the sub-field or sub-discipline we call 'design thinking'? For the inquisitive researcher, how might we confront such questions? How can we research a future that is yet to be? How might we embark on an epistemological grand project exploring one of the early twenty-first century's most widely cited design paradigms *and* make sense of where we might be headed? What and who comes next?

This chapter takes tentative first steps towards what comes next, by first exploring the emergence of Design Thinking, its popular (and scholarly) acceptance as a 'paradigm' (whether well received or not) and consider its future through the theoretical lens of science philosopher, Thomas Kuhn who – if not the first to use the word paradigm – was the first to consider the historical development of scientific knowledge from this perspective. In his postscript to *The Structure of Scientific Revolutions* (SSR), Kuhn recognised that his analysis of scientific revolutions could equally apply to comparative studies in other fields. By answering important questions about how individuals are 'elected' into a particular community (scientific or not), the process and stages of socialization of said group, and the groups goals and the deviations (individual or collective), the historian or researcher can begin to understand how ideas have emerged in a field of study and how they have held sway (Kuhn, 1970 p.209). In looking at Design Thinking from such an epistemological viewpoint, this chapter provides the design thinking researcher foundational perspective on how knowledge is created in design within communities of scholars and practitioners, thus presented as a form of research *into* design (Frayling, 1994). As Laursen and Haase (2019) have noted, the cornerstones of contemporary Design Thinking are emergent from two distinct communities - 'design thinking' practitioners *and* the design research field of 'designerly thinking' (p.814) – communities that nevertheless 'rub off on each other' (p.815). As we will explore in this chapter,

whilst the two communities of managerialist design thinking practitioners and the scholarly design researchers do not necessarily agree with definitions, processes or methods under the rubric of 'design thinking' that contribute to two distinct discourses (Johansson-Sköldberg et al., 2013), both nevertheless are interested in the broader efficacy or limitations of design-led approaches to confronting wicked (Buchanan, 1992) or complex problems.

A process of mapping the terrain of knowledge amongst a community of researchers and practitioners in a field draws attention to the controversies, interdependencies, relations (Latour, 2005) and the modalities, formalities, tactics and trajectories (Certeau, 1984, pp. 29–42) of a broader disciplinary field. The question of how and why certain knowledge appears to hold sway over other forms of knowledge (whether tacit or knowledge; expert or novice) is a perennial matter of concern. Being perpetually inquisitive to the faint signals of dissent or revolution found in disciplinary discourse is a prerequisite of effective research and criticism. Indeed, in the futuring discipline of design, the search for new ways of knowing and doing design would appear to be its *raison d'etre*.

Contested design thinking

In setting out to map the territory of people and places that have shaped the design thinking paradigm, it is worth noting the systematic reviews of Laursen and Hasse (2019) and Johansson-Sköldberg,Woodilla and Çetinkaya (2013) respectively. Other similar studies of design thinking have been conducted for researchers in educational research (Razzouk & Shute, 2012) product innovation management (Micheli et al., 2019) and organizational management (Elsbach & Stigliani, 2018). Each of these reviews has attempted to provide a taxonomy of design thinking, forming a useful foundation for future studies. For example, Johansson-Sköldberg et al identified eight distinct discourses, which Laursen and Hasse more usefully describe as falling into two distinct types of discourse 'designerly thinking' and 'Design Thinking' (see Table 1)

Table 1: Summary of Johansson-Sköldberg et al (2013) and Laursen, L. N., & Haase, L. M. (2019)

Authors	**Discourse**
Designerly Thinking	
Simon, H. A. (1969)	The creation of artefacts (the science of the artificial)
Schön, D. (1983)	A reflexive practitioner
Buchanan, R. (1992); Rittel, H. and Webber, M. (1973)	A problem-solving activity (wicked problems)
Cross, N. (2006, 2011); Lawson, B. (2006)	A way of reasoning and sense-making
Krippendorff, K. (2006)	The creation of meaning
Design Thinking in Management Discourse (Design Thinking)	
Kelley, T. (2001, 2005); Brown, T. (2008), 2009)	IDEO's way of working

Dunne, D. and Martin, R. (2006); Martin, R. (2009)	An approach and skill for managers
Boland, R. and Collopy, F. (eds.) (2004)	A management theory

What is revealing is that even the reviews themselves do not share the same language to describe the ideas being presented; what Johansson-Sköldberg et al describe as 'discourses', Laursen and Hasse describe as 'concepts. Through the reviews, however, we can see that the emergence of design thinking in the management or business literature serves a different audience to those in the 'designerly thinking' community. Further, a distinction has been made between the scholarly and theoretically grounded designerly thinking literature and the theoretically-light, toolkit-oriented management literature. Laursen and Haase's theoretical analysis reveals that the designerly thinking literature has a focus on particular paradigms ('wicked problems', 'abductive' reasoning and 'contextual meaning') (p.821) and methodological approaches to design thinking, whereas the managerial design thinking 'mainly focuses on 'suggested actions', tools and techniques…often described in a 'cookbook' format featuring significant phases and tools selected for each phase' (p.826). The reason for this, the authors posit, is that the aim of designerly thinking is to establish itself as a discipline in its own right, whilst the aim of the design thinking literature 'is to 'export designers' ways of thinking to non-designers' (p.827).

A more recent citation analysis of "Design Thinking" AND/OR "design thinking" in titles, abstracts, keywords or body copy on the Scopus database (2022) reveals the paradigmatic reach of design thinking, with the top fifty cited works (with 96-2005 citations respectively) on design thinking published from fields as diverse as educational psychology, chronic diseases, energy and environment, (local) economics and policy sciences alongside those in design, design education, management, engineering and business. Although such a search reveals that Dym et al's article on 'Engineering design thinking, teaching, and learning' (Dym, Agogino, Eris, Frey, & Leifer, 2005) is the most cited, Tim Brown's article published three years later in 2008 has been the most cited text on design thinking in peer-reviewed articles in the 2020's (Table 2).

Table 2: Scopus Citation Tracker, showing top 10 most cited works on "design thinking" and/or "Design Thinking" (Scopus, 2022)

Year	Document Title	Authors	Journal/Book Title	Citations <2020	2020 Citations	2021 Citations	Total Citations
2005	Engineering design thinking, teaching, and learning	Dym C.L., Agogino A.M., Eris O., Frey D.D., Leifer L.J.	Journal of Engineering Education	1680	170	147	2005
2008	Design thinking	Brown T.	Harvard Business Review	1296	236	247	1798
2007	Sketching User Experiences: Getting the Design Right and the Right Design	Buxton B.	Sketching User Experiences: Getting the Design Right and the Right Design (Book)	653	43	22	719
2011	The core of 'design thinking' and its application	Dorst K.	Design Studies	425	102	140	672
2013	Design thinking: Past, present and possible futures	Johansson-Skoldberg U., Woodilla J., Cetinkaya M.	Creativity and Innovation Management	224	94	66	388
2006	How bodies matter: Five themes for interaction design	Klemmer S.R., Hartmann B., Takayama L.	Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, DIS	337	27	23	388
2006	Design thinking and how it will change management education: An interview and discussion	Dunne D., Martin R.	Academy of Management Learning and Education	292	41	40	375
2002	Thinking in design teams - An analysis of team communication	Stempfle J., Badke-Schaub P.	Design Studies	298	27	29	354
2012	What Is Design Thinking and Why Is It Important?	Razzouk R., Shute V.	Review of Educational Research	177	77	88	344
2007	Innovation as a learning process: Embedding design thinking	Beckman S.L., Barry M.	California Management Review	247	43	44	338

A similar search on Web of Science identifies the top fifty cited works (with 40-1250 citations respectively) and the same top two cited papers from Dym et al (2005) and Brown (2008) (Table 3).

Table 3: Web of Science Top 10 citations for "Design Thinking" AND/OR "design thinking" (Web of Science, 2022)

Year	Document Title	Authors	Journal/Book Title	Total Citations
2005	Engineering design thinking, teaching, and learning	Dym C.L., Agogino A.M., Eris O., Frey D.D., Leifer L.J.	Journal of Engineering Education	1250
2008	Design thinking	Brown T.	Harvard Business Review	1246
2011	The core of 'design thinking' and its application	Dorst K.	Design Studies	539
2006	Design thinking and how it will change management education: An interview and discussion	Dunne D., Martin R.	Academy of Management Learning and Education	297
2013	Design Thinking: Past, Present and Possible Futures	Johansson-Skoeldberg, U., Woodilla, J., Cetinkaya, M.	Creativity and Innovation Management	292
2007	Innovation as a learning process: Embedding design thinking	Beckman S.L., Barry M.	California Management Review	265
2011	Rethinking Design Thinking: Part I	Kimbell, Lucy	Design and Culture	260
2012	What Is Design Thinking and Why Is It Important?	Razzouk R., Shute V.	Review of Educational Research	256
2007	Using Design Thinking to Improve Psychological Interventions: The Case of the Growth Mindset During the Transition to High School	Yeager, D.S.; Romero, C., Paunesku, D., Hulleman, C.S., Schneider, B., Hinojosa, C., Lee, H.Y. O'Brien, J., Flint, K., Roberts, A., Trott, J., Greene, D., Walton, G. M., Dweck, C.S.	Journal of Educational Psychology	250
2012	Design Things and Design Thinking: Contemporary Participatory Design Challenges	Bjogvinsson, E., Ehn, P., Hillgren, P-A.	Design Issues	200

Whilst regular systematic reviews of the literature are to be encouraged (using such tools as citation analysis), what is often left out of such analyses is a qualitative and wider look at the flow of knowledge between design scholars and design practitioners. Indeed, an apparent systematic, meta-level analysis of design thinking (Micheli et al., 2019) has argued that scholarship on design thinking (in its broadest sense) is still lacking theoretical and methodological rigour - particularly a lack of empirical evidence to determine the precise nature and benefits of design thinking (ibid, p.143). This is disingenuous, for they failed to identify the quarter-century systematic research outputs of the *Design Thinking Research Symposium* series - explored in the Special Issue of the *Design Studies* journal (Cross, 2018; Dorst, 2018) - and that community's substantial analyses of design thinking in practice (Ball & Christensen, 2018; Goldschmidt, 2016, 2017). Design thinking has different meanings both to the members of the two distinct DT and dt communities but also to other disciplines and publics interested in the paradigm and it is incumbent on design researchers to stay inquisitive to how design thinking – or any other design paradigm – is socialised into the both business and academic communities.

A Kuhnian Perspective

What we see in the contested space of Design Thinking/design thinking is analogous to what Thomas Kuhn had seen in communities of scientists, who can share a practice but not a body of theory, rules and definitions; and who can share a paradigm but not share the *same understanding of it* (Kuhn, 1970 [1996] pp.44, 50). What makes this apparently paradoxical situation more problematic is that what we might term a 'paradigm' is itself a contested space. Many authors have highlighted the ambiguities around the very concept of 'paradigm' within Kuhn's writing (Kindi, 2012; Masterman, 1970). However, in specific response to the apparent elusiveness of Kuhn's paradigms, Kuhn later wrote that 'less confusion will result if I instead replace it with the phrase "disciplinary matrix – "disciplinary' because it is the common possession of a professional discipline and "matrix" because it is composed of ordered elements of various sorts' (Kuhn, 1974, p. 297). A disciplinary matrix would comprise 'all of the objects of group commitment described in the book as paradigms, parts of paradigms, or paradigmatic' (p.297). He also acknowledged that paradigms could be seen as 'exemplars' which are 'concrete problem solutions, accepted by the group as, in a quite usual sense, paradigmatic' (p.298). This latter definition is one often adopted in the fields of architecture and engineering, demonstrating – to paraphrase Masterman – both the perspicuous *and* obscure notion of paradigms.

In the field of design, references to particular design paradigms as candidates for solution-finding - metaphors, shapes or models (Wake, 2000) - or (following failure) solution-avoiding (Petroski, 2012) are contrasted with design paradigms that are representative of disciplinary matrices, replete with their methodological, political or philosophical orientation and communities of practice – for example 'anti-design' (cf. Midal, 2019 for an overview). Indeed, as we explored earlier, even amongst design thinking scholars, what is termed a 'paradigm' appears to apply not only to design thinking itself (Laursen & Tollestrup, 2017), but concepts *within* the paradigm – in this case the idea of 'wicked problems', 'abduction', and 'contextual meaning' (Laursen & Haase, 2019, pp. 820–821) . In a more recent critique of 'Design Thinking', Lee (2021), has described the shortcomings of the 'making paradigm' or – referring to the Greek (Meagher, 1988) - the '*technē* paradigm' dominant in popular understandings of design thinking which relies on a technical, rational logic imposed on situations and organisations that does not 'actively recognize and discuss the importance of the social location and place of design activities in organizations' (p.506). Lee specifically refers to what he sees as two visible forms of design thinking: 'intervention design' which he attributes to the product focus or 'matryohska doll or time-release pill' version of design thinking advocated by Tim Brown and Roger Martin – and 'enterprise design thinking' exemplified by IBM's 'injection' of 2,500 designers and the training of 250,000 employees in design thinking (p.502).

The question of what we mean by 'Design Thinking' or 'design thinking' is of course an important one for designers who believe that they belong to one school of thought or another (revealing perhaps the 'mythic' qualities of the paradigm) but for forward-oriented design researchers there is an observation we can make about both conceptions. Both communities – the business-oriented DT or the scholarly 'dt' – are largely 'stable' communities who are clear about their ontological and epistemological position regarding what they believe design thinking is. Thus, Design Thinking has now reached its normative state. By this, we mean that a research

infrastructure of institutions, journals, publishers, research programmes, methodologies and people has been realised. Arguably, it is this stability that can lead us to conclude that both forms of design thinking are what Kuhn would describe as 'normal science' (Kuhn, 1970, pp. 5–6, 10 & 80), an important concept that applies to periods where scientists (for us, designers and design researchers) are tied to a particular tradition, methods, rules or worldviews, signifying a form of maturity of the nature of a paradigm (ibid, p.179).

When Kuhn talked about 'normal science' as a pre-paradigm period (before a new crisis or revolution) he was referring to a kind of knowledge creation which was 'puzzle-solving' (Kuhn, 1996, pp.35-42; 80) within the confines (and accepting the validity) of a current paradigm. This is not to belittle the work of everyday science (or in our case design) for, as Kuhn reminds us, people spend their whole working lives working within the confines of a particular paradigm. Kuhn's puzzle-solving was a recognition that in the daily practice of a particular field of inquiry wedded to a paradigm, a great deal of testing and probing paradigmatic assumptions still took place. Kuhn described periods of normal science being disrupted by anomalies that can occur in fields of science. These anomalies can lead to periods of crisis, resulting in a candidate paradigm able to give account of these anomalies and replace an existing paradigm (Kuhn, 1970, p.82). The replacement of one paradigm over another or the emergence of an entirely new paradigm in a 'Gestalt switch' (p112 for an extended explanation) marks the moment of a paradigm shift or an entire change in worldview. Normal science is thus a 'pre-paradigm' period leading up to this shift or scientific revolution.

Building on Davis' (2016) earlier application of Kuhnian though to design education, we apply this notion of normal science in a sociological and macro-level sense to describe a broad-based orientation in a community of practice (Wenger, 2000). The emergence of a paradigm occurs through a process of what Bowker and Starr have described as the 'naturalization of categories and objects' (Bowker & Star, 1999, p. 294), a process that members of a particular community of practice themselves experience when they encounter such objects and classifications within their given field. During this process of gaining membership in a particular community, an 'illegitimate stranger', (someone new to the community who does not yet see the objects and categories as anything but ambiguous) actually becomes a 'source for learning', for membership becomes a collective 'process…of managing the tension between the ambiguous (outsider, naïve, strange) and the naturalized (at home, taken-for-granted) categories' (p.295). Like Kuhn, Bowker and Star describe these tensions between new ideas, classifications and members as 'anomalies' (ibid.). By looking at how communities of practice arrange, classify and organise their ideas we find that categories (definitions, concepts) and their boundaries are important to the evolution of a particular field.

Kuhn was interested in scientific labs, theory and breakthroughs which made little distinction between the laboratory scientist or theoretician in academia and the industry-embedded scientific practitioner. Unlike those in design, individuals who act as 'researchers' in the world of science concern themselves with fundamental principles and rationalities to progress a particular scientific field. In design thinking, there are at least two types of researchers: the design thinking researcher has a critical distance and interest in the efficacy and saliency of particular designerly ways of knowing and doing; or the embedded design researcher who is employed directly with a design thinking process to inform a particular professional design project in practice. Both are interested

in the 'situatedness' of design action (Simonsen et al., 2014) and few would argue with Nelson and Stolterman who see that the purpose of designing is to survive, improve, develop, grow, thrive, evolve, serve others, make something of lasting quality, create something of real consequence and 'participate in the never-ending genesis' (Nelson & Stolterman 2014, p. 13).

Inside the boundaries of Design Thinking

One of the primary reasons for the recent emergence of Design Thinking as an apparent panacea for the problems that contemporary businesses and societies face is the rhetorical influence of Brown's HBR article (Brown, 2008), the publication of Brown's book *Change by design* on design thinking for innovation and change (Brown, 2009) and the subsequent work of Brown's IDEO partner David Kelley at Stanford d.School with the Hasso Plattner Institute. All of this work is widely seen as crucial to the recent acceptance of design as a tool for driving business innovation. Brown and Kelley's astute public advocacy for design approaches to innovations in health, computing, education and in business more generally – manifest in the term 'Design Thinking' - has certainly served IDEO's business interests well across North America, Europe, and the Asia-Pacific regions. As many design practitioners and scholars have recognised, DT has been the Trojan horse that has led design into the corporate boardroom at the request of business executives across the globe (Ely, 2020; Hill, 2012; Wrigley, 2018).

Brown's articulation of a design thinker's "personality profile" (Brown, 2008, p.87) included the characteristics of *empathy, integrative thinking, optimism, experimentalism* and *collaboration*. Importantly, Brown stated that design thinkers are not "necessarily created only by design schools…many people outside of professional design have a natural aptitude for design thinking, which the right development and experiences can unlock" (ibid). The ubiquity of Brown's article and the idea of Design Thinking (at least his version) mark it as key moment in the evolution of design – at least amongst a particular group of practitioners and scholars. These include advocates for design for business Roger Martin (Brown & Martin, 2015; Martin, 2010), Jeanne Liedtka (Liedtka, 2014; Liedtka & Ogilvie, 2013) and, more recently, the engineering-oriented Stanford and Hasso Plattner Institute scholars Larry Leifer, Hasso Plattner and Christoph Meinel (Leifer & Meinel, 2016; Plattner et al., 2011, 2016b, 2016a). Within less than two years since the HBR article, Brown's variant of design thinking was recognised as having 'paradigmatic qualities' (Badke-Schaub et al., 2010).

Badke-Schaub, Roozenburg and Cardoso's paper at the *Design Thinking Research Symposium* in 2010 (Badke-Schaub et al, 2010) not only drew attention to what they saw as a problem in "the main dogma of the new thinking approach, which strongly focuses on the user whilst leaving the designer behind" (ibid, p.41) but the twenty-five years of research on design thinking which Brown not only seemed to ignore but the main principles he apparently tried to redefine (ibid, p.40). This argument between design scholars (who literally see themselves, in this case, as part of a scientific community) and practitioners in business and management continues to cast a shadow over the DT paradigm. However, if we trace the lineage of the concept of design thinking amongst design academic-practitioners, we can perhaps begin to understand Badke-Schaub et al's

frustration with Brown's articulation of design thinking, for such a rendering does indeed ignore the creative and systematic analysis of designerly ways of doing and knowing.

We can trace ancestors to the paradigm in John Christopher Jones' analysis of design cognition and process (Jones, 1970, 1979); Bruce Archer's work at the Royal College of Art in London (Archer, 1967) and the creation of the Design Studies journal (Archer, 1979, 1991); and Nigel Cross' corpus of work on design ability and designerly ways of knowing (Cross, 1990, 1999, 2001, 2006, 2018; Cross et al., 1994, 1996; Dorst & Cross, 2001). To this body of work, we must also acknowledge the contributions of Richard Buchanan (Buchanan, 1992, 2019), Ken Friedman (Friedman, 1997) and Kees Dorst (Dorst, 2015a, 2015b, 2018; Dorst & Cross, 2001; Paton & Dorst, 2011) who have expanded our understanding of design thinking across the design disciplines, bringing with it credibility within the *academe*. Beyond this acknowledgement, however, it is important to recognise that there is no simple lineage from a single point in history to contemporary forms of 'Design Thinking' (in all of its manifestations).

Dilnot has noted in his introduction to the more recent edition of John Christopher Jones' *designing designing* (Dilnot in (Jones, 2021) p. xxviii), an interest in the methods of design and the applicability of these methods to varying levels of function and use (from systems to environments to operations) emerged not only from Jones himself but also from Herbert Simon (1996) and Horst Rittel (1972, 1987). Other key figures in the establishment of a broader interest in design methodologies include Richard Buckminster Fuller (Meller, 1972), and Victor Papanek (Papanek, 1971) who would require retrospectives too lengthy for this chapter (cf. Cross (2001) for an analysis of Fuller's contribution to design science and Clarke (2016) for an overview of Papanek's contribution). To the canon, we must also acknowledge Donald Schön (1983; 1984), who – much like Tim Brown – has become an oft-cited resource for design thinking researchers (Beck & Chiapello, 2018).

Whilst Brown and his Californian counterparts might not claim exclusivity over the notion of 'design thinking', the popular perception of Design Thinking is nevertheless *Brownian* and this has precipitated reactions from scholars and practitioners alike. Woudhuysen (2011) cites the seminal figures in design practice and scholarship who deprecate the myth of Design Thinking and it's "nonsensical, erroneous thinking" (Norman 2010), it's over-simplistic focus on process not outcomes (McCullagh, 2010) and its attention to style and user-centredness at the expense of *radical* innovation through 'making sense of things' (Verganti, 2009, p. 27, cf. 2010). Woudhuysen himself describes Design Thinking as a craze which has detracted from vigorous research and development and offered only the legitimation of 'corporate and official bodies and de-legitimation of those stakeholders known as scientists and technologists' (Woudhuysen, 2011, p.248).

Other notable critics of Brownian Design Thinking include Bruce Nussbaum, Jon Kolko and Lee Vinsel who have denounced the reductionist, divisiveness and commercialist IDEO-Stanford model (Kolko, 2018; Nussbaum, 2011; Vinsel, 2017). Nussbaum's dismissal of DT was merely the platform on which to promote an idea of his own called 'creative intelligence' – "CQ" (Nussbaum, 2011). Vinsel's dissection of the 'lipstick on the pig' innovation method (Vinsel, 2017) and its permeation into the world of university education concludes

with a satirical analysis of the ultimate in commercialisation – Bill Burnett's derivation of Design Thinking, the Stanford *Designing Your Life* programme (Burnett & Evans, 2018).

What we see above is the contestation of [D]esign [T]hinking as a paradigm, both in its substance (definitions and models), its origins and its intentions. The emergence of Design Thinking from Brown et al has resulted in a rhetorical backlash from both design practitioners and scholars which has itself only served to draw further attention to the Californication of the paradigm (Hernández-Ramírez, 2018). Whilst the initial furore surrounding its coverage in populist and business media may have subsided, DT continues to spark interest amongst scholars outside of the design academy, including business and management (Elsbach & Stigliani, 2018; Glen et al., 2015; Wrigley et al., 2020), health (Petersen & Hempler, 2017), computer science (Chou, 2018; O'Callaghan & Connolly, 2020) and education (Burrell et al., 2015; e.g. Gachago et al., 2017; Mosely et al., 2018; Sándorová et al., 2020). It has also led to the paradigm being combined with other concepts such as lean and agile thinking (Lewrick et al., 2018; Roach, 2015) and into the world of military planning (Wrigley et al., 2021) extending the reach of design thinking into the world of accelerated technological development. Design Thinking has come to represent (for those at least outside of the design research traditions) *design* itself and – to continue our Kuhnian analysis - has achieved a form of hegemonic status (Preston, 2008, p. 95) as *the* go-to paradigm for all-things 'design'.

It is now over a decade since the Brownian form of design thinking emerged as a paradigm within the modern manager's lexicon, it is another thirty-five years since architect Peter Rowe published *Design Thinking* (Rowe, 1987) in the same period of Donald Schön's *reflective practitioner* work at nearby MIT; and over fifty-five years since Bruce Archer's articulation of systematic methods for designing (Archer, 1967). In 2017, Rowe was asked what he felt about other disciplines 'taking over this concept of design thinking', to which he replied 'So I think my take on Stanford and the B-schools is that a lot of it is a gimmick. They skirt the issue. *(Pause.)* The more important work is stuff that goes back to Herbert Simon and John Shaw…and Alan Newell, who was Simon's student…' (Rowe, 2017, pp. 78–81).

This conversation draws attention to the social membership of Design Thinking and the particular characteristics of those members: the early work of industrial designers and architects in the UK during the 1960's (the so-called *Design Methods* movement) which has continued through the work of the Design Thinking Research Symposium; the work of East Coast architects and urban planners in the mid-to-late 1980s; and the work of engineering and product designers in California in the late 1990s-early 2000s. Whilst the UK and East Coast schools of thought have been built on scholarly analyses of design-in-action, the Californian school was initially business-led. Only recently has the IDEO-Stanford d-school begun to legitimise its design thinking credentials through the scholarly work of the Hasso-Plattner Institute *Understanding Innovation* series published by Springer (Plattner et al., 2011, 2016b, 2016a).

As Kuhn mentioned in his Postscript to *SSR*, a 'paradigm governs, in the first instance, not a subject matter but rather a group of practitioners. Any study of paradigm-directed or of paradigm-shattering research must begin by locating the responsible group or groups' (p.180). The social dynamics between scholars and practitioners,

between researchers and the *researched* are shaped by (and shape) the paradigm we all recognise as a 'thing' called design thinking. Within this broad membership, each member places different value on the manifestations of their inquiries and their designs; for some, a peer-reviewed published scholarly analysis; for others an improvement in the development of a process or designed outcome; for others still, simply a designed outcome; often – though rarely recorded – a design failure. Researching *about* or *for* design thinking requires an acknowledgment of these disparate views on what forms of knowledge are valued by the community that share this paradigm, which in turn will inform decisions on particular units of analysis in empirical studies (e.g., project documentation, designed artefacts, conversations, sketches, citations, documentary footage, polemical texts, social networks).

Beyond the normal

It is a bromide to suggest that we cannot consider the field of design (and the methods we deploy) as being another version of the natural or social sciences. Indeed, there is strong argument to suggest that the logic and reasoning in design is distinctly different to that found in the natural sciences (Dorst, 2011; Findeli, 2010) but we can see the parallels between developments in science and those in design and design research, for design – more broadly - is a trans- and inter-disciplinary field (Gentes, 2017) that is in a constant state of indeterminacy and emergence (Held, 2016, p. 189). It is this very quality of emergence that draws many to the profession; the 'what if' of the abductive method that sets it apart from the sciences and the changes in society, technology and culture that bring about a concomitant birth of new design philosophies, researches, methods and practices.

There are, perhaps, faint signals of a challenge to the Design Thinking paradigm emerging – again – from both design practice and design research. Kuhn argued that not all scientific revolutions were necessarily major, believing that a 'certain sort of reconstruction of group commitments' may involve 'perhaps fewer than twenty-five people' (Kuhn, 1996, p.181). Such challenges to the dominant paradigm can also be brought about by other external factors (ibid) not directly related to the immediate community but to the ideas emergent from proximate communities who are also interested in the same problem spaces as a particular community (*quod est* design thinking), and who bring (or who are asked to bring with them) knowledge which can applied to a practical design project; this may be expected given that this inter-disciplinarity is intrinsic to design and design research (Scheurmann in Joost et al., 2016, p. 139).

Such challenges to the normative practices of design thinking are often driven by practitioners themselves, although this does not mean that the two communities of practitioner and academia are mutually exclusive. In the most direct example of this cross-community collaboration is GK VanPatter's *Rethinking Design Thinking* (2020) which is a 'reinvention' of design and design thinking methods in response to the increasing complexity of challenges faced by his 'sensemaking' and changemaking consultancy, Humantific. VanPatter has enrolled OCAD Associate Professor Peter Jones (co-founder of The Systemic Design Association) and Elizabeth Pastor (co-founder of Humantific) to develop Design/Design Thinking 4.0 in response to 'super fuzzy situations' related to communities, countries and the planet. One argument put forward - informed by a recourse to the scholarly literature (specifically (Buchanan, 2019)), a systematic review of design and innovation process models and an injection of Jones' systemic design expertise - is that 'Conventional Design Thinking' is largely

concerned with the 'assumptions of product, service, or experience design' (p.5) which does not meet the needs of contemporary, highly complex contexts.

Other, more explicit paradigmatic off-spring of societal and technological shifts have been most evident on the back of environmental degradation, racial tension, unprecedented data expansion and rising nationalist populism. Such shifts have precipitated episodic epistemological and ontological crises in design (Escobar, 2018; Fry, 2009; Fry & Nocek, 2021) and a contemporaneous emergence of design paradigms ready to confront such crises. 'Transition design' (Boehnert, 2018; Irwin, Kossoff, et al., 2015; Irwin, Tonkinwise, et al., 2015), 'social design' (Manzini, 2015; Resnick, 2019; Tonkinwise, 2015) and 'decolonizing design' (Schultz et al., 2018; Tlostanova, 2017) are but three design paradigms that are representative of a disciplinary matrix of design research and practice that provide theoretical, historical, practical and philosophical reorientation to confront the sheer complexity of human and planetary problems we face. There are many others, including: 'Humanity-centred design' (Interactive Design Foundation, 2021; Russell & Buck, 2020), 'DesignX' (Ma, 2017; D. A. Norman & Stappers, 2015) and 'Design for Policy' or Policy Design (Bason, 2016; Junginger, 2017; Kimbell, 2011, 2016, 2019; Selloni, 2017)

These exemplars of contemporary design paradigms emergent since the Brownian revolution are not alone in their recognition that design (and designers) require a whole new way of approaching complexity in social, technical and environmental systems. In 2021, two 'new' forms of design-led frameworks were put forward by the Royal Society of Arts and the Design Council respectively to deal with increasing social inequality and the climate emergency. The first, *The Living Change Approach* (Choukeir, 2021), is a regenerative design framework that acknowledges that complex, intractable social problems are best confronted beyond one disciplinary or organisation outlook, requiring us to *think like a system* and *act like an entrepreneur* (Conway et al., 2017). The approach 'draws on a diverse range of other established and emergent disciplines such as critical thinking, social research, systems thinking, entrepreneurship, and futures and foresight' (Choukier, 2021, p.13) and provides an operational, cultural and organisational design framework for both the RSA and its partners in health, public services and governance (RSA, 2021).

Another recent addition to the world of design is the *Systemic Design Framework* which has been synthesised from several interviews with educators, researchers and change-makers, and analyses of the tools, methods and frameworks used to drive projects working towards net zero (Hunter et al., 2021). Working with the Ellen MacArthur Foundation - and in acknowledgement of the *Circular Design Guide* produced by the Foundation and Tim Brown at IDEO (The Ellen MacArthur Foundation & IDEO, 2018) – the *Systemic Design Framework* is an evolution of the Design Council's well-known 'Double Diamond' framework (Design Council, 2019), the more recent 'Framework for Innovation' (Design Council, 2015) and work of the Systemic Design Association, Transition Design at Carnegie Mellon, the Design Justice Network, Arturo Escobar and others (see Drew, 2021). The resultant principles and characteristics of systemic designers aim to guide the design process on complex societal challenges.

Such approaches confront the fissures in dogmatic Design Thinking which can be articulated as: an inability to provide strategic or heuristic guidance when trying to overcome legislative, organisational and technological barriers to breakthrough innovation; the super-complexity of social, technical and environmental systems; or even a recognition of the social shaping and politics of power in the success or failure of design initiatives. On closer inspection, however, it seems obvious that each framework or philosophy towards a new and improved design thinking are unreconcilable in their implementation, for they do not share the same language (linguistically or conceptually) nor entirely the same worldview - a feature of pre-paradigmatic communities (Kuhn in Lakatos & Musgrave, 1970, p. 277).

In our instance, the classificatory schema on which design process models rely is by no means shared across these design communities, making them incommensurable in Kuhnian terms (Sharrock & Read, 2002, p.181). This incommensurability is evident in pre- and post-revolutionary periods when new paradigms emerge (Kuhn, p.148). Given that emergent models for framing design projects are unreconcilable both with each other and with the Brownian Design Thinking, we could argue that we are living in a period of post-Design Thinking and pre- 'yet to be determined' new design paradigm. How might we understand such a paradigm?

Researching the New Incommensurable

One of the criticisms of design and design research is the apparent schism between real-world practice and academic scholarship. Indeed, as we have explored, in design thinking this has been manifest in the apparent criticisms aimed at the managerial, IDEO-inspired design thinking for its lack of scholarly credibility and its ignorance of (for example) the 1960s design methods movement. These binary oppositions belie the enriching interactions between design practice and design scholarship and the nuances of, for example, practice-based design research and professional criticism. Design – and design thinking – is not unusual in its intimate relation to practice, for we see similar interactions in medicine, management and pedagogy. What is at stake are fundamental questions of rigour and relevance (Bredies in Joost et al., 2016, p. 12): to what degree does the practice of design thinking demonstrate acceptability and qualification to an academic audience? What is the relevance of the subject matter of design thinking research to both practice and theory?

One path to acceptability is by remaining concerned with the scholarly pragmatics of design and designerly thinking (Dixon, 2020). The new incommensurable ideas provide a way to conduct research-informed practice, each offering new ontologies for everyday design research where the focus is on taking practical action. Even when these ideas – such as decolonizing design – appear at social or cultural odds with the situation a designer or design researcher finds themselves in, they nevertheless provide philosophical, ethical and practical guidance to enable (in this instance) more respectful and inclusive design (Abdulla et al., 2019; Akama, 2017; Akama & Yee, 2019; Hao, 2019; Holmes, 2018).

A path to relevance can be found by a Kuhnian-esqe interest in still under-explored questions around the evolution of design theory and practice through paradigms. Whilst design historians in particular have not struggled to identify the styles, tastes and movements of design since the beginning of human civilisation

(Heskett, 2005; Heskett et al., 2016; Margolin, 2005, 2016) there remains not only the writing of new decolonized histories of design, but also an under-explored territory of how particular design paradigms take hold in our respective design communities. Part of this is sociological but it is also methodological and philosophical. To borrow Kuhn, what is the process of socialization within design? How do certain design groups come to collectively develop their goals? What deviations – both individually and collectively – are tolerated?

There remain still – despite the best efforts of the likes of Cross (2019), Love (2002) and Friedman (2003, 2016, 2017) – epistemological, ontological and representational questions left unanswered. For example, in seeing how design paradigms like Design Thinking have emerged, we are still dominated by a patriarchal canon, usually white and heteronormative (Mareis & Paim, 2021, pp. 11–12) and as a result design fails to "acknowledge the complex interplay of mutually reinforcing social determinants and conditions, the dynamics of power and privilege that shape its role in everyday life" (ibid, p.13). The field of Science and Technology Studies (STS) experienced a welcomed feminist turn at the beginning of the twenty-first century (see MacKenzie & Wajcman, 1999 for an overview), identifying men's "monopoly of technology as an important source of their power" (Wajcman, 2004, p. 12). The positive consequences of this critical intervention have been evidenced in the ontological shift amongst technology developers in the field of human-computer interaction studies (Bardzell & Bardzell, 2011) who now place greater emphasis on understanding the needs of non-male, non-users (Wyatt, 2003, 2005) and who are now cognisant of the intersectional marginal communities that they must serve (see Rosner et al., 2021 Interactions issue on Disability and intersectionality). New feminist-inspired (non-binary) perspectives on design thinking, particularly in business design where heterosexual white males still dominate, are to be encouraged and welcomed. So too, non-Western voices and non-design disciplines which are likely to provide the contemporary design thinking researcher with fresh perspectives (Escobar, 2018; Mareis & Paim, 2021; Marenko, 2021); we are yet to experience a critical ontological turn in design thinking - an *alt-design thinking* if you will – on a par with that found in broader design studies, design history and design theory. Design thinking has been left standing.

Whilst we remain in a state of great expansion in the field of design it becomes increasingly harder to make sense of the paradigms that we align ourselves with. The cacophony of plural voices even within design makes it hard to distinguish one useful paradigm from another. Is regenerative design, discursive design, inter-species design, design activism or autonomous design going to become the new Design Thinking? What comes after Design Thinking will be as a result of the agency of designers, design researchers and the invisible forces of dark matter (Hill, 2012) – of social, cultural, technological, environmental and extra-terrestrial forces that even with the most intelligent computing devices will not be able to predict. It is, however, the task of the design researcher to give account of the metaphysical, sociological and conceptual becoming of nascent paradigms in design, tracing the ideas, people, places and artefacts (toolkits, designed outcomes) as a network of agents (Latour, 2005) in the transdisciplinary matrix of design. By doing so, we uncover the biases, power-relations, inequities and anomalies present in design communities, distinguishing between the rhetorical and the insightful; the vacuous and the meaningful; between the philosophic and the pragmatic. Kuhnian analyses are

interested in *how* design paradigms – and in our case Design Thinking – come into being, not just *what* constitute them. Rather than passively await the new incommensurable with eager, designerly (functionary) anticipation, design research can listen out to the faint signals transmitting across the design pluriverse. What lies beyond?

References

Abdulla, D., Ansari, A., Canli, E., Keshavarz, M., Kiem, M., Oliveira, P., Prado, L., & Schultz, T. (2019). A Manifesto for Decolonising Design. *Journal of Futures Studies*, *23*(3), 129–132. https://doi.org/10.6531/JFS.201903

Akama, Y. (2017). *Kokoro* of Design: Embracing Heterogeneity in Design Research. *Design and Culture*, *9*(1), 79–85. https://doi.org/10.1080/17547075.2017.1280266

Akama, Y., & Yee, J. (2019). Special Issue: Embracing Plurality in Designing Social Innovation Practices. *Design and Culture*, *1*(0), 1–11. https://doi.org/10.1080/17547075.2019.1571303

Archer, B. (1967). Design Management. *Management Decision*, *1*(4), 47–51. https://doi.org/https://doi.org/10.1108/eb000820

Archer, B. (1979). Design as a discipline. *Design Studies*, *1*(1), 17–20. https://doi.org/10.1016/0142-694X(79)90023-1

Archer, B. (1991). Design theory '88. *Design Studies*, *12*(1), 63–64. https://doi.org/10.1016/0142-694x(91)90016-p

Badke-Schaub, P., Roozenburg, N., & Cardoso, C. (2010). Design thinking: a paradigm on its way from dilution to meaninglessness. *The 8th Design Thinking Research Symposium*, 39–49. http://dab.uts.edu.au/research/conferences/dtrs8/docs/DTRS8-Badke-Schaub-et-al.pdf

Ball, L. J., & Christensen, B. T. (2018). Designing in the wild. *Design Studies*, *57*(1995), 1–8. https://doi.org/10.1016/j.destud.2018.05.001

Bardzell, S., & Bardzell, J. (2011). Towards a feminist HCI methodology: Social science, feminism, and HCI. *Conference on Human Factors in Computing Systems - Proceedings*, 675–684. https://doi.org/10.1145/1978942.1979041

Bason, C. (2016). *Design for Policy*. Abingdon, Oxon, England : Routledge.

Beck, J., & Chiapello, L. (2018). Schön's intellectual legacy: A citation analysis of DRS publications (2010–2016). *Design Studies*, *56*, 205–224. https://doi.org/10.1016/j.destud.2017.10.005

Black, A., Luna, P., Lund, O., & Walker, S. (Eds.). (2017). *Information design research and practice*. Routledge.

Boehnert, J. (2018). Anthropocene Economics and Design: Heterodox Economics for Design Transitions. *She Ji*, *4*(4), 355–374. https://doi.org/10.1016/j.sheji.2018.10.002

Bowker, G. C., & Star, S. L. (1999). *Sorting things out : classification and its consequences*. MIT Press.

Brown, T. (2008). Design Thinking. *Harvard Business Review*, *86*(June), 85–92.

Brown, T. (2009). *Change by design : how design thinking transforms organizations and inspires innovation* (1st ed..). HarperCollins Publishers.

Brown, T., & Martin, R. (2015). Design for Action. *Harvard Business Review*, *September*, 3–10.

Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, *8*(2), 5–21. http://www.jstor.org/stable/1511637

Buchanan, R. (2019). Surroundings and environments in fourth order design. *Design Issues*, *35*(1), 4–22. https://doi.org/10.1162/desi_a_00517

Burnett, W., & Evans, D. (2018). *Designing your life : build the perfect career, step by step*. Vintage.

Burrell, A. R., Cavanagh, M., Young, S., & Carter, H. (2015). Team-based curriculum design as an agent of change. *Teaching in Higher Education*, *20*(8), 753–766. https://doi.org/10.1080/13562517.2015.1085856

Certeau, M. de. (1984). *The practice of everyday life*. University of California Press.

Chou, D. C. (2018). Applying design thinking method to social entrepreneurship project. *Computer Standards and Interfaces*, *55*(May), 1339–1351. https://doi.org/10.1016/j.csi.2017.05.001

Choukeir, J. (2021). The Living Change Approach. *The RSA Journal*, *1*.

Clarke, A. J. (2016). Design for the Real World: Victor Papanek and the emergence of humane design. In P. Sparke & F. Fisher (Eds.), *The Routledge Companion to Design Studies* (1st ed., pp. 373–382). Routledge.

Conway, R., Masters, J., & Thorold, J. (2017). *From Design Thinking to Systems Change* (Issue July).

Council, D. (2019). *Double Diamond 2019*.

Cross, N. (1990). The nature and nurture of design ability. *Design Studies*, *11*(3), 127–140.

Cross, N. (1999). Design Research : A Disciplined Conversation. *Design Issues*, *15*(2), 5–10. https://www.jstor.org/stable/1511837

Cross, N. (2001). Designerly Ways of Knowing: Design Discipline Versus Design Science. *Design Issues*, *17*(3), 49–55. https://doi.org/10.1162/074793601750357196

Cross, N. (2006). Designerly Ways of Knowing. In *Designerly Ways of Knowing*. Springer-Verlag. https://doi.org/10.1017/CBO9781107415324.004

Cross, N. (2018). A brief history of the Design Thinking Research Symposium series. *Design Studies*, *57*, 160–164. https://doi.org/10.1016/j.destud.2018.03.007

Cross, N. (2019). Editing Design Studies - and how to improve the likelihood of your paper being published. *Design Studies*, *63*, 1–9. https://doi.org/10.1016/j.destud.2019.06.001

Cross, N., Christiaans, H., & Dorst, K. (1994). Design Expertise Amongst Student Designers. *Journal of Art & Design Education*, *13*(1), 39–56. https://doi.org/10.1111/j.1476-8070.1994.tb00356.x

Cross, N., Christiaans, H., & Dorst, K. (1996). *Analysing design activity*. Wiley.

Davis, M. (2016). “Normal science” and the changing practices of design and design education. *Visible Language*, *50*(1).

Design Council. (2015). *What is the framework for innovation? Design Council’s evolved Double Diamond*. https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond

Dixon, B. S. (2020). *Dewey and Design: A Pragmatist Perspective for Design Research*. Springer International Publishing AG.

Dorst, K. (2011). The core of “design thinking” and its application. *Design Studies*, *32*(6), 521–532. https://doi.org/10.1016/j.destud.2011.07.006

Dorst, K. (2015a). Frame Creation and Design in the Expanded Field. *She Ji: The Journal of Design, Economics, and Innovation*, *1*(1), 22–33. https://doi.org/10.1016/j.sheji.2015.07.003

Dorst, K. (2015b). Frame innovation. In *Frame Innovation: Create New Thinking by Design*. MIT Press. https://doi.org/10.1525/9780520959316-019

Dorst, K. (2018). DTRS: A catalyst for research in design thinking. *Design Studies*, *57*, 156–159. https://doi.org/10.1016/j.destud.2018.03.005

Dorst, K., & Cross, N. (2001). Creativity in the design process: co-evolution of problem–solution. *Design Studies*, *22*, 425–437. www.elsevier.com/locate/destud

Drew, C. (2021). *Developing our new Systemic Design Framework*. Medium. https://medium.com/design-council/developing-our-new-systemic-design-framework-e0f74fe118f7

Dym, C. L., Agogino, A. M., Eris, O., Frey, D. D., & Leifer, L. J. (2005). Engineering design thinking, teaching, and learning. *IEEE Engineering Management Review*, *34*(1), 65–90. https://doi.org/10.1109/emr.2006.1679078

Elsbach, K. D., & Stigliani, I. (2018). Design Thinking and Organizational Culture: A Review and Framework for Future Research. *Journal of Management*, *44*(6), 2274–2306. https://doi.org/10.1177/0149206317744252

Ely, P. (2020). Designing Futures for an Age of Differentialism. *Design and Culture*, *10*(3), 1–24. https://doi.org/10.1080/17547075.2020.1810907

Escobar, A. (2018). *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds*. Duke University Press.

Findeli, A. (2010). Searching For Design Research Questions: Some Conceptual Clarifications. In R. Chow, W. Jonas, & G. Joost (Eds.), *Questions,Hypotheses & Conjectures: Discussions on Projects by Early Stage and Senior Design Researchers* (p. 316). iUniverse.

Frayling, C. (1994). Research in Art and Design (Royal College of Art Research Papers, Vol 1, No 1, 1993/4). In *Royal College of Art Research Papers* (Vol. 1, Issue 1, p. 9). http://researchonline.rca.ac.uk/384/

Friedman, K. (1997). Design science and design education. *The Challenge of Complexity Based on the Proceedings from the 3rd International Conference on Design Management at the University of Art and Design Helsinki UIAH*, 54–72.

Friedman, K. (2003). Theory construction in design research: criteria: approaches, and methods. *Design Studies*, *24*(6), 507–522. https://doi.org/10.1016/S0142-694X(03)00039-5

Friedman, K. (2016). New Challenges for Design. *She Ji: The Journal of Design, Economics, and Innovation*, *2*(4), 271–274. https://doi.org/10.1016/j.sheji.2017.07.001

Friedman, K. (2017). Conversation, Discourse, and Knowledge. *She Ji*, *3*(2), 75–82. https://doi.org/10.1016/j.sheji.2017.10.001

Fry, T. (2009). *Design Futuring: Sustainability, Ethics and New Practice* (Australian). Berg Publishers Ltd.

Fry, T., & Nocek, A. (Eds.). (2021). *Design In Crisis: New Worlds, Philosophies and Practices*. Routledge.

Gachago, D., Morkel, J., Hitge, L., van Zyl, I., & Ivala, E. (2017). Developing eLearning champions: a design thinking approach. *International Journal of Educational Technology in Higher Education*, *14*(1). https://doi.org/10.1186/s41239-017-0068-8

Gentes, A. (2017). *The In-Discipline of Design*. Springer International Publishing AG.

Glen, R., Suciu, C., Baughn, C. C., & Anson, R. (2015). Teaching design thinking in business schools. *International Journal of Management Education*, *13*(2). https://doi.org/10.1016/j.ijme.2015.05.001

G.Nelson, H., & Stolterman, E. (2014). *The Design Way: Intentional Change in an Unpredicatable World* (Second Edi). MIT Press. https://www.ebsco.com/terms-of-use

Goldschmidt, G. (2016). Linkographic evidence for concurrent divergent and convergent thinking in creative design. *Creativity Research Journal*, *28*(2), 115–122. https://doi.org/10.1080/10400419.2016.1162497

Goldschmidt, G. (2017). Design Thinking: A Method or a Gateway into Design Cognition? *She Ji*, *3*(2), 107–112. https://doi.org/10.1016/j.sheji.2017.10.009

Hao, C. (2019). *Cultura: Achieving intercultural empathy through contextual user research in design*. https://doi.org/10.4233/uuid:88322666-9cf1-4120-bbd6-4a93438bca74

Held, M. (2016). Transdisciplinary research through design - Shifting paradigms as an opportunity. In *Design as Research: Positions, Arguments, Perspectives* (pp. 186–192). Birkhauser Verlag AG.

Hernández-Ramírez, R. (2018). On Design Thinking, Bullshit, and Innovation. *Journal of Science and Technology of the Arts*, *10*(3), 2. https://doi.org/10.7559/citarj.v10i3.555

Heskett, J. (2005). *Design : a very short introduction*. Oxford : Oxford University Press.

Heskett, J., Dilnot, C., & Heskett, P. (2016). *A John Heskett Reader: Design, History, Economics* (1st ed.). London: Bloomsbury Publishing Plc. https://doi.org/10.5040/9781474221290

Hill, D. (2012). *Dark Matter and Trojan Horses*. Strelka Press.

Holmes, K. (2018). *Mismatch: How Inclusion Shapes Design*. The MIT Press.

Hunter, N., Drew, C., Johnson, J., Chadha, S., Carlise, C., & Burnett, A. (2021). *Beyond Net Zero: A Systemic Design Approach*. https://www.designcouncil.org.uk/resources/guide/beyond-net-zero-systemic-design-approach

Interactive Design Foundation. (2021). *Humanity-Centred Design*. Http://Www.Interaction-Design.Org. https://www.interaction-design.org/literature/topics/humanity-centered-design

Irwin, T., Kossoff, G., & Tonkinwise, C. (2015). Transition Design Provocation. *Design Philosophy Papers*, *13*(1), 3–11. https://doi.org/10.1080/14487136.2015.1085688

Irwin, T., Tonkinwise, C., & Kossoff, G. (2015). Transition Design: An Educational Framework for Advancing the Study and Design of Sustainable Transitions. *International Sustainability Transitions (IST) Conference, University of Sussex*, 1–36.

Johansson-Sköldberg, U., Woodilla, J., & Çetinkaya, M. (2013). Design thinking: Past, present and possible futures. *Creativity and Innovation Management*, *22*(2), 121–146. https://doi.org/10.1111/caim.12023

Jones, J. C. (1970). *Design Methods: seeds of human futures* (1st ed.). John Wiley & Sons.

Jones, J. C. (1979). Designing designing. *Design Studies*, *1*(1), 31–35. https://doi.org/10.1016/0142-694X(79)90026-7

Jones, J. C. (2021). *designing designing* (2nd Editio). Bloomsbury Visual Arts.

Joost, G., Bredies, K., Christensen, M., Conradi, F., & Unteidig, A. (2016). *Design as Research: Positions, Arguments, Perspectives*. http://ebookcentral.proquest.com/lib/curtin/detail.action?docID=4533877.

Junginger, S. (2017). Design Research and Practice for the Public Good: A Reflection. *She Ji*, *3*(4), 290–302. https://doi.org/10.1016/j.sheji.2018.02.005

Kim, H. H. (2017). Structural Process of Design | Consilience and Concrescence Art is the imposing of a pattern on experience , and our aesthetic enjoyment is recognition of the

pattern . In *Graphic Design Discourse : Evolving Theories, Ideologies, and Processes of Visual Communication* (pp. 322–324). Princeton University Press.
Kimbell, L. (2011). Designing for service as one way of designing services. *International Journal of Design*, *5*(2), 41–52. https://doi.org/10.1016/s0142-694x(01)00009-6
Kimbell, L. (2016). Design in the Time of Policy Problems. *DRS2016: Future-Focused Thinking*, *9*, 1–14. https://doi.org/10.21606/drs.2016.498
Kimbell, L. (2019). Designing Policy Objects: Anti-Heroic Design. In T. Fisher & L. Gamman (Eds.), *Tricky Design: The Ethics of Things* (pp. 145–158). Bloomsbury Visual Arts. https://doi.org/10.5040/9781474277211.ch-010
Kindi, V. (2012). Kuhn's Paradigms. In V. Kindi & T. Arabatzis (Eds.), *Kuhn's the Structure of Scientific Revolutions Revisited* (pp. 91–111). Taylor & Francis.
Kolko, J. (2018). The Divisiveness of Design Thinking. *Interactions*, *XXV*(3), 29–34.
Kuhn, T. S. (1970). *The Structure of Scientific Revolutions* (Second edi). Chicago University Press.
Kuhn, T. S. (1974). Second Thoughts on Paradigms. In *The Essential Tension: Selected Studies in Scientific Tradition and Change* (pp. 293–319). University of Chicago Press.
Lakatos, I., & Musgrave, A. (1970). *Criticism and the Growth of Knowledge: Proceedings of the International Colloquium in the Philosophy of Science, London, 1965, volume 4*. Cambridge University Press.
Latour, B. (2005). *Reassembling the social : an introduction to actor-network-theory*. Oxford University Press.
Laursen, L. N., & Haase, L. M. (2019). The Shortcomings of Design Thinking when Compared to Designerly Thinking. *Design Journal*, *22*(6), 813–832. https://doi.org/10.1080/14606925.2019.1652531
Laursen, L. N., & Tollestrup, C. (2017). Design Thinking - a Paradigm. *ICED 2017 Conference Proceedings*, *2*(August), 229–238.
Lee, K. (2021). Critique of Design Thinking in Organizations : Strongholds and Shortcomings of the Making Paradigm. *She Ji: The Journal of Design, Economics, and Innovation*, *7*(4), 497–515. https://doi.org/10.1016/j.sheji.2021.10.003
Lees-Maffei, G., & Houze, R. (Eds.). (2010). *The Design History Reader* (English ed, Vol. 25, Issue 4). Bloomsbury Visual Arts.
Leifer, L., & Meinel, C. (2016). Design Thinking for the Twenty-First Century Organization. In *Design Thinking Research: Making Design Thinking Foundational* (pp. 1–12). https://doi.org/10.1007/978-3-319-40382-3
Lewrick, M., Link, P., & Leifer, L. (2018). *The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems*. John Wiley & Sons, Inc.
Liedtka, J. (2014). Innovative ways companies are using design thinking. *Strategy and Leadership*, *42*(2), 40–45. https://doi.org/10.1108/SL-01-2014-0004
Liedtka, J., & Ogilvie, T. (2013). Designing for Growth: A Tool Kit for Managers. *Rotman on Design: The Best on Design Thinking from Rotman Magazine*, 257–261.
Love, T. (2002). Constructing a coherent cross-disciplinary body of theory about designing and designs: Some philosophical issues. *Design Studies*, *23*(3), 345–361. https://doi.org/10.1016/S0142-694X(01)00043-6
Ma, J. (2017). What is a System?: A Lesson Learned from the Emerging Practice of DesignX. *Cross-Cultural Design*, *LNCS*(10281), 59–75. https://doi.org/10.1007/978-3-319-57931-3_6

MacKenzie, D., & Wajcman, J. (1999). *The Social Shaping of Technology: How the refrigerator got its hum (2nd Edition)* (2nd ed.). Open University Press.
Manzini, E. (2015). *Design, When Everybody Designs: An Introduction to Design for Social Innovation*. The MIT Press.
Mareis, C., & Paim, N. (Eds.). (2021). *Design Struggles: Intersecting Histories. Pedagogies, and Perspectives*. Valiz.
Marenko, B. (2021). Stacking Complexities: Reframing Uncertainty through Hybrid Literacies. *Design and Culture*, *13*(2), 165–184. https://doi.org/10.1080/17547075.2021.1916856
Margolin, V. (2005). A world history of design and the history of the world. *Journal of Design History*, *18*(3), 235–243. https://doi.org/10.1093/jdh/epi043
Margolin, V. (2016). A world history of design. In *The Routledge Companion to Design Studies* (pp. 435–444). https://doi.org/10.4324/9781315562087-49
Martin, R. (2010). Design thinking: achieving insights via the "knowledge funnel." *Strategy & Leadership*, *38*(2), 37–41. https://doi.org/10.1108/10878571011029046
Masterman, M. (1970). The Nature of a Paradigm. In *Criticism and the Growth of Knowledge* (pp. 59–88). Cambridge University Press.
McCullagh, K. (2010). Stepping Up: Design Thinking Has Uncovered Real Opportunities. *Design Management Review*, *21*(3), 36–39. https://doi.org/10.1111/j.1948-7169.2010.00076.x
Meagher, R. (1988). Technê. *Perspecta*, *24*, 158–164. https://www.jstor.org/stable/1567132
Meller, J. (Ed.). (1972). *The Buckminster Fuller Reader*. Pelican Books.
Micheli, P., Wilner, S. J. S., Bhatti, S. H., Mura, M., & Beverland, M. B. (2019). Doing Design Thinking: Conceptual Review, Synthesis, and Research Agenda. *Journal of Product Innovation Management*, *36*(2), 124–148. https://doi.org/10.1111/jpim.12466
Midal, A. author. (2019). *Design by Accident: For a New History of Design*. Sternberg Press.
Mosely, G., Wright, N., & Wrigley, C. (2018). Facilitating design thinking: A comparison of design expertise. *Thinking Skills and Creativity*, *27*(August 2017), 177–189. https://doi.org/10.1016/j.tsc.2018.02.004
Norman, D. (2010). *Design Thinking: A Useful Myth*. Core77. http://www.core77.com/blog/columns/design_thinking_a_useful_myth_16790.asp
Norman, D. A., & Stappers, P. J. (2015). DesignX: Complex Sociotechnical Systems. *She Ji*, *1*(2), 83–106. https://doi.org/10.1016/j.sheji.2016.01.002
Nussbaum, B. (2011). *A Failed Experiment. So What's Next?* CoDesign; Fast Company & Inc. https://www.fastcompany.com/1663558/design-thinking-is-a-failed-experiment-so-whats-next
O'Callaghan, G., & Connolly, C. (2020). Developing creativity in computer science initial teacher education through design thinking. *ACM International Conference Proceeding Series*, 45–50. https://doi.org/10.1145/3416465.3416469
Papanek, V. J. (1971). *Design for the real world: human ecology and social change*. Thames & Hudson.
Paton, B., & Dorst, K. (2011). Briefing and reframing: A situated practice. *Design Studies*, *32*(6), 573–587. https://doi.org/10.1016/j.destud.2011.07.002
Petersen, M., & Hempler, N. F. (2017). Development and testing of a mobile application to support diabetes self-management for people with newly diagnosed type 2 diabetes: A design thinking case study. *BMC Medical Informatics and Decision Making*, *17*(1), 1–10. https://doi.org/10.1186/s12911-017-0493-6

Petroski, H. (2012). Galileo and the Marble Column. In *Design Paradigms* (pp. 47–63). https://doi.org/10.1017/cbo9780511805073.005

Plattner, H., Meinel, C., & Leifer, L. (2011). *Design Thinking: Understand - Improve - Apply* (H. Plattner, C. Meinel, & L. Leifer, Eds.). Springer-Verlag. https://doi.org/10.1007/978-3-642-13757-0

Plattner, H., Meinel, C., & Leifer, L. (2016a). *Design Thinking Research: Making Design Thinking Foundational*. Springer International Switzerland. https://doi.org/10.1007/978-3-319-19641-1

Plattner, H., Meinel, C., & Leifer, L. (2016b). *Design Thinking Research: Taking Breakthrough Innovation Home*. Springer International Switzerland. https://doi.org/10.1007/978-3-319-40382-3

Poggenpohl, S. H. (2009). Time For Change: Building A Design Discipline. In S. Poggenpohl & K. Sato (Eds.), *Design Intergrations: Research and Collaboration* (pp. 3–22). Intellect Books.

Preston, J. (2008). *Kuhn's The Structure of Scientific Revolutioons: A Reader's Guide*. Readers's Guides/Bloomsbury.

Razzouk, R., & Shute, V. (2012). What Is Design Thinking and Why Is It Important? *Review of Educational Research*, *82*(3), 330–348. https://doi.org/10.3102/0034654312457429

Resnick, E. (Ed.). (2019). *The Social Design Reader*. Bloomsbury Visual Arts.

Rittel, H. (1972). Structure and Usefulness of Planning Information Systems. *Bedrifts Økonomen*, *8*, 53–63. https://doi.org/10.1007/978-94-009-7651-1_5

Rittel, H. (1987). The Reasoning of Designers. *International Congress on Planning and Design Theory*, *August 1987*, 1–9. https://doi.org/10.4324/9780203851586

Roach, T. (2015). *How to combine Design Thinking and Agile in practice*. Startup Frontier on Medium.Com.

Rosner, D., Taylor, A., Wiberg, M., & Windle, A. (2021). Interactions: May 2021. *Interactions*, *28*(3), 5–5. https://doi.org/10.1145/3460778

Rowe, P. G. (1987). *Design Thinking*. MIT Press.

Rowe, P. G. (2017). *Design Thinking in the Digital Age*. Harvard University Graduate School of Design & Sternberg Press.

RSA. (2021). *Future Change Framework*. RSA. https://www.thersa.org/globalassets/living-change/rsa-future-change-toolkit.pdf

Russell, P., & Buck, L. (2020). Humanity-centred design-defining the emerging paradigm in design education and practice. *Proceedings of the 22nd International Conference on Engineering and Product Design Education, E and PDE 2020*, *September*. https://doi.org/10.35199/epde.2020.32

Sándorová, Z., Repáňová, T., Palenčíková, Z., & Beták, N. (2020). Design thinking - A revolutionary new approach in tourism education? *Journal of Hospitality, Leisure, Sport & Tourism Education*, *26*, 100238. https://doi.org/https://doi.org/10.1016/j.jhlste.2019.100238

Schöen, D. A. (1983). *The Reflective Practitioner*. Basic Books.

Schön, D. A. (1984). Problems, frames and perspectives on designing. *Design Studies*, *5*(3), 132–136. https://doi.org/10.1016/0142-694X(84)90002-4

Schultz, T., Abdulla, D., Ansari, A., Canlı, E., Keshavarz, M., Kiem, M., Martins, L. P. de O., & J.S. Vieira de Oliveira, P. (2018). What Is at Stake with Decolonizing Design? A Roundtable. *Design and Culture*, *10*(1), 81–101. https://doi.org/10.1080/17547075.2018.1434368

Selloni, D. (2017). *CoDesign for Public-Interest Services*.
Simon, H. A. (1996). *The Sciences of the Artificial (Third Edition)* (Third). The MIT Press.
Simonsen, J., Svabo, C., Strandvad, S. M., Samson, K., Hertzum, M., & Ole Erik Hansen. (2014). Situated Methods in Design. In J. Simonsen, C. Svabo, S. M. Strandvad, K. Samson, M. Hertzum, & Ole Erik Hansen (Eds.), *Situated Design Methods*. MIT Press.
Teal, T., & Atzmon, L. (Eds.). (2019). *The Graphic Design Reader*. Bloomsbury Visual Arts.
The Ellen MacArthur Foundation, & IDEO. (2018). *Circular Design Guide*. https://www.circulardesignguide.com/
Tlostanova, M. (2017). On decolonizing design. *Design Philosophy Papers*, *15*(1), 51–61. https://doi.org/10.1080/14487136.2017.1301017
Tonkinwise, C. (2015). Is Social Design a Thing? In E. Resnick (Ed.), *The Social Design Reader* (pp. 9–16). Bloomsbury Visual Arts.
VanPatter, G., Pastor, E., & Jones, P. (2020). *Rethinking Design Thinking: Making Sense of the Future That Has Already Arrived*. Humantific Publishing.
Verganti, R. (2009). *Design-Driven Innovation: Changing the Rules of Competition by Radically Innovating What Things Mean*. Harvard Business School Publication Corp.
Verganti, R. (2010). *One Size Does Not Fit All in Innovation (and Never Will)*. Harvard Business Review Blog. https://hbr.org/2010/04/one-size-does-not-fit-all-in-i
Vinsel, L. (2017). *Design Thinking is Kind of Like Syphilis — It's Contagious and Rots Your Brains*. https://medium.com/@sts_news/design-thinking-is-kind-of-like-syphilis-its-contagious-and-rots-your-brains-842ed078af29
Wajcman, J. (2004). *TechnoFeminism*. Polity Press ;
Wake, W. K. author. (2000). *Design paradigms: a sourcebook for creative visualization*. Wiley.
Wenger, E. (2000). Communities of Practice and Social Learning Systems. *Organization*, *7*(2), 225–246. https://doi.org/10.1177/135050840072002
Woudhuysen, J. (2011). The Craze for Design Thinking: Roots, A Critique, and toward an Alternative. *Design Principles & Practice: An International Journal*, *5*(6).
Wrigley, C. (2018). Editorial: Deception by design. *Journal of Design, Business & Society*, *4*(1), 3–5.
Wrigley, C., Mosely, G., & Mosely, M. (2021). Defining Military Design Thinking: An Extensive, Critical Literature Review. In *She Ji* (Vol. 7, Issue 1). Elsevier. https://doi.org/10.1016/j.sheji.2020.12.002
Wrigley, C., Nusem, E., & Straker, K. (2020). Implementing Design Thinking: Understanding Organizational Conditions. *California Management Review*, *62*(2), 125–143. https://doi.org/10.1177/0008125619897606
Wyatt, S. (2003). *Non-Users Also Matter: The Construction of Users and Non-Users of the Internet* (N. Oudshoorn & T. J. Pinch, Eds.; pp. 67–79). MIT Press.
Wyatt, S. (2005). The digital divide, health information and everyday life. *New Media & Society*, *7*(2), 199–218. https://doi.org/10.1177/1461444805050747