Worth-Focused Design, Book 1
Balance, Integration, and Generosity

Gilbert Cockton, University of Sunderland

Design now has many meanings. For some, it is the creation of value. For others, it is the conception and creation of artefacts. For still others it is fitting things to people. These differences reflect disciplinary values that both overlap and diverge. All involve artefacts: we always design things. Each definition considers people and purpose in some way. Each handles evaluation differently, measuring against aesthetics, craft standards, specifications, sales, usage experiences, or usage outcomes. There are both merits and risks in these differences, without an appropriate balance. Poor balance can result from professions claiming the centre of design for their discipline, marginalising others. Process can also cause imbalance when allocating resources to scheduled stages. Balance is promoted by replacing power centres with power sharing, and divisive processes with integrative progressions. A focus on worth guides design towards worthwhile experiences and outcomes that generously exceed expectations.

This book places a worth focus (Wo-Fo) in the context of design progressions that are Balanced, Integrated, and Generous (BIG). BIG and Wo-Fo are symbiotic. Worth provides a focus for generosity. Effective Wo-Fo needs BIG practices.

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Worth-Focused Design, Book 1
Balance, Integration, and Generosity
Synthesis Lectures on Human-Centered Informatics

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ABSTRACT
This book will develop an appropriate common language for truly interdisciplinary teams involved in design. Design now has many meanings. For some, it is the creation of value. For others, it is the conception and creation of artefacts. For still others, it is fitting things to people. These differences reflect disciplinary values that both overlap and diverge. All involve artefacts: we always design things. Each definition considers people and purpose in some way. Each handles evaluation differently, measuring against aesthetics, craft standards, specifications, sales, usage experiences, or usage outcomes. There are both merits and risks in these differences, without an appropriate balance. Poor balance can result from professions claiming the centre of design for their discipline, marginalising others. Process can also cause imbalance when allocating resources to scheduled stages. Balance is promoted by replacing power centres with power sharing, and divisive processes with integrative progressions. A focus on worth guides design towards worthwhile experiences and outcomes that generously exceed expectations.

This book places worth focus (Wo-Fo) into the context of design progressions that are balanced, integrated, and generous (BIG). BIG and Wo-Fo are symbiotic. Worth provides a focus for generosity. Effective worth-focused design requires BIG practices. The companion book Worth-Focused Design, Book 2: Approaches, Contexts, and Case Studies (Cockton, 2020b) relates the concept of worth to experiences and outcomes based on a number of practical case studies.

KEYWORDS
design theory, design research, creative practice, design process, design management, critical creative design, design reflection, design planning
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Computers are now everywhere, supporting websites, in mobile devices, on desktops, and in public information systems, ticket sales kiosks, home appliances, in car-systems, and much more. Our digital age can feel radically different to previous ones, but continuities reach back decades, centuries, and even millenia. For example, the many professions involved in design and development of digital artefacts all predate computers in some way. Visual designers have been with us for millenia, engineers for several centuries, and modern professional (business) managers for around one century. Human factors (ergonomics) barely predate the invention of the stored program computer approximately seven decades ago. Professions bring value systems that shape both their attitudes towards design and also their expectations for design practice. These value-driven expectations begin with education and are refined and reinforced by the professional bodies that steadily superseded craft organisations during the Industrial Revolution.

Design is inherently axiological (Biedenbach and Jacobsson, 2016): value trumps fact. Disciplines that construct themselves as objectively value-neutral cause friction in multi-disciplinary settings, as they lack the critical reflective practices that expose and acknowledge unavoidable value orientations.

Broadly speaking, three major value systems mould software design, respectively prioritising desirability, capability, and rationality. The first had its roots in pre-industrial craft traditions, but broadened in modern Schools of Art and Design to consider aesthetics in the context of manufacturing for mass markets. The second had its roots in the Scientific Revolution, and focused on technical considerations, for example in British Mechanics Institutes, which evolved into university Engineering departments. The third major value system has its roots in Scientific Management, as initially taught in Colleges of Commerce (UK) and similar educational institutions worldwide. Each value system spans distinct educational and professional practices.

Initially, computers were the domain of engineers, focused mostly on hardware at first, and then increasingly on software. Once computers became important commercial and administrative tools, business schools developed Management Information Systems as a subdiscipline. Once consumer markets developed for hardware, software, and computer services, established management disciplines such as marketing and innovation extended their interest to digital products and services. With digital convergence for all existing audio-visual media, design and media educators and professionals extended their interests and expertise into multimedia and interaction design (IxD).

Professionals and educators in engineering, management, and design have distinct value systems. There are overlaps between, and differences within, each group of professional values.
However, their different respective core values of capability, rationality, and desirability shape how design work is understood and practiced. At the risk of oversimplification:

- engineering seeks demonstrable solutions (preferably optimal) to clearly specified problems;

- management stresses outcomes, with digital artefacts judged by their value achieved through ownership and use by organisations and individuals; and

- creative design stresses delight and appreciation, with consumers being surprised by, admiring, and enjoying outstanding imagination and realisation.

While optimal solutions, achieved value, and audience delight can and do overlap, it is possible (and very common) for one or two to be achieved without the other. Engineers can thus solve a challenging technical problem in ways that have no obvious value for any human activity, and do not excite possible consumers. Similarly, designers can be outstandingly original and creative but fail to properly consider user needs or technical realities. Also, management strategists can become fixated on new product or service propositions for which there can be no viable technical and/or creative realisation in any foreseeable future.

Brown (2009) has framed design thinking as something that “brings together what is desirable from a human point of view with what is technologically feasible and economically viable,” but this aspiration is not systematically met in practice. Unfortunately, current approaches to developing digital products and services tend to be firmly rooted in one value system. Engineering design approaches focus on systematic approaches to problem analysis, requirements specification, and design and analysis of solutions. Management approaches focus on business cases and value propositions. Creative design can develop radically novel artefacts that previously had not been envisaged. However, any single “centre” for design makes it hard to balance capability, rationality, and desirability. However, a hybrid methodology that aims to blend the best of disjoint value systems will introduce new problems of integration across different professional work streams.

**TAKING LEAVE OF OUR CENTRES**

My career has repeatedly cycled me through three disciplinary value systems. As a high school teacher, I designed and implemented e-learning systems to achieve educational outcomes. As a freelance programmer, I wrote computer games to delight. As a computer science researcher, I sought systematic approaches to the design and specification of interactive systems, which became the basis for my teaching on undergraduate computing degrees. As a user-centred design researcher, I worked with research groups to develop novel approaches to designing for contexts of use (Cockton and Clarke, 1999) and evaluating quality in use (Cockton et al., 2003; McDonald et al., 2006). As the director of support projects for a region’s digital sector, I worked with business owners and
senior managers to deliver value to a rapidly growing cluster of digital service providers and their value chains. As I followed their lead to think in terms of value propositions, I became critical of user-centred design (UCD) and its foci on quality in use and fit to context. While both of these could be engineered, assisted by creative flair, the choice of evaluation targets felt arbitrary without understanding the rationale for a digital product or service in terms of the value that it should deliver (Cockton, 2004a, 2004b).

A solution was obvious: stop centring on users and usage and, instead, centre on value. This radically new value-centred design (VCD) would focus on the value achieved during and after use of a digital product or service. This was later extended to worth-centred design (WCD). The broader concept of *worth* better captures the balance between positive and negative values (Cockton, 2006). As I was moving from users and usage to value and worth, John Heskett was moving his graduate seminar on Design and the Creation of Value with him from Chicago to Hong Kong (Dilnot, 2017). However, Heskett and I had different aims.

Heskett sought to improve design's ability to demonstrate how it creates and adds value by drawing on economic theory, although for Dilnot (2017, p.11), Heskett “never conflates ‘economic value’ with value or values per se.” Interestingly, his focus on economic value was often turned to other perspectives on value and values (Heskett, 2017, Appendix B).

My aim was practice-based. I sought to improve design teams’ understanding of value (or better still, worth) and their ability to make explicit use of their understanding when designing interactive systems. I was able to build on my undergraduate and postgraduate studies in history, philosophy, psychology, and sociology. Heskett and I ended up with similar positions but with very different disciplinary balances. However, we were focused on different audiences and purposes: demonstrating design’s overall value as a professional practice in economic terms (Heskett); designing for specific worth for specific digital products or services. In Frayling’s (1993) terms, Heskett was carrying out research *into* design, and I was carrying out research *for* design.

Over the previous decade, I had become intermittently aware of the nature of creative design practices, with their roots in the new Art and Design Schools of the Industrial Revolution. I had based much of a Master’s design course that I taught in 1996 on Lawson’s (1980) research into creative design practices, with a clear focus on the concurrent nature of creative design activities, in contrast to the sequential stages of idealised engineering design (iteration preserves sequence). As a UK NESTA fellow from 2005–2008, I was mentored by two distinguished design researchers and educators, reawakening my interest in creative design practice. However, even towards the end of this fellowship, when I spent three months at Microsoft Research Cambridge, I failed to support concurrent creative practices (Cockton et al., 2009a). Centring on worth was effective for integrating across completed design work on a digital Family Archive, but not for directing, balancing, and scheduling additional work.
Unsurprisingly, any design methodology with a single centre is biased in ways that obstruct the balance of activities that best suits a specific project. I began to explore balance through the concepts of design choices within Abstract Design Situations (Cockton, 2009a, 2010b), which involved four different design arenas (Cockton, 2013a, 2013b). Arenas are worked on concurrently in different episodes of design work, with shifting foci instead of a single “centre” for design. Worth is only a focus within the design purpose arena. This evolved worth-centred design into a balanced worth-focused (Wo-Fo) approach with integration across four design arenas. My Ph.D. student Jenni George developed a family of representations for Abstract Design Situations that are used to track, reflect, and plan during design work (George, 2016).

Concurrent work on design arenas lets creative design-led activities go beyond known needs, wants, desires, and dreams of identified beneficiaries to more generous approaches to design purpose. Design could thus be BIG—Balanced, Integrated, and Generous—by balancing design activities across a project and also integrating these activities in ways that left room for creative opportunities alongside well-grounded insights about beneficiaries.

Changing design’s centre from users via value to worth was less effective than supporting multiple foci, being Wo-Fo some but not all of the time (and actually, not much of the time relatively). Multiple changing integrated foci increase the manageable complexity of factors under consideration during design. Rather than:

- placing all our trust in a single centre (such as users, usage, value, values or worth), BIG expects and supports multiple dynamic foci; and

- focusing predominantly on positive or negative outcomes, a Wo-Fo considers the balance of both, based on the understanding that positives can outweigh, or compensate for, negatives.

Such complexity may feel very challenging, with so many factors under consideration. A key aim of this book is to communicate how such complexity can be managed and, thus, avoid the (often unacceptable) compromises that methodologies with centres and fixed processes (such as UCD) impose on design teams. BIG design combines existing perspectives from UCD, VCD, and WCD. The last two are variants of UCD, but BIG design subsumes them all. User-focused UCD and user experience (UX) practices co-exist alongside (or either side of) Wo-Fo and design-led practices.

WHO SHOULD READ THIS BOOK?

This book is for everyone who is aware in any way of limitations of current approaches to IxD at their current career stage. Students or professionals working within constraining engineering or innovation (“design thinking”) methodologies can learn how to open up their work to more creative
practices while maintaining a focus on worthwhile experiences and outcomes. Similarly, designers working in loosely structured practices such as Agile development or unconstrained exploratory design can learn how to add useful and productive structure to their work, especially a clear sense of design purpose coupled with the ability to ground this in understandings of beneficiaries and evaluations of usage. Managers and directors can learn practices and perspectives that take them beyond the limitations of current design thinking, design led, agile, and lean practices and improve their tracking, scheduling, and subtle direction of concurrent design work.

I see reading as an active process and writing as a resource to prompt reflection, criticism, questions, and deliberation. I thus use a mix of writing styles in this book, building on experimental writing for the ACM CHI conference alt.chi track that has used drama form (Cockton, 2008d), parody (Cockton, 2012a, 2012b), and humanities-influenced critique (Cockton, 2008b, 2013c, 2017). While styles of technical writing have much to commend them, they are inherently conservative and too often write to avoid active reading (e.g., reflection, deliberation, questions, critical responses). The situated nature of design means that design teams must be able to relate what they have read to their projects. The cookbook extreme of technical writing is thus unsuitable for this book's content. Even its more technical parts of this book are written to prompt reflection, criticism, questions, and deliberation. Where easing up a technical writing style is not enough to expose the limitations of current orthodoxies for software design, I have used fiction, extending current design fiction work from envisioning future artefacts to fictions on design practice and research. I have done this to put creative values on an equal footing with technical ones through the creative use of language. Being open to creative practice is helped by being open to creative writing.

I also see both reading and writing as a critical process, where close attention to language is needed to expose hidden assumptions and masked lacunae (gaps). Inadequate conservative approaches to design from engineering and human-centred practices are often spared critical examination through the use of language that appeals to rational value systems such as Scientism and Bureaucratism.

**LETTING GO WITHOUT LOSING YOUR GRIP**

Our education socialises us into disciplinary value systems that are reproduced through professional practices. Employers and customers also bring their own value systems. Successful design depends on being able to let go of strong socialised value orientations to thoroughly explore new perspectives. It also depends on being able to persuade employers and customers, too, that they will benefit from being more open to innovative design practices beyond the commoditised packaging of Design Thinking, UCD, Engineering Design Management, and similar “answer-to-everything” approaches. Instead, we need to develop competences, expertise, and principles that maintain and
develop a “palette” (Friedland, 2019) that supports a wide range of demanding projects and stakeholders, given structure for specific contexts as possible within a “playbook” (Gajander, 2019).

One advantage of focusing on worth in design is that it applies to the process as much as the outcomes of design. If we are generous with our beneficiaries as designers, then we must also be generous with our own design processes. We need to understand what is worthwhile about a range of disciplinary and professional practices. We then need to take the best of each and reduce their drawbacks. Benefits can make drawbacks worthwhile, but when drawbacks are reduced or even removed, design practices become even more worthwhile.

Thinking in terms of worth means that we must assess both the positives and negatives of specific disciplinary and professional practices and respond appropriately. As designers, we primarily serve others and not our disciplines or professions. We need to be able to critically reflect on the values into which we have been socialised by education or professional practice. We should be comfortable with having our values challenged and be able to assess their impact on our design practices. We need a strong grip on how we get design work to work, and that means letting go of values when they do not demonstrably translate into effective actions.

With an undergraduate degree in Humanities, a post-graduate certificate in Education, a Ph.D. in Computing Science, and a UK NESTA fellowship for design research, I have no one disciplinary loyalty, which makes me stand back from my writing as it develops. Most of this book draws on Software Engineering and Interaction Design, but my Humanities and Applied Human Science backgrounds spawn critical responses. I thus found myself looking for a deeper underpinning of the practice-based work in this book. This search has been as creative as the practice-based work that it sought to critique, so unsurprisingly my position on the unavoidable risks of creative work eventually had me rendezvous with theories and frameworks from social approaches to risk (Beck, 1992; Renn, 2008). Surprisingly, though, some key positions there turned out to resonate strongly with the tensions between creative and rational design that this book seeks to tame. Ultimately, an effective rendezvous between the creative and the rational is about understanding and managing risk. Both “camps” in design have strengths and weaknesses that must be recognised and responded to.

Gilbert Cockton
April 2020
Acknowledgements

This book has its roots over 25 years ago in the work of my first two Computing Ph.D. students at Glasgow University. Steven Clarke responded to second wave HCI (Rogers et al., 1993) by exploring the nature of links (connections, in this book) between contextual research into beneficiaries and the design of software artefacts. He moved away from assumptions of synchronised clean interfaces between phases of software development cycles to incremental asynchronous connections. Darryn Lavery developed methodological resources for the systematic study of evaluation work that was to develop into a resource-based approach to design work.

Ph.D. students and colleagues in computing at Sunderland University built on this research from 1997–2009. Alan Woolrych and Mark Hindmarch developed an understanding of informative and expressive resources in evaluation work. Sharon McDonald and Kelly Monahan demonstrated the flexibility of UCD methods by repurposing contextual research approaches for evaluation. Alongside this continuing work on evaluation, specialised approaches and resources for contextual research were developed for accessibility (Eamon Doherty, Paul Gnanayutham, Brendan Cassidy), culture (Fuad AL Qirem), and e-learning (Susan Jones).

From 1999–2005, I directed regional support projects for the digital sector in the northeast of England. Industrial board members on three projects improved my understanding of business strategy and made me more aware of the limitations of UCD approaches to contextual research and usability evaluation in the broader context of developing and marketing digital products and services. I thus chose to focus VCD for the UK NESTA fellowship that I was awarded from 2005–2008. I had the very good fortune to be mentored by Gillian Crampton-Smith. Gillian and her husband, Phil Tabor, developed my understanding of perspectives from creative design education and research. During this fellowship, I was seconded to Microsoft Research Cambridge and was an international advisor to the Finnish TEKES VALU project. At Microsoft, Abigail Sellen, David Kirk, and Richard Banks were particularly helpful with the development of worth sketching and mapping, which Sari Kujala, and Piia Nurkka developed further on the VALU project. I developed a range of Wo-Fo resources during my NESTA fellowship.

The rejection of fixed design and evaluation methods, and their reconceptualization as approaches and resources, developed during two European COST networks, MAUSE and TwinTide, with applications in consultancy as part of the regional CODEWORKS digital support project. Resource functions underpinned work by my Ph.D. students in Northumbria University’s School of Design from 2010 onwards. Malcolm Jones discovered multiple resource functions (rather than
types) in his Ph.D. on storytelling resources (Jones, 2020). Jenni George’s Ph.D. applied a wide range of new design theory to a Wo-Fo case study (George, 2016).

Stuart English, Bob Young, and Matt Lievesley introduced me to some of the key references on creative design work in Northumbria’s former Centre for Design Research, where Louise Taylor and Joyce Yee invented what I call Why-Frames in Cockton (2020b, Chapter 4).

The research framework that was refined within the TwinTide project and by Ph.D. students has been the basis for teaching undergraduate and postgraduate students in Italy, Slovenia, Iceland, and the Netherlands. It has also been the basis for workshops and courses at conferences in Finland, Germany, Estonia, U.S., Sweden, Canada, and the UK. I have gained much from the hundreds of participants on these courses. My framework has also been extended in response to several Ph.D.s that I have examined, and collaborations arising within the TwinTide COST network, in particular with Kasper Hornbæk, Erik Frøkjær, Marcin Sikorski, Igor Garnik, Marta Lárusdóttir, and Åsa Cajander.

This book is thus the result of dozens of collaborations and several funded projects. I have also benefitted from independent use of the approaches that I have developed, as covered in Cockton (2020b, Chapter 6). I have been very fortunate to have received advice, ideas, knowledge, and guidance from a wide range of colleagues in academia and business, as well as the trust and enthusiasm of colleagues who have independently applied my approaches. Most recently as Co-Editor-in-Chief of ACM Interactions magazine, I have had the opportunity to interact with colleagues at all stages of their careers, which has refreshed and extended the framework presented here.

Gilbert Cockton
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It’s been three years since CloudBooks was launched. It’s a Software as a Service product for managing a small company’s accounts, with additional support for setting up, running, and growing a business. Customers access it through a web interface in return for an annual subscription. CloudBooks is developed using an Agile development process, with bi-weekly updates to the live system. There are a few dozen professionals working on CloudBooks, spanning marketing, product management, software development, product support, and user experience. Product management are focused on future strategy, but will answer questions and give feedback on current work items. The team has planned activities for the next months at different levels of detail. For the next two weeks, the developers and their interaction design (IxD) team know the detailed design and implementation tasks for the current sprint and the user experience (UX) team is working on a range of multidisciplinary activities.

The UX team lead has some customer visits planned, where she will find out about how CloudBooks is being used, what is found most valuable, what difficulties customers experience, and what revisions and extensions would be attractive. The usability evaluation lead has some test sessions arranged with members of their user panel. He will be gathering evidence in relation to user feedback from different support channels, after which he will inspect the user interface designs for the next sprint. The three Interaction Designers are working on two tasks: pixel perfect user interface design for the next sprint, and prototyping some new capabilities in support of the product road map, which will be demonstrated to visitors to the company’s stand at an upcoming trade show.

CloudBooks is not a real product, but there are ones like it. The imaginary example above exposes the realities of work on versions of software after its first release. The CloudBooks team are working across four distinct areas of design, which each bring their own development activities and require specific professional expertise in creative design, software design and engineering, product strategy, user research, or usability evaluation (Table 1.1). The first design area focuses on development of a complex software artefact, CloudBooks. The second concerns current and future product strategy. The third carries out evaluations of CloudBooks at various stages of development. The fourth develops understandings of CloudBook’s users. There’s nothing radical in these work patterns. The interleaving of design, coding, planning, hypothesis testing, information gathering, strategic goal setting, and other activities is what we would expect for a mature product. It would be highly inefficient to queue work for each design area, e.g., making development work wait for
evaluation results, having strategic reviews wait for completion of a prototype, and delaying cus-
tomer visits, prototype planning and demonstrations, and evaluation until a current sprint ends.

<table>
<thead>
<tr>
<th>Design Area</th>
<th>Week 1 Activities</th>
<th>Week 2 Activities</th>
</tr>
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<tbody>
<tr>
<td>Development</td>
<td>Implement user stories for next sprint</td>
<td>Prototype new capabilities from CloudBooks road map</td>
</tr>
<tr>
<td>Strategy</td>
<td>Answer queries from Interaction Designers about current CloudBooks road map while framing future product strategy</td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td>Usability work in response to customer feedback</td>
<td>Usability and wider UX inspection of user interface design for next sprint</td>
</tr>
<tr>
<td>User Research</td>
<td>Planned customer visits</td>
<td>Plan demonstrations and insight gathering procedures for upcoming trade show</td>
</tr>
</tbody>
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At the same time, there is no clear co-ordination across design areas here. The team are working on the current, next, and as yet unscheduled versions of CloudBooks simultaneously. It is not clear how evaluation work feeds into other design areas. It is less clear whether questions to Product Management from the Interaction Designers will lead to tweaks, or perhaps more, to the CloudBooks road map. It is even less clear whether findings from the customer visits will have any impact on the other three design areas. Least clear of all (understandably) is the eventual impact of the demonstrations at the upcoming trade show.

These difficulties of co-ordination can be expressed diagrammatically, as in Figure 1.1. The top-left diagram illustrates lack of clear co-ordination from evaluation work to the other areas of design work. The top-right shows a lack of clarity on the impact on product strategy of questions from development about it. The bottom-left shows lack of co-ordination from user research to other design areas. The bottom-right shows a more complex lack of co-ordination from a demonstration via its evaluation to the other design areas.

The work patterns here are thus understandable, but perhaps not ideal. If so, this raises the question as to what would be ideal. It also raises questions about whether these work patterns should ever be different, even when developing the first release of a software product or service. This book addresses these and other questions in depth. It seeks to continue the agile shift from formal engineering design and development sequences to more open and creative practices.
1.1 HOW THIS BOOK CHALLENGES STRONGLY ESTABLISHED POSITIONS

This is the first book of two on having a worth focus (Wo-Fo) in IxD. The second book addresses this Wo-Fo in detail. This first book develops a context that enables a Wo-Fo in design by developing a framework for critical creative design practices. The second book builds on this by covering design approaches and resources that focus on *worthwhile* usage. These are addressed in Book 2, along with approaches and resources for other foci in IxD and approaches to integration across all foci. Book 2 has two chapters on case studies of these approaches in use in a broad framework for critical creative design and evaluation practices.

This first book challenges some strongly established disciplinary and professional ideals. This introduction, with the Preface, provides an overview and motivation for this book. The Preface describes the origins and development of the research covered in this book, which draws on three decades of human-centred practices in conjunction with creative, business, and engineering approaches. This chapter began with a *design practice fiction* to which some later chapters will refer. It relates how software design teams do not follow textbook development processes from software engineering and human-centred design, as well as augmenting creative studio practices.
Both books are focused on IxD, but the first is mostly general, and develops theory that applies to other design practices. The foundations for better integration of existing design paradigms lie in understanding and accepting:

- the key realities of creative design work and
- the insurmountable limitations of engineering project management approaches, even in their agile and “Design Thinking” manifestations.

Better integration than that found in current practices can be achieved via comprehensive design situations that can be modelled at varying levels of abstraction in ways that support the effective integration of currently separate design practices. Such modelling can be both theoretically informed and practically applicable.

This book extends design fictions to design practice and design research. Fictitious examples are used to let a range of values and paradigms be introduced in ways that prompt readers to reflect on how different disciplinary and professional practices can look from the outside, as well as on what an honest appraisal looks like from the inside. Most of this book takes more well-established approaches to research writing, combining analyses of literature with development of concepts and theories that lend themselves to practical realisations.

This book continues with Chapter 2, which looks at what five decades of research into creative design practice tell us about the structure of design work. After that, Chapter 3 uses a design research fiction to explore how engineering and management values gave rise to normative development processes that have a poor fit to the empirical realities summarised in Chapter 2.

Common ground between ideals, realities, and possibilities that are superficially incompatible is made possible through the concept of Design Arenas, a formalisation of Heskett’s (2005) position on the origins of design outcomes. Chapter 4 builds on the concepts of design arenas to form a superordinate concept of Abstract Design Situations (ADS) that can be used to scope design work at all levels of abstraction from paradigms, via processes, organisations, projects, phases, and methods down to work resources and even brief design moves. ADS can be used to track and plan design work from inception onwards. Chapter 5 relates Chapter 2’s understandings of creative design practices to ADS, by showing how a partially planned development process can be tracked and replanned using design arenas and ADS concepts. These chapters develop a new lexicon for design progressions, replacing the processes and phases of idealised normative engineering design.

A glossary is used in both books to gather this new lexicon in one place.

Chapter 6 concludes this book with a summary of a new approach to design paradigms that values balance, integration, and generosity rather than centres, processes, and delivering to specification. In the second book, the focus shifts to practical IxD. Chapter 5 provides a bridge from this book’s theory to the practice of the second book.
1.2 WHAT IS IMPORTANT ABOUT HOW THE CLOUDBOOKS TEAM WORKS

The CloudBooks team’s story is simple. They work as they do because this is how all creatives work. They did not sleepwalk into the chaos of a parallel process with multiple concurrent design activities, with reflective pauses for integration and forward planning and strategy. Instead, they always work this way from project inception onwards. There is never a “big upfront” analysis and specification at the outset, and no fixed iterative cycle of analysis, synthesis, and evaluation. They are more agile than any published Agile methodology. Although they work creatively, the CloudBooks team are not a loose collection of independent creative prima donnas. Their work is often shaped by user- or market-focused activities, but is primarily driven forward by a strong product strategy, understandings of a broad range of trends (creative, business, and technological) and the creative confidence required to pull all these disparate design inputs together. The team do not follow a single process and methodology. Instead, they leverage a continuously evolving “palette” of design resources and approaches (Friedland, 2019), some of which are combined into a “playbook” of set piece design processes for common project contexts (Gajander, 2019).

The CloudBooks team’s work raises some important questions despite its fictitious nature.

1. What are the main areas of design work? Can it reasonably be divided up in some way (as in Table 1.1)? What are the alternatives to the areas in Table 1.1?

2. How do design work areas relate to each other? How are they connected? What sort of transitions are made as areas are connected?

3. Are there standard process structures that can organise design work without regimenting it into a sequence of phases? How much iteration is needed? How much concurrency can be handled simultaneously? Is there a correct structure?

The goal of this book is to answer these questions in ways that move beyond failed dreams of exclusively rational evidence-based design methodologies to ones that are more open, and take realistic approaches to balancing the creative realities of design work, based on palettes that support multiple “play” tactics for rigorously combining and information with creative design work. After reviewing research into creative design in the next chapter and seeing how much of the above can be answered with it, Chapter 3 returns with a design research fiction that will add further questions to those above.
The CloudBooks’ story in Chapter 1 is a design practice fiction. Even so, we can ask whether it is typical of software development practice. Alternatively, we could ask if it conforms to relevant standards. The main international standard for Human-Centred Design (HCD) is ISO 9241-210 (ISO, 2019a; Figure 2.1), which began as the earlier ISO13407 standard, with a previous version in 2012. It is the basis for a major ongoing UX certification initiative (uxqb.org).

Figure 2.1: HCD process for ISO 9241-210 (example resources on solid arrows omitted).

ISO 9241-210 is a linear process where each phase has a single work focus. A phase’s output is input to the next: nothing else is needed. Simple arrows represent routine transitions between phases. Updates since ISO13407 have not changed the linear nature of this process model. In
2012, two extra iteration transitions (dashed) were added post evaluation. There was just the dotted transition in Figure 2.1 in ISO13407. Rather than repeat a full “waterfall” cycle of four main development phases for every iteration, following evaluation development can continue with any other phase. Even so, all iterative processes are sequential in underlying structure, with no concurrent phases (Fallman, 2003). Iteration only makes sense for sequential processes. It is meaningless for concurrent ones. Interestingly, Jones (1970) “designer as computer model” has one feedback link from evaluation to analysis (top “understand” box in Figure 2.1 and possibly its requirements box too), so iteration fashions very over time.

The CloudBooks team’s processes are nothing like ISO9241-210, which is unrealistic and riddled with gaps that have remained unacknowledged for the two decades of it and its predecessor. It does not match how creative design work actually happens in practice, as consistently revealed by over 50 years of research into creative design practice. The next section reviews this to show why the CloudBooks process cannot be like ISO9241-210.

After this review, 50 years of research into creative design practice are expressed as three key realities of creative design practice, which call for a new compatible design work vocabulary. The need for this vocabulary is then considered, followed by reviews of the nature of transitions between work areas in creative design and understandings of creative work in HCI research.

2.1 A HALF CENTURY OF RESEARCH INTO DESIGN

Early design research was normative, like ISO 9241-210 today. It was research for design (Frayling, 1993) that set standards, irrespective of realities. It aimed to improve creative design work by making it better informed, and more systematic and rational. Creative expertise and judgement were seen as impeding more scientific practices, such as human factors and ergonomics. Difficulties in scientifically informing design-led engineers such as Bruce Archer (Royal College of Art, UK) and John Chris Jones (Associated Electrical Industries then UMIST, UK) to propose systematic approaches. In the Preface to the second edition of Jones’ Design Methods, he was quoted:

*I didn't want to get involved with design theory or methods … I did this ergonomic study of how the designing was done purely with the view of getting the ergonomic information, which was obviously sound and well tested, into the engineering design process at the point where it wouldn't be rejected, … in doing that I hit on what's now called design methods* (Mitchell, 1992).

Note that Jones began with research into design (Frayling, 1993) to establish why his ergonomic information was not used at the right “point” in an engineering design process. He followed through with research for design, proposing a systematic design method as a solution to his problems. Research for design dominated the first decade of design research, but with very limited success (Jones, 1988), resulting in a shift to research into design. Even though Jones had studied
engineering design practice before proposing his systematic design method, there was clearly some form of disconnect between the actual problem and Jones’ solution. The middle decades of design research focused on understanding how designers actually worked, with no preconceived notions that design work was scientifically problematic and had to be fixed.

Today there are many published first- and second-hand accounts of creative design work, e.g., focusing on Software Design (Petre and van der Hoek, 2016), Product Design and related practices (Dorst, 2017), Advertising (Hegarty, 2014), and creative arts in general (Al-Maria et al., 2016). These four publications are well-designed easy reads with simple spreads, short essays, and discussions to quickly communicate the diversity of creative practice. There is much in common across the professional practices covered, and it is this core creative practice that is our first basis for identifying common realities of creative practice. Dorst (2015) proposed five lessons from design:

1. Co-evolution
2. Developing problem situations
3. Handling frames
4. Exploiting themes
5. Fostering a discourse

### 2.1.1 CO-EVOLUTION

In creative design work, problem and solution spaces co-evolve. They are not worked on separately in fixed sequences. An early recognition of this was Rittel and Webber’s (1973) account of “wicked problems,” which cannot be not finally framed until a solution is accepted. ISO 9241-210, like most rational methodologies, expects a problem to be analysed and requirements specified before design work begins. Rittel and Webber, however, were not the first to note that “a vast variety of design decisions cannot be taken … before the solution in principle is known, conjecture and problem specification thus proceed side-by-side rather than in sequence” (Hillier et al., 1972).

Interestingly, Rittel and Webber presented wicked problems as a policy problem (in particular for urban planning) and not as fundamental to creative practice. It was almost two decades before Dorst and other design researchers located “wickedness” in creative practice rather than in (just) the world. By letting problem and solution spaces continuously co-evolve, creative designers acknowledge the impossibility of completely closing on the exact nature of a problem without giving substantial consideration to possible solutions. Current leading edge design research practices such as Annotated Portfolios (Gaver and Bowers, 2012) make co-evolution explicitly symbiotic, with artefacts illuminated by annotations and annotations illustrated by artefacts: “annotations and the designs they annotate are mutually informative.”
2. THE REALITIES OF CREATIVE DESIGN PRACTICE

2.1.2 DEVELOPING PROBLEM SITUATIONS

With co-evolution, both problem situations and potential solutions are developed concurrently. Tame problems aside, design teams do not analyse problems and specify requirements once and for all, or in isolation. Instead, understandings of problem situations co-evolve alongside development of possible solutions. Problem situations are open, complex, dynamic, and networked (Dorst, 2015), unlike closed frozen problem definitions. Consequently, problem situations are being continuously developed by design teams, and for Dorst this has more impact on innovation than a focus on solutions. While problems and solutions co-evolve, the framing of problem situations spawns innovation more than the creation of solutions.

2.1.3 HANDLING FRAMES

The role of frames may be Dorst’s (2015) most important “lesson from design.” A creative design team’s approach to “a problem” is expressed by a frame. Solutions are also framed, but for Dorst, radical innovation is more strongly associated with imaginative problem framing. For design, it is an old lesson, but one that may not be readily learned elsewhere. Doblin (1978) included semantic definitions as a resource for innovation:

Consciously switching the semantic description of a product produces new ideas. The word “chair” can cause a mental block by describing a platform 18 inches off the floor with four legs and a back. Changing the product description to “body support” can cause the designer to envision a column of air, a ball of foam, a stick strapped to the back, etc.

Innovative or not, frames give coherence to problem and solution spaces. They summarise the current understanding of a problem or a preferred solution. For Dorst (2015), a frame can be an organising principle, a coherent set of statements, or a combination of both. Gaver and Bower’s (2012) designers’ “position statement” can be thought of as a frame, for example “framing older people as curious and engaged” and not “as individuals requiring medical care or assistance.”

Co-evolution lets problem frames evolve beyond an initial brief, challenge, or insight to guide development of solutions. For Dorst, frames steer explorations and perceptions, directing intentions and actions. They are original, lively, and draw forth mental imagery across design teams, harmonising the thoughts of stakeholders. Innovation results from realistic frames.

Good frames span and integrate a broad range of issues. They can be hard to communicate, but may trigger “mini-stories” that open up shared experiences across a team. Frames also must be fresh. If fossilized, they become limiting rationales: when something is a frame is more important than what is in one, i.e., to work as a frame, the timing of its formulation is more important than the content of the formulation. Once a frame is accepted, it can fade as design becomes routine once a problem is tamed.
A problem frame is far more extensive than a problem description or specification. It is not
enough to coldly state something. A problem frame must inspire, provoke, captivate, inspire, unite,
evoke, elicit, share, and more. Less a *what* than a *when*, a frame is only *when* when its formation
leads to emotional, inspirational, and social responses. A problem frame that is *generous* is more
likely to trigger the positive responses that elevate a proposal to a frame.

Frames are thus simple concepts with complex consequences in design work, but only when
they meet the many challenging demands that Dorst places on them. Coming up with strong
frames depend on a design team's ideative repertoire.

A difficulty with Dorst’s (2015) position on frames is that he has two. The first is summarised
above, and is consistent with a broad literature on research into design. The second is more analyti-
cal, and starts with models of reasoning to reach a more constrained position on frames that is not
backed up by vast literature. This position comes first in Dorst (2015) and is critiqued in Chapter 4.

### 2.1.4 EXPLOITING THEMES

Co-evolution does not occur in a vacuum. Considerations for frames’ scopes are drawn from a
pool of possibilities organised around *themes*, which design teams draw on when considering
potential frames. Frames bring themes from the background consciousness of a design team to
the foreground. They make some themes central to the current framing of a design. Themes span
problem and solution, letting considerations of both merge during ideation: “concepts that bridge
the human (cultural) domain and the technical or economic realms can be inordinately useful as
themes” (Dorst, 2015). Themes are patterns in the world that can aid formation of frames, coming
into and out of play as frames co-evolve. However, specific themes are always “there” whether or
not they direct frame evolution.

Davies and Talbot’s (1987) study of elite UK designers revealed broad ubiquitous themes that
were often considered: public/private, individual/collective, past/future, and familiar/unfamiliar. A
similar practice was called *placements*, which like categories “have boundaries to shape and constrain
meaning, but” unlike categories “are not rigidly fixed and determinate” (Buchanan, 1992). Buchanan
uses “intrinsic/extrinsic” as an example placement from the designer Jay Doblin, whose *Innovation,
A Cook Book Approach* (1978), discusses other themes such as universalities/peculiarities and good/
bad, but does not call any of these placements. Buchanan used this term from rhetoric to contrast
flexible design thinking with rigid logical categories.

Themes were used when designers noticed particular coincidences that other people failed
to notice, drawing on visual imagery. Thirty-five years later, Gaver and Bowers’ (2012) portfolio
annotations included themes such as “constraint and openness” and “threshold to the surrounding
world.” Themes are more abstract than specific designs or the contexts that they are designed for.
Annotations vary in their levels of abstraction and scope. They apply with varying balance to one or more designs, their context of use, or both (Löwgren, 2013).

Themes that dissolve apparent design paradoxes are particularly valuable. Initial paradoxes arising from apparently incompatible stakeholder positions can disappear as more universal human needs and values are considered. Themes capture the underlying phenomena in a situation without prejudgement or oversimplification. Themes hang in the balance, neither positive nor negative, until they come together in new ways. They are not part of a problem or solution space, but are important enigmatic resources in design work.

### 2.1.5 FOSTERING A DISCOURSE

In a ISO 9241-210, each phase follows logically from the next, with a phase’s outputs generating, or being translated into, the inputs of the next. There is little need for discourse here, as one phase should set up comprehensively for the next. However, in creative design work, relationships between problems and solutions cannot be like mathematical functions such as generation or translation. Both are too simple. Instead, problems and solutions are in mutual dialogue as part of Schön’s (1992) “reflective conversation with the materials of a design situation.”

Schön’s “conversation with materials” were originally within the context of solo design work such as sketching (where sketches “talk back”). For Dorst (2015), fostering a discourse is primarily social with design teams nudging co-evolution forward (sometimes by a considerable distance) through joint reflection on current relationships between problem and solution frames.

Discourses are essential in design work, even when there is a single designer in “reflective conversation with the materials of a design situation.” As design teams become more diverse and sometimes conflicted, effective discourses become more challenging. Divided loyalties can result when trying to reconcile the needs of customers with those of a firm (Stevens and Moultrie, 2011).

In this book, design teams are understood broadly to include all involved stakeholders. This is especially important for service and policy design work in the public and third sectors, because providers who implement services must be included in the design team (Junginger, 2017). Also, when using design strategically within an organisation, a “complex interplay of influencers and stakeholders” is involved with design integrating and mediating between professional domains (Stevens and Moultrie, 2011), both inside organizations (e.g., marketing, production) and outside (e.g., suppliers, partners).

### 2.1.6 OTHER SUMMARIES FROM RESEARCH INTO DESIGN

Dorst’s (2015) list is one of many from research into design, but it is sufficiently comprehensive to be a good basis for understanding creative design. It foregrounds design practices, i.e., co-evolution,
(problem) framing, themes, fostered discourses, which are all at the same level of abstraction. This makes it more useful than other lists.

Items on earlier proposed lists of key design factors are less incisive and focused, e.g., Krippendorf (2005), who lists designers’ future orientation, envisaging usage, understanding stakeholders, gathering substantiating evidence, and learning through critical examination to adapt and improve. Similarly, Lawson (1980) presents six generalities that are less action-oriented than Dorst’s five. Cross (2011) has a loosely coupled short list at very different levels of abstraction, taking a broad systems view, distinctive problem framing, and designing from first principles. Stevens and Moultrie (2011) offer examples, rather than a comprehensive list, of internal capabilities and resources relevant to design and other sources of competitive advantage that let design practices “safely explore the unknown territory of the future.” Their examples are tacit knowledge, corporate culture, and shared vision, a list as heterogeneous as those from Cross and others that is not action oriented.

Nelson and Stolterman (2012) present a more complex four foundations and six fundamentals. While much can be empirically grounded in design practices, this must be unpicked from their normative context. Their foundations and fundamentals provide useful concepts for research into design, but must be used selectively and judiciously elsewhere.

Dorst’s list thus comes closest to the realities of the activities of creative practice. It maintains a common level of abstraction, which makes for a coherent model of designer behaviour. It is the most up to date and is aligned with the most recent research. It also emphasizes the tacit nature of design work more than other lists, due to its focus on designers’ action rather than their “thinking.” Focusing on Dorst takes nothing of importance from the other lists that span 21 years of research into design. However, overlap within his five lessons lets them be reduced to three key realities.

2.2 THREE KEY REALITIES OF CREATIVE DESIGN PRACTICES

By reducing overlaps in Dorst’s list, we can identify three key realities of creative design practices.

2.2.1 CO-EVOLUTION

Dorst’s first lesson, co-evolution, corresponds directly to a key reality of creative practice. His next three lessons (developing problem situations, handling frames, exploiting themes) either follow from co-evolution or determine its quality, especially via a problem frame.

Co-evolution underlies “overlapping development phases,” one of the six factors in successful Japanese consumer product innovation identified by Takeuchi and Nonaka (1986), which contrasted the relay of linear engineering design with the concurrent scrum of “overlapping development phases” (thus inspiring Agile’s Scrum methodology). A study of elite UK designers (Davies and Talbot 1987) complemented this by noting that creative activities overlap and occur in any order.
Rittel and Webber (1973) contrasted “wicked problems” with “tame” ones, where problems could be confidently framed early in a project, and alternative solutions are well known (one of their ten distinguishing properties of wicked vs. tame problems).

Design work can be routine, even barely creative. Such work is still however design, as solutions must still be drawn and/or specified. However, this is largely design as in the narrow sense of its French root, *dessiner* (to draw). Innovative design, not tame design practices are the focus of this book. Currently, software design work is more innovative than routine.

Rittel and Webber’s wicked problems are a key reality of innovative creative practice, unlike the normative models of design work that are barely 75 years old (Eckert and Stacey, 2010), and intended to benefit managers, not designers (e.g., ISO, 2019a). They fit the traditions of scientific management well. However, in addition to what we know about creative design, there is evidence that engineering designers do not adhere to strictly analysis-synthesis-evaluation sequences. This evidence includes: software engineering (Guindon, 1990); large technology projects (Eckert and Stacey, 2010); and electronic circuit designers (McNeill et al., 1998). Also, engineering education research has consistently found ubiquitous creative practices (e.g., Atman et al., 2008; Turns et al., 2010). Co-evolution is the norm and creative engineers start young, which is no surprise, since what is a tame problem for experienced engineers may be a wicked one for novices.

### 2.2.2 Generosity

Co-evolution does not cover all aspects of *developing problems* and *handling frames*. Some very important aspects involve a second key reality, *generosity*. Generous design aims to deliver as much worth as possible, beyond what user research may tell us. Worth here means delivering *benefits* that (far) outweigh *sacrifices* (costs and risks).

Possibilities for generosity arise from themes that exist in the world and inspire frame evolution. This can underpin *design wisdom* (Nelson and Stolterman, 2012), going beyond problem solving and its “focusing only on avoiding undesirable states, to focusing on intentional actions that lead to states of reality which are desirable and appropriate.” While Nelson and Stolterman (2012) reserve “purpose” and “worth” as a judgement for clients and not designers, they also see the meanings and appropriation of design in the world as “intrinsic worth,” which thus associates worth with products and designers as well as clients.

While design is “service on behalf of the other” (Nelson and Stolterman, 2012), design teams have a major personal stake in delivering the best service possible, which go beyond a client’s brief. This personal stake is often reflected in designers’ enjoyment of talking about their projects as “if talking about a favourite child” (Darke, 1979).

In his overview of Design Thinking, Cross (2011) quotes the architect Dennis Lasdun [corrected]:
Our job is to give the client, on time and on cost, not what [s]he wants, but what [s]he never dreamed [s]he wanted; and when [s]he gets it, [s]he recognizes it as something [s]he wanted all the time.

Note that such transcendence of client dreams is not grounded in user research, but in the design team’s vision, empathy, and receptiveness. Cross (2011) also reviewed Kenneth Grange’s 1971 redesign of the Frister and Rossmann 804 sewing machine. Asked to restyle the 804 to compete with other manufacturers’ products, Grange quickly noticed that styling alone would deliver few benefits. Grange therefore developed an alternative design that went beyond re-styling to focus on improving use by adding storage, creating a better work area, and making cleaning more straightforward with less risk of needle injuries. Unlike those engineers who feel that they must design exactly to specification, Graham’s generosity far exceeded the initial brief.

Creative designers strive to go beyond an initial brief and deliver as many benefits as possible, while also reducing costs and risks, increasing a design’s worth. Examples of the generosity espoused by Lasdun and delivered by Grange are commonplace in the design literature. Junginger (2017) uses pictures of walking aids when communicating the value of design to government policy forums: one is grey bare metal without wheels; while the other is painted red with big wheels, a handbrake, a seat, and a shopping basket. The latter is not only better for impaired users, but also for government purchasers, since it reduces accidents, reliance on paid carers, and health problems, all of which will cost governments more than any cost difference between the crude frame and the generously equipped alternative. Similar comparisons can be made between low-cost standard spectacles, ones styled for individual tastes, and ones designed for specific activities such as sports (Cockton, 2010b). Eyesight correction is not a tame engineering design problem. People’s feelings about appearance and suitability are not amenable to precise specification. Nevertheless, a short glance at any retail display of spectacle frames, from “designer” models to stylish budget versions, demonstrates that eyewear design can respond to the needs and wants of diverse populations. As a result, we rarely see spectacles or contact lenses as prostheses or assistive technologies. They are lifestyle choices, and are even worn by people with good eyesight.

In craft too, there are millennia of examples of qualities of workmanship that far exceed what would be required by function alone, even in the making of palaeolithic flint tools (Pye, 1968). Moving on millennia to the previous century, design historians such as Heskett (2017, p. 204) can pile up examples of generous design work in a single end note, e.g., the London Underground map, the Austin Mini, Mary Quant’s mini skirt, and the Oxo good grips range. In each case, an existing product category is transformed by reconfiguration, reconceptualization, or both. Such design classics all begin with a designer’s vision, adding worth through multiple benefits and reduced sacrifices for apparently “tamed” product categories.
Factors that early economic theories regard as exogenous become endogenous (and thus within organisations’ control) in later theories considered by Heskett (2017). Design can thus contribute to competitive advantage, value creation and strategic fit, resources and capabilities, and strategic vision (Stevens and Moultrie, 2011). One case study in Stevens and Moultrie (2011) revealed design as a differentiator that added value in a variety of markets, where human-focused practices were enough to differentiate. This does not necessarily result in generous design, but may only meet customers’ expectations rather than exceed them.

Heskett’s (2017) *Value Creation Theory* extended Economics’ *New Growth Theory* to “growth theory plus” (Weber, 2017) by adding *knowledge of users* as a factor of production, connecting knowledge of users to technology/ideas. New Growth Theory had added the latter as a factor of production to capital and labour from older theories. Austrian economic theory often includes the entrepreneur as a factor of production. Design(ers) can be included too, as another form of entrepreneur that adds generosity to knowledge of users.

An open framing of problems in design practice, and its associated competences, which is not restricted to knowledge of users, extends economic inputs beyond “labour” to human capital, skills, and knowledge. Knowledge management becomes crucial for innovation. Takeuchi and Nonaka’s (1986) analysis of Japanese consumer product innovation built on and fed into the second author’s expertise as a pioneer of knowledge management research and practice.

Dorst’s focus on problem framing does not explicitly identify designers’ generosity as a key factor in radical innovation, nor does he explicitly identify knowledge of users, as Heskett did. His lessons from design are at a higher level of abstraction (e.g., frame, theme, development, discourse) than specific design practices. Nevertheless, a problem framing that is radically innovative brings goals for design purpose that originate from designers’ vision and passion as much as from implications of user research. Inspirations for design can achieve more than implications for design.

### 2.2.3 REFLECTIVE COMMUNAL CONVERSATIONS VIA THE MATERIALS OF A DESIGN SITUATION

Dorst’s fifth lesson, fostering a discourse, is an example of the third key reality of creative practice, extending “conversation with the materials of a design situation” to include social deliberation *via* these materials. Given the multidisciplinary design teams involved in contemporary commercial, public, and third-sector innovation, discussions on the current state of design work and its forward direction are vital. Such discussions drive co-evolution.

Themes are conceptual “materials of a design situation” and as such, when they do connect with problem or solution spaces, it may well be through Schön’s (1992) *backtalk* (Dorst does not speculate thus, but only notes designers’ lack of deliberate or systematic ways to deal with themes). As with co-evolution, backtalk involves a range of practices and expertise. *Judgement*
is vital here. Petroski (1994) stresses the self-critical faculty of the designer: “the first and most indispensable design tool is judgement.” Nelson and Stolterman (2012) propose ten forms of judgement in design.

There are inevitably gaps in the backtalk of design materials to designers. Designers must thus bring their own vision and direction to conversations with both materials and colleagues. They must also bring their judgement. Conversation with the materials of a design situation are not always playful chit chat, but can involve important ethical deliberations that a linear engineering design process could freeze out before requirements specification. This is now especially important in the context of increased use of artificial intelligence and data mining from online interactions (Woodruff, 2019). When and where design decisions with potential adverse consequences have low or no reversibility, the precautionary principle (Arrow and Fischer, 1974) may have to apply.

2.2.4 THREE INTIMATELY CONNECTED REALITIES

The three key realities of creative design practice are intimately connected. They cannot be rigidly separated. Backtalk conversations and generosity can be understood as two key practices that can drive co-evolution, supported by judgement, expertise, and other resources. While it is possible to have co-evolution without generosity, it needs conversations with materials.

Design management must respect the realities of creative design work. Problem and solution spaces must co-evolve concurrently. A team’s “reflective conversation with the materials of a design situation” (Schön, 1992) will be obstructed by sequential methodologies that limit design work within each phase, and thus silence backtalk between complementary activities that could happen concurrently. Lastly, it must be possible to frame problem spaces generously, and not be reined back prematurely to make projects (too) easy to track, manage and control.

Overall, top-down management needs to focus on coaching, mentoring, directing, and other forms of “subtle management control,” another of Takeuchi and Nonaka’s (1986) six success factors. Design professionals who have been educated in an Arts School studio culture should have creative confidence in co-evolution, listen to backtalk, and be generous. Professionals from other design backgrounds such as engineering may be less confident, attentive, and generous, but they will still encounter co-evolution and backtalk during creative design work, even if their textbooks’ methodologies reject the former and devalue the latter.

The Scrum agile methodology took its name from Takeuchi and Nonaka (1986), but overlooked four of their success factors (Cockton et al., 2016a). Design team members must be comfortable with: built-in instability (through lack of an upfront imposed process); overlapping development phases (concurrent engineering); multi-learning (multidisciplinary people); and subtle management control. Scrum only took its name, self-organizing teams and some organizational transfer of learning (through sprint and project retrospectives) from Takeuchi and Nonaka. No reasons have been given
for ignoring other critical factors, which has unfortunately been to Scrum’s disadvantage, gaining stability at the expense of agility, capability, and wisdom. Despite its name, Scrum imposes linear “relay” processes that obstruct co-evolution.

Radical innovation needs “multi-learned” team members who are managed subtly, can reflect on work so far, and self-direct future work to maintain an appropriate balance across design work. Cockton (2020b, Chapter 3) addresses balance in detail.

CloudBooks’ development clearly corresponds to the first of the three key realities, as the team work concurrently on four work areas. The roadmap and current sprint may have evidence of generosity, but there was nothing in their story about that. There is some evidence of conversations between design/development (R&D) and strategy above interpretation of the roadmap, one material of their design situation. Key realities of creative design work may thus have a better fit with CloudBooks working practices than ISO9241-210. However, further improvements on the current state on the art on creative practice may be both possible and desirable.

2.3 WHAT ACTUALLY CO-EVOLVES?

There were no mentions of problems or solutions in the CloudBooks’ story. Sales and marketing will no doubt talk of solutions in their conversations, but this occurs outside of, and mostly after, R&D. Instead they work on Strategy, User Research, Evaluation, and Development (aided by much design!).

This should be no surprise, as there is clearly a problem with problems. When a tame problem can be clearly stated in advance, there is limited need for creative work, especially when viable alternative solutions are known (which was not the case with the “solution” to the simply stated “tame” problem of Fermat’s last theorem). When problems are “wicked,” they are not problems as most would understand them, since it must be possible to state problems before solving them.

Rittel and Webber’s (1973) use of “wicked” and “problem” is an example of being trapped by a dominant language, which is well understood by marginalised minorities. For example, in Black Skin, White Masks (Fanon 1967), a landmark in postcolonial thinking, Fanon notes that: “to speak a language is to take on a world, a culture” and “mastery of language affords remarkable power.” Darke (1979) similarly remarked on “analysis” that “the language is deficient here.” However, analysis-synthesis remains THE dominant espoused model design processes even today, regardless of who actually follows it. Gedenryd (1998) identified four fundamental principles of analysis-synthesis models, but noted that none are articulated within existing design methodology lexicons. There are lacunae, productive silences, and absence of presences (Derrida, 1976/1967), that divert attention from poor assumptions. Despite many problems, rational linear engineering design still holds the high ground. While agile methodologies relax on complete upfront problem analyses and requirement specification, they do not yet fully embrace some key realities of creative design
practice (Cockton, 2016a). Dorst (2015) quotes Einstein: “a problem can never be solved from the context in which it arose.” We need to move away from the problematic context that misrepresents how designers work. Ironically, this means moving away from problems and solutions.

As long as we continue to speak in terms of problems and solutions, we remain in the rationalist culture of idealised linear engineering design, and afford it “remarkable power” as we cover our creative skins with managerial masks. Creatives become suppressed minorities, with practices such as Dorst’s (2015) themes lost in the split between problems and solutions.

Even the 1960s design process of “analysis-synthesis-evaluation” goes beyond problems and solutions. However, to normalise creative design practice, we need a new vocabulary, not just extra phases (Cockton, 2017). Rather than ask how we get to solutions, we can instead ask what choices are made to get there, bearing in mind that “a myriad of choices go into the design of any given artefact” (Gaver and Bowers, 2012). Heskett (2005) draws on his design history expertise to provide a valuable answer that encompasses this myriad of choices. For him, design outcomes result from:

> decisions … Choice implies alternatives in how ends can be achieved, for what purposes, and for whose advantage. … design is not only about initial decisions or concepts by designers, but also about how these are implemented and by what means we can evaluate their effect or benefit.

Heskett’s analysis here follows a short inconsequential discussion of definitions of design. By moving away from what design “is” to “how design does,” results in a clarity that escapes dictionary definitions. Gedenryd (1998) considered dictionary definitions of design with their multiple senses, e.g., a plan; a project, a reasoned purpose; an intent, a deliberate intention. Heskett’s forms of design choice unpack these senses through ends (purpose, intent, intention), means (plan, project), reasons (for whose advantage), and evidence (evaluate). There are four forms here:

1. purposes, ends;
2. means (how ends can be achieved, initial decisions or concepts, how … implemented);
3. beneficiaries (for whose advantage); and
4. by what means we evaluate their effect or benefit.

We can think of these different forms of choice as being made in different design arenas, i.e.,
1. purpose;
2. artefacts (means to ends, through ownership and/or usage);
3. beneficiaries; and
4. evaluations.
Gaver and Bowers (2012) offer six examples of “concerns” that group design choices. These concerns correspond to purpose (design motivation, socio-political concerns), artefacts (functionality, aesthetics, production), and beneficiaries (people for whom intended). There is no concern in relation to evaluation, but the common HCI reference to “design and evaluation methods” can separate the latter from choices about design. However, Heskett (2005) includes evaluation, and once we take a broad view of it (e.g., to include reflection-in-action, technical feasibility, platform style, and standards conformance), we can see that we diminish design by isolating evaluation.

Only one design arena corresponds straightforwardly to a problem or solution: an artefact is a solution, but only when evaluated as delivering on purpose. Purpose may be thought of as within a problem space, but Dorst’s rich analysis of frames (Section 2.1.3) above places some aspects of it in the solution space. Like Dorst’s themes (Section 2.1.4), beneficiaries simply “are”: they are neither within the problem nor the solution space. Indeed, for there to be a problem and a solution, they must be in both: in the former as research respondents; and in the latter as artefact users. Evaluations span both spaces, evaluating how well “solutions” solve “problems.” Design arenas are more clear cut than problems and solutions, drawing on different disciplines and professional practices:

1. Product Management and Marketing
2. Software Engineering and Interaction Design
3. (and 4.) Human Sciences

Following Junginger (2017), in this book “products” will refer to goods, services, or a mix of both (as in a product-service system). Design arenas reframe design work as spanning four distinct work areas (note the similarities with CloudBooks work):

1. Product Strategy
2. R&D
3. Stakeholder Research
4. Evaluation

Table 2.1 renames the CloudBooks work areas in Table 1.1 as design arenas, as derived from Heskett’s (2005) analysis of the origins of design outcomes. Its left column of provides an answer to the first group of questions at the end of Chapter 1.

What are the main areas of design work? Can it reasonably be divided up in some way?

What are the alternatives to the areas in Table 1.1?

Design arenas are worked on concurrently, which leads to the second group of questions:
How do design work areas relate to each other? How are they connected? What sort of transitions are made as areas are connected?

The next section begins to address this second group of questions from Chapter 1.

<table>
<thead>
<tr>
<th>Design Arena</th>
<th>Week 1 Activities</th>
<th>Week 2 Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artefacts</td>
<td>Implement user stories for next sprint</td>
<td>Prototype new capabilities from Cloudbooks road map</td>
</tr>
<tr>
<td>Purpose</td>
<td>Answer queries from Interaction Designers about current Cloudbooks road map while framing future product strategy</td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td>Usability work in response to customer feedback</td>
<td>Usability and wider UX inspection of user interface design for next sprint</td>
</tr>
<tr>
<td>Beneficiaries</td>
<td>Planned customer visits</td>
<td>Plan demonstrations and insight gathering procedures for upcoming trade show</td>
</tr>
</tbody>
</table>

### 2.4 CREATIVE CONNECTIONS BETWEEN DESIGN ARENAS

Concurrent work in different design arenas raises a question as to how these are co‐ordinated. In linear engineering design, each phase is presented as systematically interfacing seamlessly with the next. The output from one phase becomes the input for the next, with nothing else needed. Dym et al. (2014) presents some of a very few examples of seamless interfaces in practice. Linear engineering design advocates can rarely demonstrate how one phase transitions to another. Does creative design have anything to offer instead, especially given the explosion of interfaces when multiple design arenas are worked on concurrently? The answer from the distinguished designer Charles Eames is yes, albeit nonchalantly:

> Eventually everything connects—people, ideas, objects … the quality of the connections is the key to quality per se (eamesfoundation.org).

Charles Eames has the creative confidence of designers who expect everything to connect eventually. This is echoed in more recent work on online business design (Mok, 1996), which has to:

> …create meaningful connections among people, ideas, art, and technology, shaping the way people understand their relationships with … new products

Nelson and Stolterman (2012) have a whole chapter on composing and connecting. Connections are often seen as “creative leaps,” but analysis of design work has demystified them as bridge‐building (Cross, 1997). A decade before this, Davies and Talbot (1987) interviewed UK Royal Designers for Industry (RDIs) about their work as outstanding professionals and likened the